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## Three essays on local tax rates and household behavior.

Asmae Aqzzouz

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## **Three essays on local tax rates and households behavior**

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## AVANT PROPOS

*“L'impôt ne doit être prélevé que sur les riches; vous ne pouvez pas demander au pauvre une partie du pain qu'il gagne, et du lait que les mamelles de sa femme donnent à ses enfants. Ce n'est pas sur le pauvre, sur le manœuvre, qu'il faut imposer une taxe ; il faut, en le faisant travailler, lui faire espérer d'être un jour assez heureux pour payer des impôts.”*

François-Marie Arouet, dit Voltaire (1694-1778), célèbre écrivain, poète et philosophe français



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# **INTRODUCTION**





Most industrialized countries have applied different decentralization processes. One of the principal advantages of decentralization is that it leads incumbents to take into consideration the individual preferences of residents in term of local public goods and services. Decentralization implies that local territories possess high fiscal autonomy. In 1982, France voted the decentralization laws which consist on transferring the decision-making power from the State to the local territories' administration.

With decentralization, local territories started playing an important role in local development which required an important volume of resources in order to invest in the maintenance of roads, schools, in social action, in cultural activities and in economic development. According to the French General Authority of Local Governments (Direction Générale des Collectivités Locales, DGCL), the revenue of local territories represents 270.2 billion euros, in 2019. This revenue emerges from the local taxes (59 %), subventions (31 %), loans (6 %) and the financial counterpart of a service paid by the user (5 %).

Local taxes represent 59 % of the local territories' income and constitute the main revenue collected by local institutions, enabling them to undertake their public service missions. French local taxes are composed of direct and indirect taxes. The direct taxes income represent 92.6 billion euros, which account for 58.16 % of the local taxes income while the indirect local taxes income represents 66.8 billion euros, which account for the rest 41.84 % of the local tax income. The direct local taxation is subdivided into 15 different taxes with the most important being the property tax on built properties, the property tax on non-built properties, the housing tax and the territorial economic contribution (which replaces the professional tax in 2011). Those four taxes represent more than 50 % of the local tax income. They are all assessed on a cadastral rental value which represents the theoretical annual rent that a property can produce (Leprince et al., 2005).

In 2019, two-thirds of the local tax revenue are transferred to counties, 27 % to the Departments and 6.1 % to the Regions. With the reform of the suppression of the housing tax on residences, French counties meet a decrease in their revenue. To compensate the loss in income, the State provides a transfer of property tax income from Departments to counties. Since the replacement of the professional tax by the territorial economic contribution, the property tax on built properties represents the most important revenue for local territories. This tax is paid annually by property-owners.

From a theoretical point of view, Tiebout (1956) develops the basic model aiming to explain the behavior of households against local taxes and local public expenditures. His original model of households “voting with feet” yields to an important literature on fiscal policies and local public goods (Hamilton, 1975; Yinger, 1982; Gilbert and Guengant, 2002). He argues that each household chooses a location in function of his income, by comparing the amount of local public expenditure to local tax rates. The objective of households is, thus, to maximize their utility function, through the choice of their location.

Oates (1969) develops the Tiebout model and shows that the property taxes have a negative influence on the housing prices. He argues that this effect is due to the negative capitalization of the property tax on the property prices. With an increase in the property tax and a corresponding decrease in the property prices, households feel that their wealth decreases (Cao and Hu, 2016). This may lead households to move to another area where their needs are better met in terms of property tax.

An increase of local tax rates in a territory creates a positive externality to the neighboring territories (Beck, 1983; Zodrow and Mierzkoski, 1986; Brueckner and Saavedra, 2001). This is the reason why before a local government adopting a new tax policy, it takes into consideration the tax policies of its neighbors (Mintz and Tulkens, 2006; Bucovetsky, 1991). Each local government tries to do better than the neighboring local governments in terms of local public spending and taxes which collapses to a tax mimicking behavior (Vermeir and Heyndels, 2006; Delgado et al, 2015; Bocci et al, 2019).

Tax mimicking occurs when the local decision-makers consider the probability of individuals moving out of a given territory in the case of an increase in tax rates (Leprince et al., 2005; Gérard, Jayet and Pat, 2009; Lyytikainen, 2012). Three sources of tax mimicking have been identified: yardstick competition, tax competition and spillover effects. Tax competition signifies that residents could move to another territory if, with the same level of public goods and services, tax rates are much higher than the tax rates of neighboring territories (Wilson, 1986; Bucovetsky, 1991). Yardstick competition occurs when consumer-voters ignore the quantity of local public goods and services supplied in their territory. To judge the performance of their incumbents, they compare the tax policy choices of their neighboring territories to the tax policy applied in their own territory. If in the neighboring territories, tax rates are lower, the incumbents are punished by the consumer-voters. Incumbents maximize their chance to be re-

elected by mimicking the most favorable tax strategies of the neighboring territories (Salmon, 1987; Vermeir and Heydels, 2006; Delgado et al., 2015).

Finally, the spillover-effect model implies that a new tax policy or a new public equipment in a territory creates positive or negative externalities affecting the locational behavior of residents in neighboring territories. These externalities lead the neighboring territories to adjust their tax policies (Gordon, 1983; Hanes, 2002; Ollé, 2006). According to Brett and Pinkse (2000), the tax rates of neighboring territories reflect the choices made by competitive territories in response to the demand for local public goods and services under the constraint of the disposable local tax base.

In many tax competition models, the increase of the local tax base is due to the migration of housing capital and individuals from territories adopting high tax rates to the territories where tax rates are low. The result of tax mimicking is residential mobility. Local territories are seeking to become more attractive in order to keep their residents and to attract mobile individuals. For that, local territories adopt multiple policies (such as the increase in local public expenditures or a decrease in local tax rates) by taking into consideration policies adopted by their neighbors to catch new individuals into their territories and to maintain their residents. The variation of local tax rates and the variation of housing prices could be a factor driving individuals to migrate.

The objective of this thesis is to study the empirical connection between property taxes, strategic interaction between local counties and the residential mobility. One of the most original aspects of this work is that it mainly applies to a very thin spatial level of analysis, which is the county level. Most studies on the French territories apply to a larger level of spatial analysis (Regions, Departments or zones d'emplois) because of the difficulties in building a solid and reliable database for the 34 973 French counties.

In chapter one, we observe the relation between property taxes and property prices by focusing on the housing market in the counties of the region Provence-Alpes-Côte-d'Azur for 2018. Database consists about information on housing prices and property tax rates in the 978 counties of the region. The methodology used in this chapter is driven from the work of Charlot et al. (2013). We work on the county level to capture the property prices variation between counties. We show that an increase of the property tax rates has a negative effect on the property prices of counties in the region of Provence-Alpes-Côte-d'Azur. This result confirms the

existence of a negative capitalization of property taxes into the property prices. We show that local public expenditures are positively capitalized into the property prices. Those results confirm that property prices are connected to property taxes and local public expenditures.

In the second chapter, we try to identify property tax mimicking among French local governments and its sources. In this chapter, we test the existence of property tax mimicking and its sources in the counties of the regions of Provence-Alpes-Côte-d'Azur and of Rhône-Alpes for 2014. Our database features 3865 counties (978 counties of Provence-Alpes-Côte-d'Azur and 2887 of Rhône-Alpes). The methodology in this chapter is driven from the work of Delgado et al. (2015), Ferraresi et al. (2018) and Lattarulo (2019).

We compare tax mimicking among counties in both regions and detect if the sources of tax mimicking are similar. This work delivers two conclusions: first, counties of both regions mimic the property tax policies of their neighboring counties; second, property tax mimicking among Provence-Alpes-Côte-d'Azur counties is due both to yardstick competition and to spillover effects, while the property tax mimicking among Rhône-Alpes counties is due to spillover effects only. Incumbents of the counties of Provence-Alpes-Côte-d'Azur are interested by mimicking the property tax policies of neighboring counties in order to be re-elected. They mimic the property tax policies of their neighbors because they realize that consumer-voters judge their performances by comparing the tax policy of their own county to the tax policies of the neighboring counties. If consumer-voters discover that, for the same level of local public expenditures, neighboring counties apply lower property tax rates than their own county, they punish their incumbents by not voting for them. Highly populated counties (Lyon, Marseille, Nice, Saint-Etienne, Grenoble, Toulon, etc.) hardly react to a change in the property tax by neighboring counties because the spillover effects are inconsiderable. Small counties, on the other hand, mimic tax policies of their neighboring counties in order to attract new mobile individuals and keep their own residents.

In the third chapter, we study the residential mobility of young people among French counties. We focus on young individuals aged between 15 and 29 years since they represent the most mobile population, which means that their behavior could stick to an empirical analysis of the Tiebout's voting with feet model. To catch local public goods, we identify the provision of social housing which is managed at a municipality level. We study the young people residential mobility within the social housing to see how public taxes and services affect residential mobility between 2012 and 2017. The methodology used is driven from Schaffar et al (2019).





## **Chapter 1**

# **THE EFFECT OF PROPERTY TAXES ON PROPERTY PRICES**



## INTRODUCTION

Local property taxes are paid annually by real-estate owners to local State or regional governments. Property taxes are an important source of revenue for local governments since they serve to finance local public spending. Nevertheless, most analysts consider that there is a negative causal relationship between the functioning of real estate markets and local property taxes. Local taxes are considered to negatively impact real estate exchanges since they exogenously increase global housing costs.

Local governments vote annually to determine the property tax rate brackets. Leprince et al. (2005) show that the calculation of this tax is done by applying the tax rate, determined by local governments, to half of its rental value. The rental value is equivalent to the annual income a real estate property would generate if rented under normal conditions.

We collect data for 2018 and build an original database for property tax rates, real estate prices, and several control variables for the 978 French counties of the region of Provence-Alpes-Côte-D'Azur. Data is collected from the French National Institute for Statistics (INSEE) and the French General Authority of Local Governments (Direction Générale des Collectivités Locales, DGCL). We test for the presence of spatial autocorrelation in housing prices for the 978 French counties. Using the Moran and the LISA tests, we find that there is a functional relationship between housing price of a county and housing prices of its neighboring counties. To take into consideration spatial autocorrelation, we build a spatial econometric model to study the relationship between local property taxes and the functioning of the local housing markets.

This chapter is organized as follows. Section 1.1 provides a review of related literature. Section 1.2 presents some stylized facts of the French local tax policy and the French housing prices trends. In this section, we provide a descriptive analysis of housing prices and property tax rates of the PACA counties. Section 1.3 delivers the main results from the empirical models used to study the relation between property taxes and housing prices.

## 1.1. LOCAL TAXES, PROPERTY PRICES AND LOCAL PUBLIC SPENDING: A THEORETICAL ANALYSIS

Brown (1924) was the first to address the question of the effects of property taxes in his book "The economic taxation". According to Simon (1943), an increase in local property tax negatively impacts household's consumption. Following Simon's intuition, Tiebout (1956) models household behavior against local taxes and local public expenditure. He assumes that mobile households face different location choices. Each household chooses a location, according to its budget, by comparing the amount of local public goods to local tax rates.

According to Oates (1969), in Tiebout's model, households select from different territories offering varying packages of local public services in order to choose the one that offers a tax expenditure program best suited to their preferences. His original model of households "voting with feet" has yielded important literature on local fiscal policies (Hamilton, 1975; Yinger, 1982; Fischel, 2000; Gilbert et Guengant, 2002).

The early empirical work of Oates (1969) tests the impact of local property taxes on real estate values for fifty-three New Jersey counties in 1960. He finds a negative relationship between local property taxes and housing prices; a one percent increase in local taxes leads to a decrease of \$1500 in real estate prices. The property tax burden is shifted to property owners since it is capitalized in the form of reduced property prices. Oates (1969) also describes a positive relationship between real estate prices and school expenditures. He develops a cross sectional work of the impact of property tax rates and local public expenditures on property prices and shows that if the increase of local expenditure is not proportional to the increase of property tax rates, the property prices will decrease. Tax capitalization serves to measure the degree of the housing market efficiency.

Edelstein (1974) confirms Oates's findings in the suburban Philadelphia area. He works on 2143 residential properties for 1967-1969 and shows that the property taxes are capitalized into the property prices. Edel and Sclar (1974) find similar results in the Boston metropolitan area. Their paper extends Oates (1969) capitalization phenomenon. They relate property prices to local taxes and to local public services attributed over different time periods for the Boston area. They find that property tax capitalization is negative and significant for 1940, 1950 and 1970. Hamilton (1976) determines some characteristics of property taxes that may impact their capitalization in property prices. Tax rates vary across territories and these variations are

capitalized into property prices in the US. The difference in tax rates relative to public service benefits are often reflected in property prices.

Palmon and Smith (1998) stipulate that the property tax capitalization occurs when the present value of future tax liabilities is incorporated into real estate values. They also define two levels of tax capitalization which are the full capitalization and the partial capitalization (or overcapitalization). The full capitalization occurs when differences in housing prices are equal to the present value of variations in expected tax liabilities; the partial capitalization occurs when the differences in housing prices are lower or higher than the present value of variations in expected tax liabilities.

The property tax capitalization is controlled by the elasticity of the housing supply. When the housing supply is inelastic, an increase in the housing demand in a given territory increases housing prices. In a similar way, an increase in local public services and a decrease in property tax rates increases the housing demand and the housing prices. The increase of housing demand in a territory decreases housing demand and prices in other territories. When the housing supply is elastic, an increase in housing demand in a given territory do not increase housing prices because new properties will be constructed in response to an increase in housing demand. In this case, property taxes and local public services are not fully capitalized in house prices (Brasington, 2001; Sirmans et al., 2008).

Netzer (1966, 1968) and Mieszkowski (1972) stress that property tax may lead to an important distortion in local housing markets. They stipulate that the property tax decreases the housing capital' gain. An increase in property taxes leads the housing capital (which is mobile) to move to jurisdictions where property tax rates are lower (Mieszkowski, 1972). This means that the property tax negatively impacts the housing capital. Fiscal negative externalities appear in the jurisdictions that increased their property tax rates and fiscal positive externalities in those who set lower property tax rates (Wildasin, 1986, 1989).

Goodman (2006) tests the long term relation between property taxes and real estate prices by using a panel of 40 000 houses and dwellings. In 1950, the property tax income represented 50% of the local revenue in the United-States. In 2002, the property tax income represents only 27% of the local revenue which shows the increase in the level of competition among counties to attract newcomers or to keep their already settled residents. Goodman differentiates flats and houses and finds the existence of a strong negative correlation between

property tax and the price of flats. He stipulates that this negative effect is due to the lower average price of flat.

Kang et al. (2015) evaluate the effects of changes in property tax rates and school spending on residential and business property values in the Southeast Michigan. Kang et al. (2015) use panel data from 1983 to 2002 for 152 counties in the five regions surrounding Detroit. The results show that residential property prices are more affected by changes in school spending than by tax rates changes. On the empirical side, they introduce in their model a contemporaneous lagged value of all policy variables to test the duration of time it takes for the policy changes to be wholly reflected in the property prices. They find that the effect of changes in property taxes on residential properties is negative and statistically significant, but it dissipates just after two years. In the same time, school spending variable has a positive and a significant effect on residential properties and the coefficient of school spending is larger than the coefficient of property taxes.

According to Yinger et al. (2016) two identical houses located in the same neighborhood, but affected by different property tax rates, feature different prices in the housing market; the house with a higher property tax rate has a lower selling price since the property tax is fully capitalized into an asset. Song and Zenou (2005) worked on 448 urbanized areas and discovered that the property tax rates are higher in small counties and when the population densities are weak.

In France, Charlot et al. (2013) evaluate the impact of local property taxes on housing prices from 1994 to 2004 for two French cities, Dijon and Besancon. They develop a theoretical model to introduce the property tax capitalization into the property prices. They explain that local taxes are capitalized into the property prices when the variation in the property prices within or between local jurisdictions reflects what households are ready to pay for the different local public goods and taxes in different locations. To estimate the impact of property tax on property prices, they estimate a spatial difference model similar to that of Fack and Grenet (2010). In the first step, prices are estimated using a classical hedonic regression with only property characteristics. In the second step, the estimated price is transformed and regressed on territory variables.

When studying the Swedish housing market, Elinder and Persson (2014) show that higher property taxes decrease real estate prices. Tajani et al. (2017) show that an increase in

local property taxes negatively affects real estate prices in the Apulia region in Italy. Bai et al. (2014) study the influence of property taxes on property values in China, with a focus on Shanghai and Chongqing. They found that a rise in local property taxes decreases real estate values in Shanghai between 11% to 15%. In Chongqing, however, there seems to be a positive relationship between property taxes and real estate values. Cao and Hu (2016) deliver a simulation for property tax policy in China for 25 provinces. They find controversial results showing that real estate values are positively affected by local government expenditure and negatively affected by increases in local property taxes. Glaeser et al. (2005) specify that an increase in property tax rate is related to high income real estate.

In another work, Cao and Hu (2016) implement a theoretical model where they detect the impact of the property tax on the household' utility. The result of their theoretical model shows that the impact of property tax on the household' utility could be divided into four different effects. The first effect is the household's pocket effect: as the property tax increases, households must pay higher taxes which negatively impact their consumption. The second effect is the price effect: when the property tax increases, the rent and the property values decrease. The third effect is the housing wealth effect: when the property tax increases, the property values decreases which cause households to feel that their overall wealth decreases. The last effect is the redistribution effect: local government uses the revenue from property taxes to finance local expenditures that supply public goods and services to the inhabitants. For some households, this appears to be a positive externality due to the development of local welfare state. For others, this results a negative externality as these households are affected by the increase in local taxes, while receiving no benefit from the changes in local services. (See 6.1 in appendices for the development of the theoretical model of Cao and Hu (2016)).

Finally, Mikhed and Zemcik (2009) consider that an increase of property tax rate decreases the property prices which could impact the renting prices. Ayuso and Restoy (2006) and Sivitanides et al. (2001) also support that an increase in rents leads to an expansion in the real estate demand for housing and for investment and an increase in real estate prices.

## 1.2. LOCAL TAX AND HOUSING POLICIES IN FRANCE: A DESCRIPTIVE ANALYSIS

### 1.2.1. Stylized facts

#### 1.2.1.1. French local tax policy

Local authorities collect taxes but their policies are exercised within the framework of a nationally defined legislation. In 2018, a new reform led to a partial abolition of the housing tax on the primary residential properties. In 2020, 20 % of French households still pay the housing tax on their primary residences. The objective of this reform is to remove completely the housing tax on the primary residential properties for all the French tax payers in 2023.

Table 1.1: French local tax revenues (in million)

	2014	2015	2016	2017	2018	Difference between 2017 and 2018	
Housing tax (1)	20615	21778	21862	22282	22767	485	2,17%
Property tax on built properties (2)	29312	30429	31940	32723	33628	905	2,76%
Property tax on unbuilt properties (3)	1014	1040	1042	1054	1067	13	1,23%
<i>Household taxes</i> <i>A = (1 + 2 + 3)</i>	<b>50941</b>	<b>53247</b>	<b>54845</b>	<b>56058</b>	<b>57462</b>	<b>1404</b>	<b>2,5%</b>
Territorial economic contributions (4)	22891	23861	24287	25244	25679	435	1,17%
Tax on network companies (5)	1447	1467	1494	1527	1538	11	0,72%
Tax on commercial areas (6)	712	737	753	942	774	-168	-17,83%
<i>Economic taxes</i> <i>B = (4 + 5 + 6)</i>	<b>25050</b>	<b>26066</b>	<b>26534</b>	<b>27713</b>	<b>27992</b>	<b>279</b>	<b>1,00%</b>

Source: French General Direction of Public Finance (DGFIP)

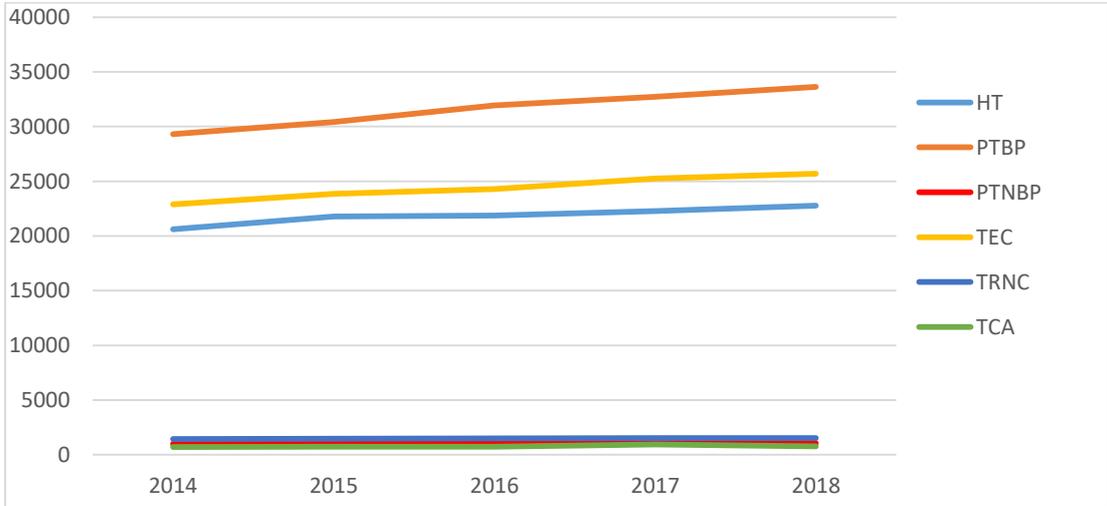
Table 1.1 and figure 1.1 describe the French local tax revenues. We distinguish two important categories of local taxes which are household taxes and economic taxes. The household taxes are paid by households and they are composed of the housing tax, the property tax on built properties and the property tax on non-built properties. The economic taxes are paid by firms and are composed of the territorial economic contribution, the tax on network companies and the tax on commercial areas.

In 2018, with 92.6 billion euros, direct local taxes represented three quarters of tax revenue collected for the benefit of local authorities. However, the revenue of property taxes on

built reached 33.6 billion euros which accounts for more than a third of the direct local tax revenue of local collectivities (Filomin, 2019). The increase of French local tax revenues is mainly driven by the increase in household taxes (12.80 % between 2014 and 2018) and more specifically to the increase of tax base values. The property tax on built properties income increased by 14.7 % between 2014 and 2018. This increase is due, on one hand, to the increase of the property tax rate and, on the other hand, to the increase of the tax base values, that is, the increase in real estate and housing values. Economic taxes income also increased by 11.74 % between 2014 and 2018. More than 70 % of this increase comes from the rise of the cadastral rental values.

Table 1.2 represents the distribution of the various local direct taxes, in French counties, Departments and regions in 2018. At the county level, local direct tax revenues depend upon the housing tax (44.40 %), the property tax on built properties (50.68 %) and the property tax on unbuilt properties (2.41 %).

Figure 1.1: French local tax revenues



Source: French General Directorate of Public Finance (DGFIP) and the graphic representation made by the author

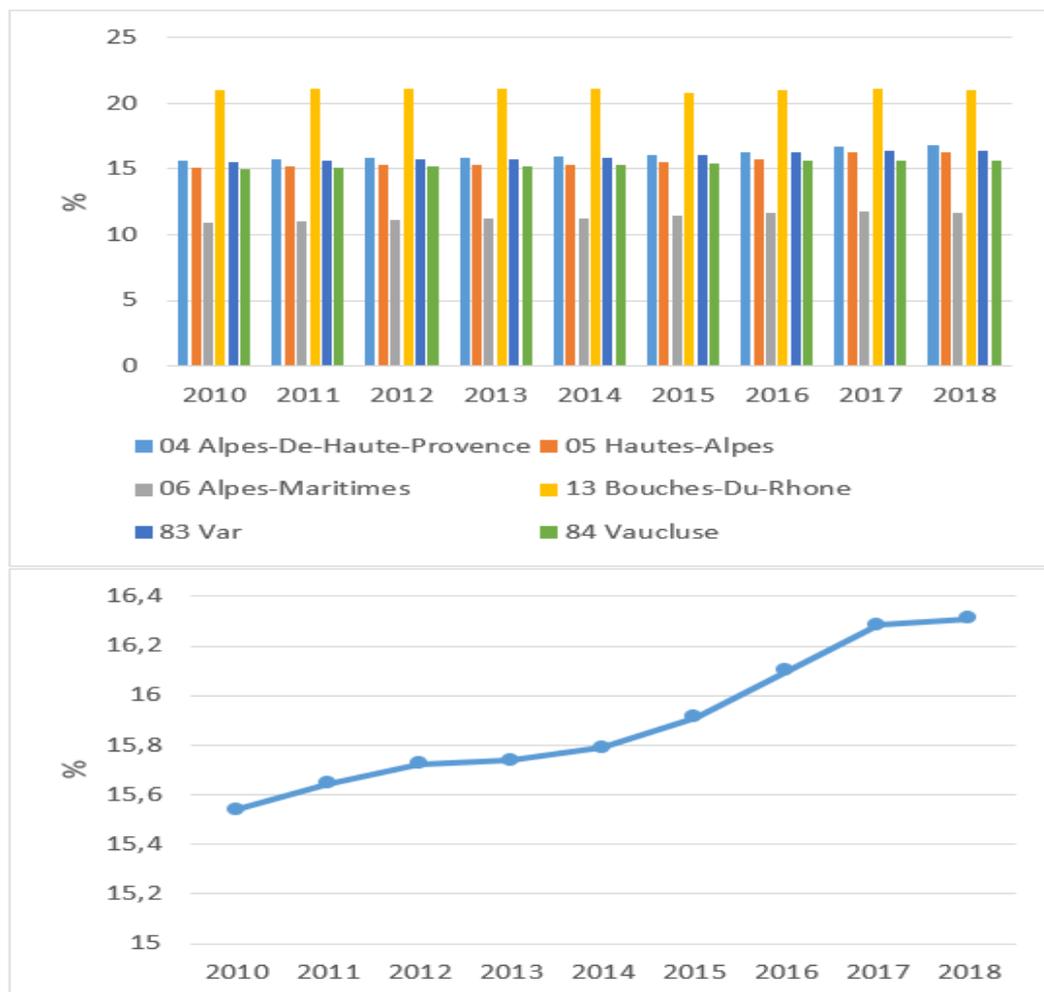
The revenue from the property tax on built properties collected by the departments (+ 2.3% in 2018) is growing less quickly than the revenue from the property tax on built properties collected by the counties (+ 2.5 % in 2018) : 54.73 % of the income of property tax on built properties are collected by counties and 45.27 % by departments.

Table 1.2: Distribution of local taxes to counties, Departments and Regions in 2018

	2018 (in millions)				2018/2017 (%)		
	counties	departments	regions	EPCI	counties	departments	regions
Housing tax	15354	0	0	7413	+2%	0	0
Property tax on built properties	17527	14494	0	1607	+2,5%	+2,3%	0
Property tax on unbuilt properties	835	0	0	232	+1,2%	0	0
<i>Household tax</i>	<i>33716</i>	<i>14494</i>	<i>0</i>	<i>9252</i>	<i>+1,9%</i>	<i>+2,3%</i>	<i>0</i>
Territorial economic contributions	767	4200	8830	11882	-6,4%	+1,6%	+0,3%
Tax on network companies	71	285	650	532	-6,4%	+1,4%	-1,3%
Tax on commercial areas	28	0	0	746	-24,1%	0	0
<i>Economic tax</i>	<i>865</i>	<i>4485</i>	<i>9480</i>	<i>13160</i>	<i>-5%</i>	<i>+1,6%</i>	<i>+0,3%</i>

Source: French General Directorate of Public Finance (DGFIP)

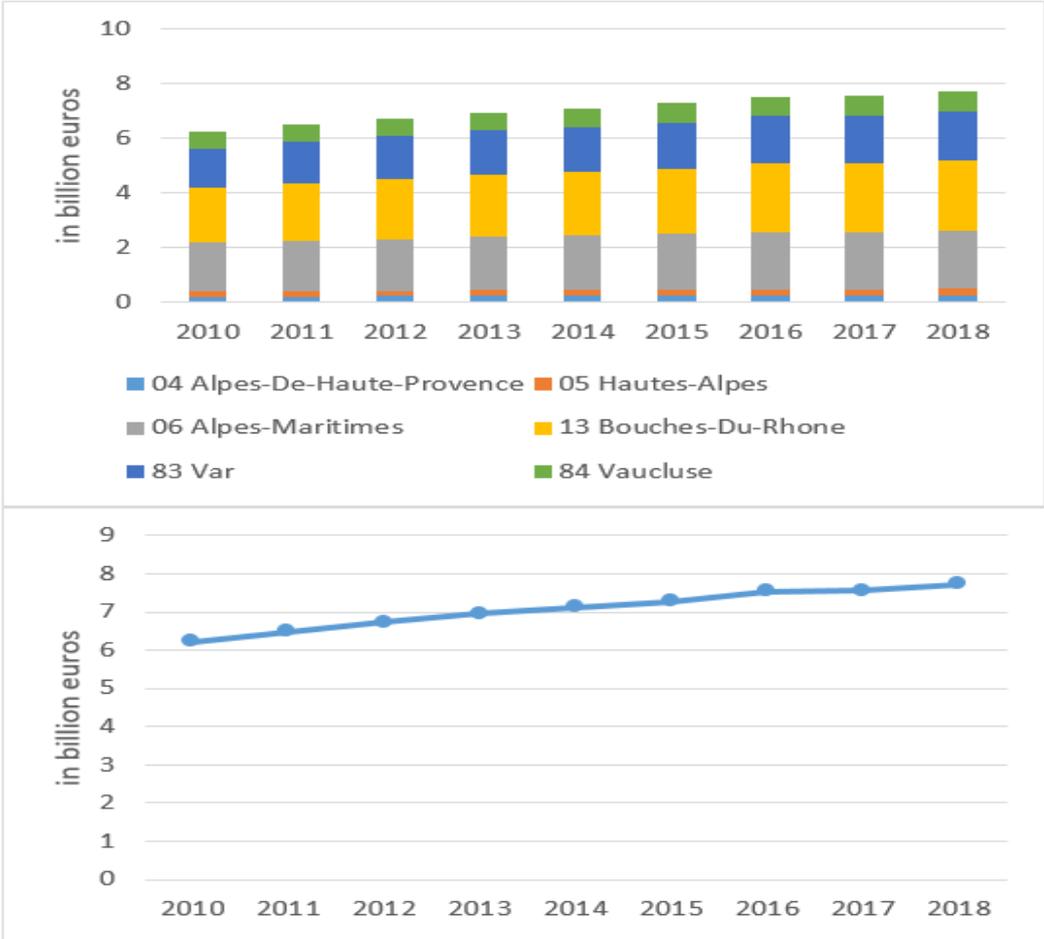
Figure 1.2: Property tax rate of the Provence-Alpes-Côte-d'Azur counties



Source: French General Directorate of Public Finance (DGFIP) and the graphic representation made by the author

Figure 1.2 presents the evolution of the property tax rates in the PACA counties. The property tax rate only increases by 0.77 % between 2010 and 2018. PACA’s counties income mainly increased by the rise of housing values (Figure 1.3). Property tax rates of PACA counties are already high comparing to the property tax rates of its neighboring regions.

Figure 1.3: The evolution of the property tax base value



Source: French General Directorate of Public Finance (DGFIP) and the graphic representation made by the author

In 2018, the property tax income per capita in the region of PACA represent 585 €/capita which is higher than the national average (495 €/capita).

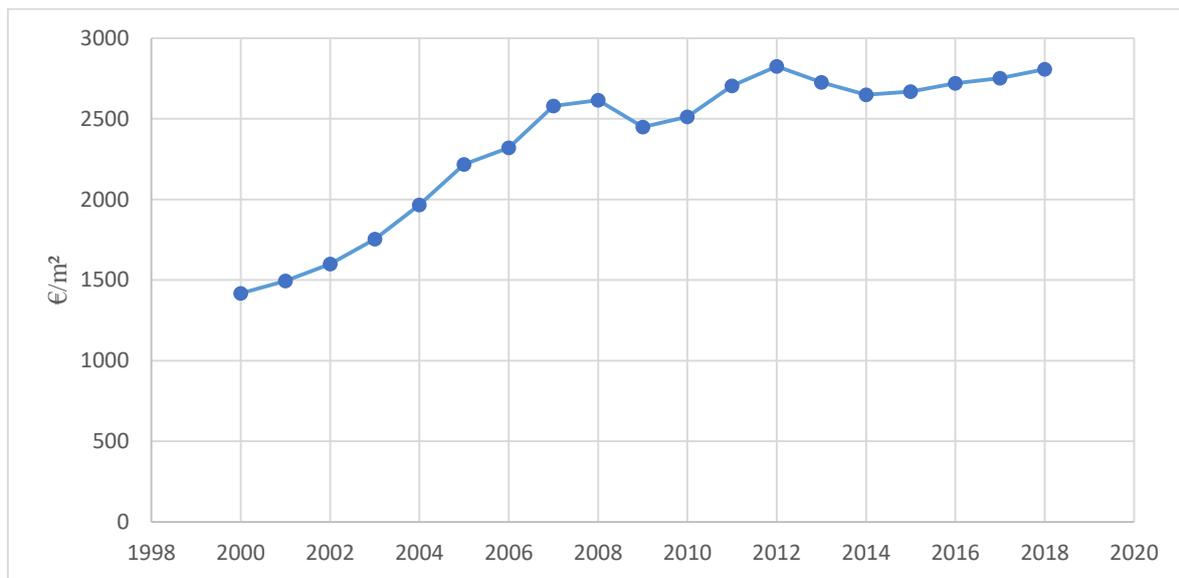
1.2.1.2. French housing policy

Figure 1.4 presents the evolution of the housing selling prices between 2000 and 2018 and figure 1.5 shows the number of houses sold between 2006 and 2018 in France. Between

2000 and 2018, the housing prices increased by 98.05 %. Housing prices mainly increased until the peak reached in 2008.

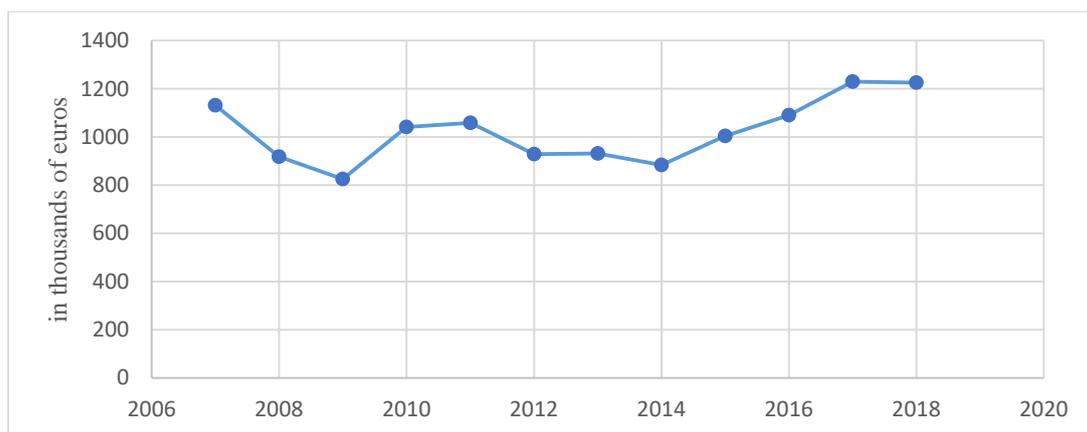
During the subprime crisis, housing prices have decreased by 6.37 % and the number of housing exchanges have decreased by 10.13%. This decrease is due to the increase of the interest rates (in 2008, the interest rate reached its highest level: 5.19 %) and the decline in the volume of the mortgage loans.

Figure 1.4: The evolution of the housing prices in France



Source: The national institute of statistics and economic studies (INSEE), calculations made by the author

Figure 1.5: The evolution in housing transactions



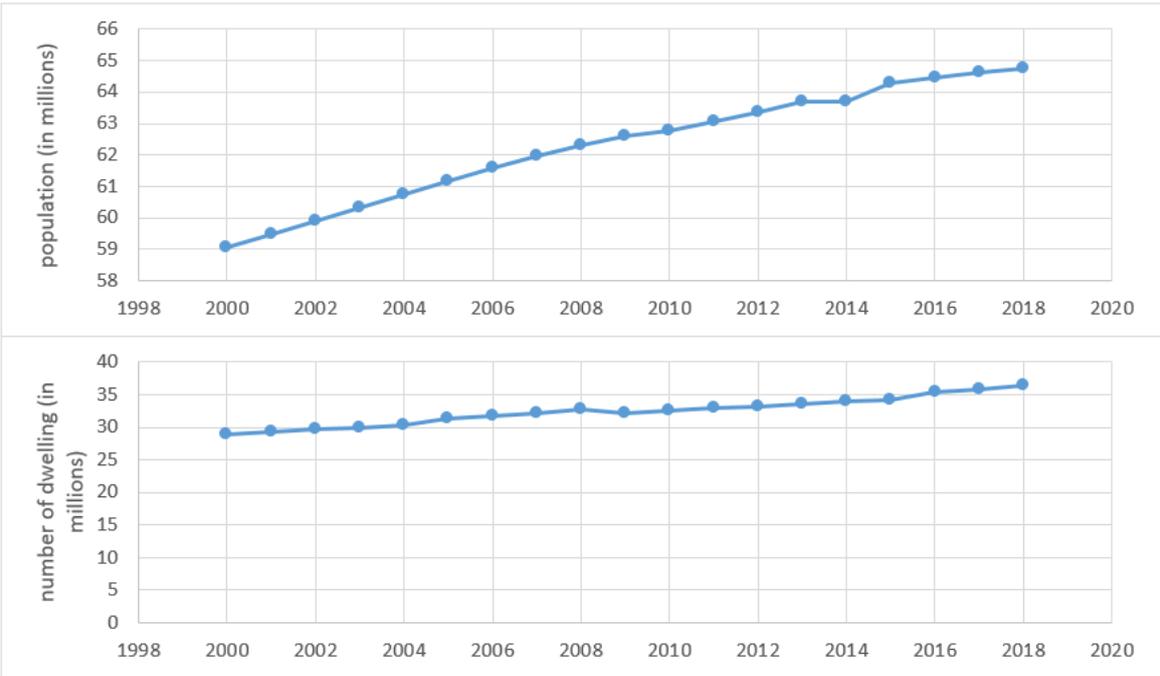
Source: The national institute of statistics and economic studies (INSEE), calculations made by the author

Between 2010 and 2011, housing prices increased by 7.70 %. A probable explanation of this trend is that in this period, interest rates decreased (3.44 %), leading to an increase in housing credits and the housing demand. Between 2012 and 2015, housing prices follow a

steady though slightly decreasing trend because of a low housing demand. After 2016, housing prices increase again by 3.16 %, thanks to a new decrease in interest rates and an increase in households' demand.

Finally, demographics influence the housing market. Figure 1.6 represents the evolution of the population and the number of housing units in France. Between 2000 and 2018, the number of dwelling increases by an average of 326 000 housing units each year. This increase could be explained by the increase of the housing demand which is partially due to the increase in population size. The regions where housing increased the most are located on the Atlantic coast, Ile-De-France, Provence-Alpes-Côte-D'Azur and Auvergne-Rhône-Alpes (Dejoux et al., 2019).

Figure 1.6: The evolution of the population and the dwellings



Source: The national institute of statistics and economic studies (INSEE) and the graphic representation made by the author

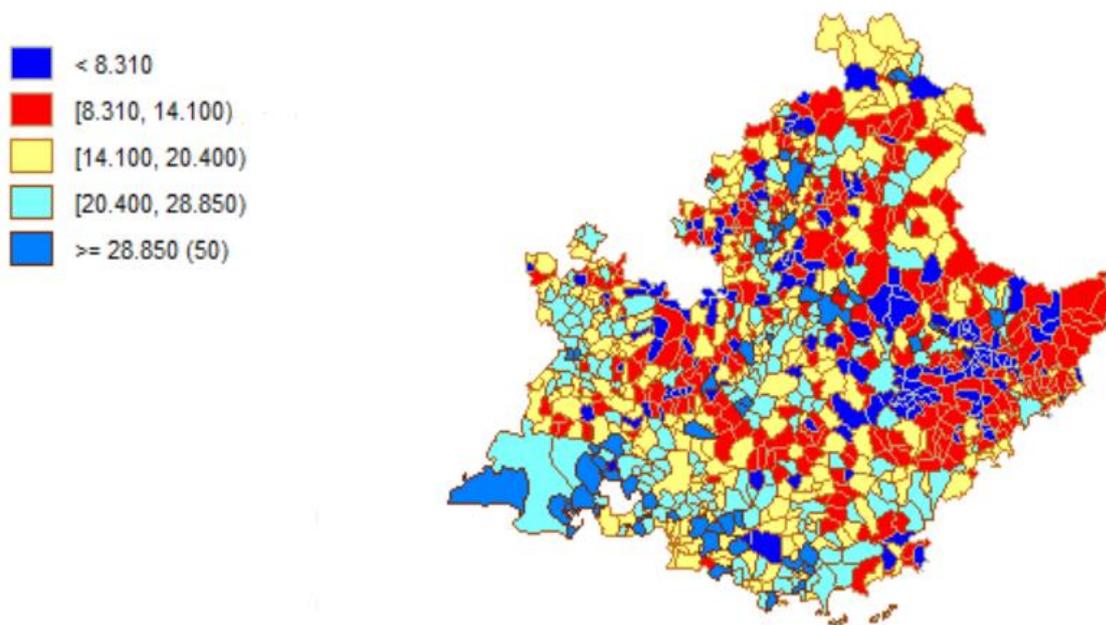
Fernandez-Duran et al. (2011) and Wittowsky et al. (2020) indicate that other factors could have influenced the housing prices and most of all the way people change their appreciations on some housing characteristics such as the location, the age of the building, the heating system, the presence of a garden, etc.

In France, the empirical analysis of the impact of the property tax on the property price has been the subject of a series of investigations which conclude to a negative relation between the property taxes and the property prices (Charlot et al., 2013). The interest of our analysis on the impact of the property tax on property prices in the PACA counties is threefold. First, we work at the county level to capture the property price differences between thin spatial units. We focus on counties to catch the local disparities effects, which we can't control at the level of the Departments. Second, we focus on the counties of the PACA region because it is a touristic region and contains a higher proportion of secondary residences. Third, according to the DGCL, the counties of the region PACA feature higher tax base values and property tax rates.

### 1.2.2. Database analysis

Property tax data from the PACA counties are extracted from the database of the French General Authority of Local Government (Direction Générale des Collectivités Locales, DGCL).

Figure 1.7: Property tax rates for Provence-Alpes-Côte-D'Azur counties

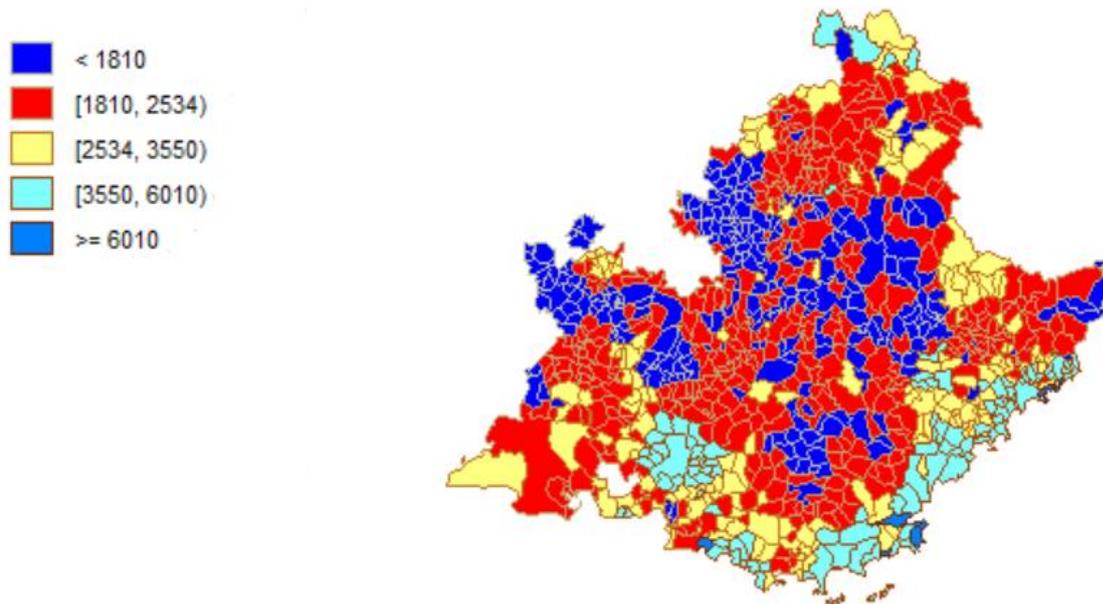


Source: Authors, data from the French General Direction of Local Authorities (DGCL)

Figure 1.7 illustrates the distribution of property tax rates of the PACA counties in 2018. In the Alpes-De-Haute-Provence department, counties with the highest property tax rates are Digne-Les-Bains (44.42 %), Cerestre (38.61 %) and Draix (38.32 %). In the Hautes-Alpes department, counties with the highest property tax rates are Briancon (42.62 %) and Upaix (37.72 %). In the Alpes-Maritimes department, counties with the highest property tax rates are

Ilonze (29.54 %) and Tournefort (28.23 %). In the Bouche-Du-Rhone department, counties with the highest property tax rates are Port-Saint-Louis-Du-Rhon (41.88 %) and Vitrolles (37.67 %). In the Var department, counties with the highest property tax rates are La-Seyne-Sur-Mer (34.11 %), Saint-Zacharie (33.36 %) and Cuers (33.32 %). In the Vaucluse department, counties with the highest property tax rate are Le-Pontet (33.82 %) and Pertuis (29.75 %).

Figure 1.8: Median housing price per square meter of Provence-Alpes-Côte-D'Azur counties

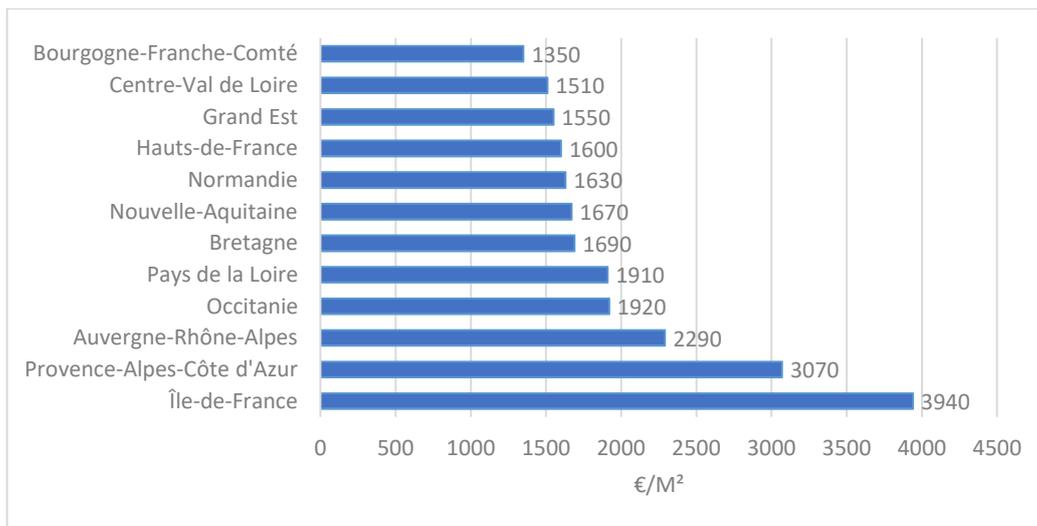


Source: Authors, data from MeilleuresAgences.fr

Figure 1.8 presents the median housing price per square meter of counties of the region of PACA. Housing prices in the Alpes-Maritimes and Var departments are the most expensive. Higher property prices are in Saint-Jean-Cap-Ferrat (8970 €/m<sup>2</sup>), Ramatuelle (8290 €/m<sup>2</sup>), Beaulier-Sur-Mer (7420 €/m<sup>2</sup>), Saint-Tropez (7100 €/m<sup>2</sup>) and Grimaud (6640 €/m<sup>2</sup>). While lower housing price per square meter are located in Alpes-De-Haute-Provence, Hautes-Alpes and Vaucluse departments. Property prices in the departments located near to the littoral are higher than the property prices of departments located far from the littoral.

Housing demand is higher than housing supply which leads to an increase in the housing prices in the region of PACA. In 2018, the property price per square meter in this region is of 3070 €/m<sup>2</sup>, which is much higher than the national average property price per m<sup>2</sup> (2010.83 €/m<sup>2</sup>).

Figure 1.9: Average housing price per square meter in 2018



Source: Authors, data from Meilleuresagences.fr

The database consists of 978 counties of the French PACA region collected for the year 2018. Taking into consideration the relation between property tax rates and real estate prices that was described in the literature review, the variables examined in our model are land surface and population, the property tax rates (expressed in % in each county), local public expenditures per capita, the number of principal and secondary residences, median household income, and the presence of a coast which is a dummy variable and takes the value 1 if the county is located near the sea and 0 if not.

Data on property tax rates and local public expenditures have been obtained from the database of the French General Direction of Local Authorities (DGCL). Table 1.3 delivers some descriptive statistics. The average property tax rate in the region of PACA is 15.57 %.

Table 1.3: Descriptive statistics of the variables of the sample

Variables	Mean	Std. Dev	Min	Max
Housing prices	2382.18	978.33	381	8970
Property tax rate	15.57	7.32	0	44.42
Population	4715.51	29402.15	7	797491
Local public spending per capita	2972.66	5497.02	14.51	139838.5
Number of principal residences	1979	13007.73	3	346743
Number of secondary residences	445.06	1588.83	3	23560
Household income	19920.93	2694.08	11798	41574
Land surface	3239.45	3777.93	58	75821

Source: Authors, database of National Institute of Statistics and Economic Studies, French General Direction of Local Authorities, MeilleuresAgences.fr, and General Direction of Public Finance.

### 1.2.3. Spatial analysis methodology

In this chapter, we use spatial econometrics because of the spatial dependency of property prices between French counties. This means that we suppose the existence of a correlation between property prices of neighboring counties. In order to avoid any bias, Anselin (2002) and Elhorst (2010) propose to implement a spatial interaction model. LeSage and Pace (2009) present various technical arguments justifying the choices of such models.

Spatial autocorrelation is a phenomenon which describes the lack of independence between geographic observations in a sample. The higher the observed spatial autocorrelation, the more observations from geographically close neighbors affect observations. There are, however, several kinds of spatial autocorrelation: a positive spatial autocorrelation describes the spatial grouping of similar values ; negative spatial autocorrelation describes the spatial clustering of dissimilar values where nearby counties tend to be more different than distant territories; finally, the absence of spatial autocorrelation describes the random distribution of the values of the variable over the geographic territory.

#### 1.2.3.1. The different weigh matrix

Before starting any spatial analysis, it is important to determine which type of spatial unit to choose (Fingleton, 2009). For 978 counties, we define a square matrix of size 978 x 978, where diagonal elements are null. Different spatial matrices exist: such as the contiguity matrices<sup>1</sup>, the distance matrices<sup>2</sup>, or matrices taking into account the strength of relations between areas<sup>3</sup> and the k nearest neighbors' matrices.

These neighborhood matrices are most often normalized by row which means that the sum of the elements per row is equal to 1. For a contiguity matrix, if a county has k neighbors, each

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<sup>1</sup> The contiguity matrices associates each immediate neighbor with the value 1 and 0 in the opposite case.

<sup>2</sup> The coefficients of the matrix take the value 1 if  $d$  is less than  $d_0$  and thereafter the relations become weaker with the distance. At the same time, too short distance can create many islands (areas without neighbors). Choosing a distance such that each zone has at least one neighbor can create zones with a very large number of neighbor relationships. Griffith (1996) specifies that it is preferable to use an under-specified matrix (distance less than the optimal distance) to an over-specified matrix (greater distance).

<sup>3</sup> Matrices taking into account the strength of relations between areas, for example the percentage of common borders. The neighborhood weight between two zones  $i$  and  $j$  can thus be defined by with  $b_{ij}$  a measure of the strength of the relationships between areas  $i$  and  $j$  (which is not necessarily symmetrical) such as the percentage of common borders, the population, the wealth and  $d_{ij}$  is the distance between the areas.

non-zero term of the k-th row will thus be equal to  $1/k$ . In our case, the specification tests show that the contiguity matrix, fits better than the distance matrix.

### 1.2.3.2. The measure of the spatial autocorrelation

After defining the weigh matrix, the second step is to look for the presence of spatial autocorrelation. As stated previously, there are several statistics to measure the presence of spatial autocorrelation in a sample. According to Cliff and Ord (1981), Upton and Fingleton (1985) and Baumont (2009), Moran's statistic is the most widely used. For a year  $t$ , it is written in the following form:

$$I = \frac{N}{\sum_i \sum_j w_{ij}} \cdot \frac{\sum_i \sum_j w_{ij} (y_i - \bar{y})(y_j - \bar{y})}{\sum_i (y_i - \bar{y})^2} \text{ with } i \neq j \quad (1.1)$$

with  $i$  and  $j$  the spatial units,  $N$  the number of spatial units,  $y_i$  and  $y_j$  are the values of the variable in the unit  $i$  and  $j$ ,  $\bar{y}$  is the mean of  $y$ , and  $w_{ij}$  the elements of the standardized spatial weighting matrix. Moran's statistic is used to analyze the level of spatial autocorrelation of a sample and to test the associated significance. The index of the Moran statistic is interpreted as follows: when the index is close to 1 the statistic indicates a positive spatial autocorrelation. When the index is close to -1, the statistic indicates a negative spatial autocorrelation, and when the index is very close to 0, the statistic indicates a lack of spatial autocorrelation.

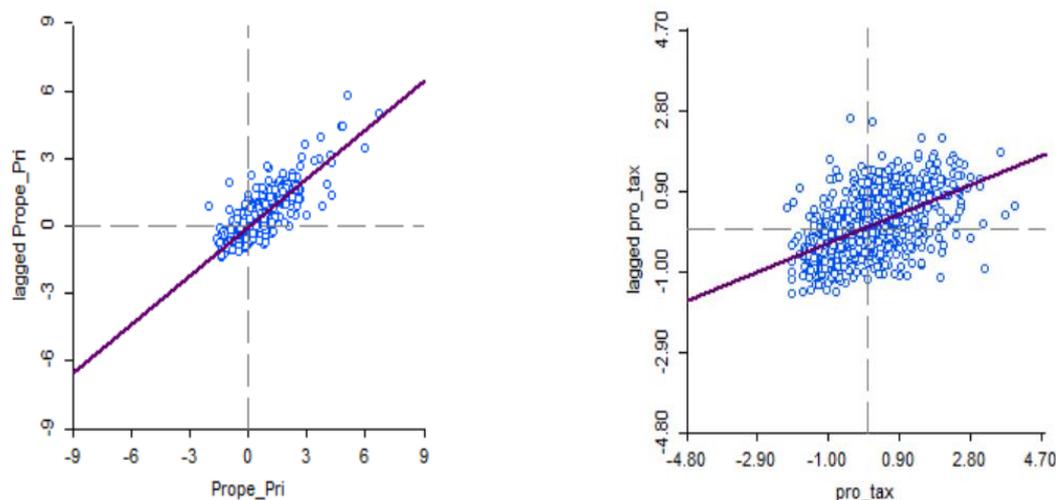
Table 1.4 presents the results of the Moran I statistics for all variables used in the model. The global Moran statistics are positive and significant. They show the existence of neighborhood effects among PACA counties. The Moran statistic of the property prices per square meter shows that counties with higher property prices are ringed by counties with higher property prices, and conversely, counties with lower property prices are ringed by counties having similar characteristics. The Moran statistics of the population, local public spending per capita and the principal residences are close to 0, which means that there is no spatial autocorrelation. Figures 1.10 and 1.11 show the graphics of Moran statistics for the property prices per square meter and the property tax rates of the PACA counties.

Table 1.4: Moran I statistics

Variables	I	P-value
Property price	0.722***	0.000
Property tax rate	0.362***	0.000
Population	0.051***	0.000
Public spending per capita	0.088***	0.000
Principal residence	0.046***	0.000
Second residence	0.287***	0.000
Household' income	0.415***	0.000
Littoral	0.667***	0.000

Source: Authors, database of National Institute of Statistics and Economic Studies, French General Direction of Local Authorities, MeilleuresAgences.fr, and General Direction of Public Finance.

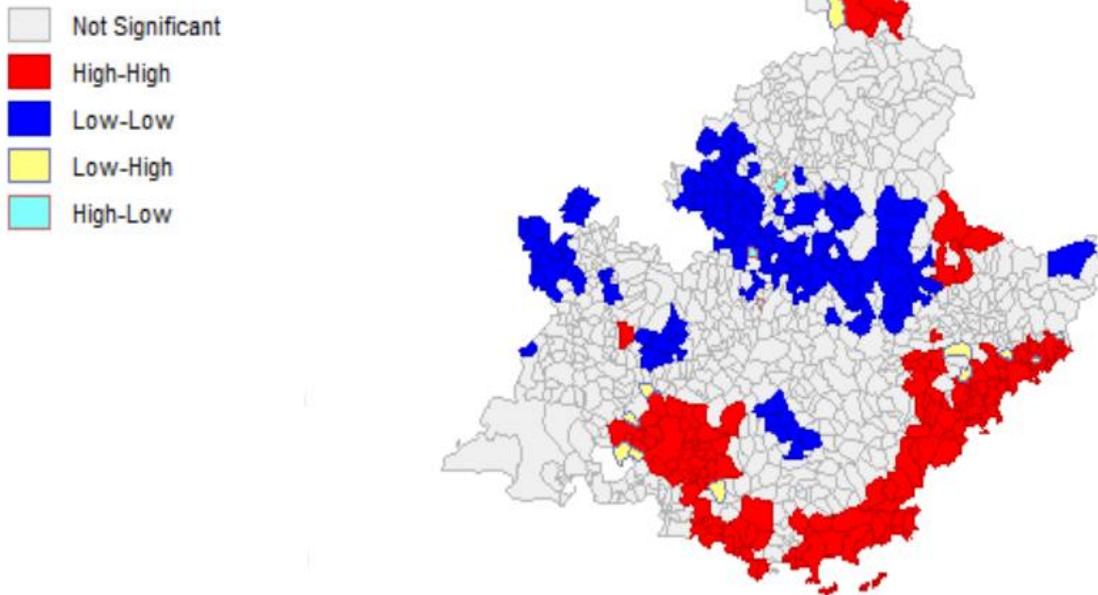
Figure 1.10: Moran test for property prices Figure 1.11: Moran test for property tax rates



Source: Authors

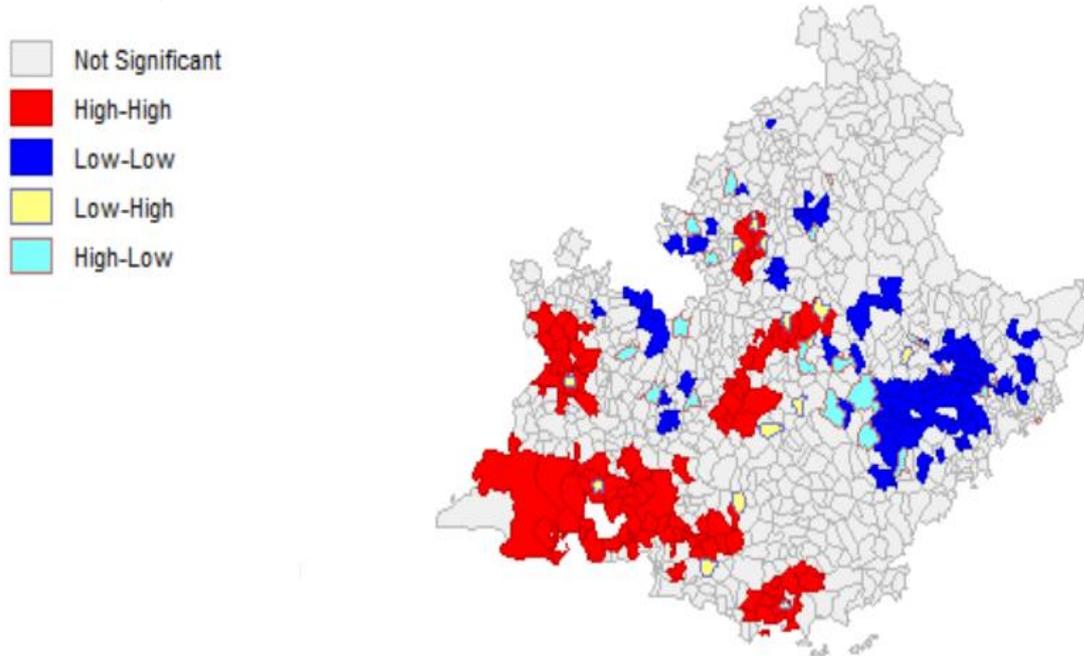
Figures 1.12 and 1.13 show the Lisa statistic of the property prices per square meter and the property tax rates of the counties of PACA. The Lisa statistics for both variables are significant at the thresholds of 5%. It exists within the sample of the property prices per square meter some clusters. High-High clusters regroup counties with higher property prices surrounded by counties with higher property prices, especially counties located near to the littoral. Clusters Low-Low regroup counties with lower property prices surrounded by counties with lower property prices, especially counties of Alpes-De-Haute-Provence department.

Figure 1.12: Lisa statistic of the property prices



Source: Authors, database of meilleures-agences.fr

Figure 1.13: Lisa statistic of the property tax rates



Source: Authors, database of General Direction of Public Finance.

For the sample of the property tax rates, it also exists some clusters. Clusters High-High which regroups counties with higher property tax rates surrounded by counties with higher property tax rates, in particular for the counties of the Bouche-Du-Rhone and the Var

departments. Clusters Low-Low regroup counties with lower property tax rates surrounded by counties with lower property tax rates. Those clusters are much represented in the Alpes-Maritimes department.

### 1.2.3.3. Spatial econometric models on cross section data and methodology

Elhorst (2010) establishes a classification of the main models of spatial econometrics. Manski's (1993) model is the general model distinguishing 3 types of spatial interaction: an endogenous interaction, where the economic decision of an agent depends on the decision of its neighbors (ex: property price of a county depends on the property price of neighboring counties); an exogenous interaction, where an agent's economic decision depends upon the observable characteristics of its neighbors (ex: the number of secondary residences of a county depend upon the number of secondary residences of neighboring counties) and a spatial correlation of the effects which is linked to unobserved characteristics. The matrix form of the model is as follows:

$$y = \rho \cdot wy + X\beta + wX\vartheta + \mu$$

$$\text{with } \mu = \lambda W\mu + \varepsilon \quad (1.2)$$

where  $\beta$  is the parameter of the exogenous variables,  $\rho$  captures the effect of the endogenous interaction, called spatial autocorrelation.  $\vartheta$  captures the effects of exogenous interactions and  $\lambda$  is linked to the effects of spatial correlation of errors called spatial autocorrelation.

From Manski's model (1993), two main models can be deduced depending on the constraint used  $\vartheta = 0$  and  $\lambda = 0$ . If  $\vartheta = 0$  we find the Kelejan-Prucha model also called "Spatial autoregressive confused" SAC:

$$y = \rho Wy + X\beta + \mu \text{ where } \mu = \lambda W\mu + \varepsilon \quad (1.3)$$

The estimators of the SAC model have the drawback of being biased and not convergent if the model includes exogenous interactions (Lesage and Pace, 2009). In this case, there is a bias of omitted variables. This is not the case for the "Spatial Durbin Model" noted SDM where  $\lambda = 0$ :

$$y = \rho \cdot wy + X\beta + wX\vartheta + \varepsilon \quad (1.4)$$

From the SDM model, we can deduce two different models named Spatial Autoregressive model “SAR” and Spatial Error Model “SEM”<sup>4</sup>. SAR takes the form  $y = \rho \cdot wy + X\beta + \varepsilon$  (1.4) and the SEM takes the form  $y = X\beta + \mu$  with  $\mu = \lambda W\mu + \varepsilon$  (1.5).

LeSage and Pace (2009) argue that the Spatial Durbin model is the best starting point when choosing a spatial model. Conversely, Florax et al. (2003) and Elhorst (2010) posit that the expansion of a linear equation with spatially lagged variables is optimal for findings the true data generating process for this class of spatial models. In this chapter, we subscribe to Elhorst’s (2010) methodology who provides a review of issues concerning the taxonomy and the choice of estimation between the main five spatial cross section models.

To choose the best model, two main approaches are used. The first known as "Bottom-up" which is based on starting by the non-spatial model (Le Gallo, 2002). The Lagrange multiplier tests (Ausel et al., 1996) make possible to decide between the SAR, the SEM and the non-spatial model. The second known as "top-down" approach, which is based on the SDM. Using the likelihood ratio tests, we deduce the model best suited to the observations<sup>5</sup>. For the estimators, Lee (2004) and LeSage and Pace (2009) consider the Lagrange multiplier to be the best fit for estimating the different spatial models.

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<sup>4</sup> To obtain the SEM from the SDM model, we set  $\vartheta = -\rho\beta$ , a so-called common factor hypothesis. The SDM is written in this case,  $y = X\beta + \rho W(y - X\beta) + \varepsilon$ . By noting  $\mu = y - X\beta$ , we find the SEM.

<sup>5</sup> Elhorst (2010) proposes a mixed approach. It consists in starting with the bottom-up approach but in the event of spatial interaction ( $\rho = 0$  and  $\lambda = 0$ ), instead of directly choosing a SAR or SEM model. Studying the SDM, allows to confirm, using different tests, the relevance of the chosen model. It also allows to integrate exogenous interactions into the analysis. In the event of uncertainty, the most robust model (SDM) is chosen. If from the residuals of the OLS model, the Lagrange multiplier tests ( $LM_\rho$  and  $LM_\lambda$ ) conclude that there is spatial autocorrelation, the SDM is estimated. If the tests conclude to the presence of residual autocorrelation, i.e.  $\rho = 0$  and  $\lambda \neq 0$ , a test of the likelihood ratio of the hypothesis of the common factor ( $\vartheta = -\rho\beta$ ) allows to choose between the SEM model and SDM model. In the case where the tests underline the absence of autocorrelation, i.e.  $\rho = 0$  and  $\lambda = 0$ , the SLX model is estimated.

### 1.3. EMPIRICAL ANALYSIS AND RESULTS

The empirical models employed in this chapter use cross-section data. Focusing on the year 2018 and a sample of 978 French counties of the region of PACA, these models seek to test the effect of the property tax on the property price per square meter. The non-spatial model is written as follows, where the index  $i$  represents the counties and  $t$  the year 2018:

$$\ln\_PROPERTY\_P_{it} = \beta_{0it} + \beta_1 PT_{1it-1} + \beta_2 \ln\_POPUL_{2it} + \beta_3 \ln\_PUBLIC\_SPEND_{3it} + \beta_4 PRINCIP\_RESIDE_{4it} + \beta_5 SECOND\_RESIDE_{5it} + \beta_6 \ln\_INCOME_{6it} + \beta_7 LITTORAL_{7it} + \varepsilon_{it} \quad (1.6)$$

$t = 2018$  and  $\forall i = 1, \dots, 978$

where  $PROPERTY\_P_{it}$  is the property prices per square meter,  $PT_{1it-1}$  is the property tax rates of different counties for the year 2017,  $POPUL_{2it}$  is the number of population in each county,  $\ln\_PUBLIC\_spend_{3it}$  is the amount of local public spending per capital of each county,  $PRINCIP\_RESIDE_{4it}$  is the proportion of principal residences out of all residences and  $SECOND\_RESIDE_{5it}$  is the proportion of second residences out of all residences.  $INCOME_{6it}$  is the household income of each county and  $LITTORAL_{7it}$  is dummy variable which takes the value 1 if the county is located near to the littoral. The methodology used in this analysis focuses on the work of Charlot et al. (2013).

#### 1.3.1. The effect of property tax on property prices

The presence of the spatial autocorrelation observed in the previous section confirms the need to use spatial econometrics on cross section. Table 1.5 presents the results of the spatial specifications SAR, SEM, SDM and SACM. Table 1.6 presents the results of the specification tests which match with the recommendations of Lesage and Pace (2009) and Elhorst (2010). In their recommendations, they indicate that, the first step should begin by the SDM model as a general specification. In the second step, they recommend to use the LR. In other works, the AIC criteria is used (Burnham and Anderson, 2004).

The coefficients of the spatial autocorrelation<sup>6</sup> " $\rho$ " and the spatially weighted variables " $w_x$ " of the property tax rate, local public spending per capita, proportion of second residences, household income and the littoral are significant and seem to affect the property price of PACA

<sup>6</sup> The spatial autoregressive coefficient is positive and significant which is consistent with the Moran I findings. This confirms the existence of a significant correlation between the property prices of the PACA counties.

counties. The results of the four spatial models are very close. The results of the table 1.5 show that the SDM model offers the best specification. SDM models allow to estimate the impact of the dependent variables on the property price of a county.

Table 1.5: Results of the spatial models

	a-spatial (1)	SAR (2)	SEM (3)	SDM (4)	SAC (5)
Log of population	0.066*** (0.0075)	0.014** (0.0057)	0.005 (0.0075)	0.009* (0.0061)	0.006 (0.0043)
Property tax rate	-0.007*** (0.0014)	-0.002* (0.0011)	-0.001 (0.0012)	-0.002* (0.0012)	-0.001 (0.0008)
Log of local public spending per capita	0.046*** (0.0168)	0.0173 (0.0109)	0.028** (0.0118)	0.0207* (0.0116)	-0.003 (0.0088)
Proportion of principal residence	0.171 (0.2476)	0.082 (0.1700)	-0.053 (0.1814)	0.219 (0.1747)	0.188 (0.1383)
Proportion of second residence	0.0608** (0.0235)	0.046** (0.0135)	0.048** (0.0149)	0.0585*** (0.0148)	0.038*** (0.0106)
Log of household' income	0.822*** (0.0916)	0.357*** (0.0614)	0.260*** (0.0707)	0.258*** (0.0688)	0.279*** (0.0497)
Littoral	0.283*** (0.0558)	0.122*** (0.0324)	0.149** (0.0491)	0.053* (0.0499)	0.0783** (0.0226)
Spatial					
$\rho$	-	0.718*** (0.0239)	-	0.691*** (0.0261)	0.879*** (0.0198)
$\lambda$	-	-	0.782*** (0.0229)	-	-0.577*** (0.0730)
$w_x$					
Property tax rate	-	-	-	0.0007* (0.0017)	-
Log of local public spending per capita	-	-	-	-0.0633** (0.0197)	-
Proportion of second residence	-	-	-	0.011* (0.0249)	-
Log of household' income	-	-	-	0.379** (0.1205)	-
Littoral	-	-	-	0.154** (0.0655)	-
R <sup>2</sup> (%)	31.74	39.56	22.69	43.97	43.45
Observation	978	978	978	978	978

Notes: \*, \*\*, \*\*\* correspond respectively to a significance at the thresholds of 1%, 5%, 10%

Source: Authors, INSEE, French General Direction of Local Authorities, and General Direction of Public Finance.

In this work, the SDM model is privileged because of its theoretical foundations and its power to target the role of the property tax on the property prices in the PACA counties for the year 2018. In the same time, the results of LR tests confirm this choice. In the SDM model (column 4), property tax rates have a negative and significant effect on the property prices of the PACA counties. This result is consistent with the assumption of negative capitalization of

property tax into property prices. Local public spending per capital has a positive and significant impact on the property prices of PACA counties. This is due to the positive capitalization of local public spending into the property prices. This means that an increase in public infrastructure and equipment increases housing prices.

These results are consistent with the outcomes of the theoretical analysis developed above. Property prices are positively impacted by local public spending and negatively impacted by property taxes. This result is expected from a theoretical point of view but counterbalances a common belief among local economic agents in France that the level of property taxes depends on the level of property prices and not the opposite.

Table 1.6: Tests for the selection of the model

Model tested	$\chi^2$	P-value	AIC
SDM/SAR	24.53	0.0002	-
SDM/SEM	66.16	0.0000	-
SDM/SAC	-20.59	1	-
SAC	-	-	-110.34

Source: Authors

The results of  $w_x$  of the property tax rate and local public spending per capita show some additional results. An increase of the property tax in a county has a positive effect into the property price of a neighboring county; conversely, an increase of the local public spending per capita in a county has a negative effect into the property price of a neighboring county. The introduction of the shifted spatial variable " $\rho$ " does not allow the interpretation of the value of the coefficients of the SDM model. Table 1.7 presents information about the direct, indirect and total spatial effects of different variables on the property price of each county.

The results of the decomposition of the direct, indirect and total spatial effects highlight several important results. First, the population size plays an important role to the property price of a county and also to the property prices of its neighboring counties. With the increase of population, housing demand increases which rises the property prices and the tax base value.

Second, property tax rate has a negative effect on the property price of a county and its effect is not significant into the property prices of neighboring counties. An increase of 1 % of property tax rate in a county decreases its property price per square meter by 0.002 % (direct effect). This result converges towards the conclusion of several papers which deal with the same issues (Charlot et al., 2013; Bai et al., 2014; Kang et al., 2015; Tajani et al., 2017). In the SDM,

the coefficient of the local public spending per capita is higher than the coefficient of the property tax rate. This means that the positive capitalization of local public spending is higher than the negative capitalization of property taxes into property prices. Oates (1969) explains that, when the increase in the property tax rates is accompanied by an increase of local public expenditure, the positive capitalization of the local public expenditure into the property prices could be higher than the negative capitalization of the property taxes into the property prices.

Table 1.7: Direct, indirect and total effects of the SDM model

<b>Direct effects</b>	
Log of population	0.010* (0.0069)
Property tax rate	-0.002** (0.0012)
Log local public spending per capita	0.010* (0.0127)
Proportion of principal residence	0.251 (0.1996)
Proportion of second residence	0.069*** (0.0157)
Log of household' income	0.372*** (0.0706)
Littoral	0.0932* (0.0478)
<b>Indirect effects</b>	
Log of population	0.0192* (0.0125)
Property tax rate	-0.0027 (0.0048)
Log of local public spending per capita	-0.148** (0.0583)
Proportion of principal residence	0.461 (0.3687)
Proportion of second residence	0.156** (0.0696)
Log of household' income	1.675*** (0.3128)
Littoral	0.583*** (0.1354)
<b>Total effects</b>	
Log of population	0.029* (0.0194)
Property tax rate	-0.005* (0.0053)
Log of local public spending per capita	-0.138** (0.0647)
Proportion of principal residence	0.711 (0.5674)
Proportion of second residence	0.226*** (0.3363)
Log of household' income	2.047*** (0.3363)
Littoral	0.676*** (0.1372)

Third, local public spending per capita impacts positively the property prices of the county but negatively the property prices of neighboring counties. A probable explanation of this effect is that an improvement of the quality of local characteristics of a county attracts households living in neighboring counties. Local public services such as the quality of schools or the proximity of transport facilities have a major influence on property prices and increase the individual mobility (Bowes and Ihlanfeldt, 2001; Fack and Grenet, 2010; Gibbons, 2004; Gibbons et al., 2014 and Zheng and Kahn, 2008). An increase of 1 % of the local public spending in a county increases its property price by 0.01 % (direct effect) and decreases the property prices of its neighboring counties by 0.148 % (indirect effect).

Fourth, secondary residences impact positively the property price of the county and also the property prices of its neighboring counties. PACA counties with high proportion of secondary residences are generally touristic areas where the property prices are often high. Fifth, an increase in a county's households' income impacts positively its property prices and the property prices of its neighboring counties. This is an expected result since real estate consumption and rents feature among the primary expenses of households. Rich households tend to cluster together, while poor households have also no choice but to cluster together.

## CONCLUSION

The aim of this chapter was to determine the effect of property taxes on housing prices of the PACA counties. The chapter presents, first, a brief literature review which outlines the main theoretical and empirical works that investigated the relationship between property taxes and property prices. Second, this chapter draws a unique dataset with locational characteristics of the 978 counties of the PACA region in 2018. This work builds a series of empirical spatial models to test the presence of spatial autocorrelation. We introduce variables such as local public spending per capita, population size, second residences, and property tax rate.

The interest of studying the impact of the property tax on the property price of PACA counties is threefold. First, we focus on a county level analysis to capture the property price variation between counties and to catch the local disparities, which we cannot control at the departmental level. Second, we work on a touristic region such as the region of PACA, with a high number of secondary residences. Third, PACA counties are characterized by higher property tax rates and greater value of tax base than other areas and French regions.

The results of our chapter can be summarized as follows: First, property taxes impact negatively the property prices. This negative effect is due to the negative capitalization of the property tax into the value of the property. Second, the local public spending per capital impacts positively the property price of a county and negatively the property prices of its neighboring counties. Third, the median household income has an important role on the property price of the PACA counties. An increase of the household income increases the property prices of the county and the property prices of its neighbors. Fourth, the property price of a county located near to the littoral is often higher than the property price of the county located far from the littoral.

The main outcome of the chapter is that local policy adopted by French counties to increase property tax rates could affect real estate prices. When the property tax increases, the rate of return that is expected to be generated on a real estate investment property decreases. When the property tax increases, the burden of the tax is supported by owners and maybe by renters (by increasing the price renting). An increase of the property tax rate may be capitalized into the property prices, whereas, an increase of the local public spending can have a compensatory effect.



**Chapter 2.**  
**THE EFFECT OF TAX MIMICKING IN**  
**DETERMINING THE PROPERTY TAX**  
**AMONG FRENCH LOCAL GOVERNMENTS**



## INTRODUCTION

Local tax rates are determined by a series of economic and political variables such as the size of a county, the real-estate market conditions, rightist and leftist local governments, but also local productive specialization or unemployment rates. Recent studies stress out that the public choices and fiscal policies of neighboring counties also determine local tax rates. Several empirical studies examine the effects of a tax mimicking behavior among local governments (Jayet et al., 2002; Vermeir and Heyndels, 2006; Delgado et al., 2015; Bocci et al., 2019). To prove the existence of strategic interactions, these studies mainly use spatial econometrics where tax choices are represented as a reaction function of choices made by neighboring local governments.

Three specific sources of tax mimicking are mainly retained. The first source of tax mimicking is tax competition (Beck, 1983; Wilson, 1986; Zodrow and Mierzkoski, 1986; Oates, 1988; Brueckner and Saavedra, 2001). In tax competition, local public decision makers consider the probability of people moving out of a given county in case of a tax raise. Consumers compare tax rates of their county to the tax rates of neighboring counties. By supposing a given level of mobility of individuals, tax interaction explains why households move into the county where tax rates are lower than where they live (Mintz and Tulkens, 1986; Wildasin, 1988; and Bucovetsky, 1991).

The second source of tax mimicking is yardstick competition (Salmon, 1987; Besley and Case, 1995; Delgado et al., 2015; Vermeir and Heydels, 2006) which implies that consumer-voters compare the quantity of public goods and services supplied by their own county to other counties. To judge the performance of their local politicians, consumer-voters compare the tax policy choices of the neighboring counties to their own county's one. If they find that neighboring counties supply the same level of local public goods and services with lower tax rates, they will punish their local incumbents by not reelecting them.

The third source of tax mimicking relies on spillover effects (Gordon, 1983; Case et al., 1993; Hanes, 2002; Lundberg, 2006; Ollé, 2006). The spillover effects models admit that a new tax policy or a new public equipment in a county induces positive or negative externalities affecting the locational behavior of households in neighboring counties. The positive or negative externalities could represent a strategic incentive for neighboring counties to change or to adjust their tax policies.

This work examines local tax policies' mimicking among French counties by using a cross-sectional dataset with information about the 3865 counties of two main French regions, Provence-Alpes-Côte-d'Azur and Rhone-Alpes in 2014, which is an election year for local representatives. The contribution of our paper to recent literature on tax mimicking is threefold. First, this work is applied on the French counties which represent an interesting level of analysis since they represent the smaller institutional unit in the country. The county level is the only one to allow the modelling of electoral behavior. Second, this work tests for the existence of tax mimicking, then determines whether this phenomenon is due to yardstick competition or to spillover-effects. If tax mimicking is due to yardstick competition, incumbents will be interested in mimicking the tax policies of neighboring counties in order to be re-elected. If the tax mimicking is due to the spillover-effects, then small counties, in term of population size, are more influenced by the tax choices of their neighbors than the bigger counties. Third, by working on spatial data, we test the presence of spatial autocorrelation using Moran I and LISA tests. We draw spatial models which aim to determinate the direct and indirect spatial effects of exogenous variables to the tax policy decisions of the French counties.

The question of this chapter is whether French local governments take into consideration the tax-policies of other local governments when taking their own decisions. To find an answer to this question, this chapter is organized as follows: section 2.1 presents the theory of local tax mimicking. In this section, we expose a brief literature review about the tax mimicking theory and its sources. Section 2.2 delivers data information and discusses econometric issues. In this section, we present the database used in this chapter and in the same time we present the results of the Moran I and Lisa tests. Section 2.3 delivers the results of the property tax mimicking among French local governments and its sources.

In our results, we find that property tax mimicking features among Provence-Alpes-Côte-D'Azur counties and among Rhône-Alpes counties. This means that counties of both regions mimic their neighbors in term of property tax policies. We also find that the property tax mimicking among Provence-Alpes-Côte-D'Azur counties is due to yardstick competition and to the spillover effect, whereas, the property tax mimicking among Rhône-Alpes counties is due only to the spillover effect.

## **2.1. A THEORY OF LOCAL TAX MIMICKING**

Tax mimicking strategies have been introduced in Tiebout's (1956) original "voting with feet" model which focuses on the effects of fiscal interaction and local public services on the mobility of households. Several studies analyze the impact of local taxation on the choices of economic agents in terms of geographic location (Guengant, 1992; Houdebine and Schneider, 1998; Feld and Kirchgassner, 2001 and Feld and Kirchgassner, 2003). Recent studies attempt to analyze the consequences of tax mimicking between local authorities on the determination of tax rates. Three theories of tax mimicking were developed: yardstick competition (Salmon, 1987; Besley and Case, 1995a), tax competition (Wildasin, 1988; and Wilson, 1999) and spillover effects (Gordon, 1983; Case et al., 1993). They all lead to a common conclusion which is the existence of fiscal interactions among local authorities having the same spatial level.

### **2.1.1. The fiscal policy interactions: A brief literature**

Tiebout (1956) develops a model of "voting with feet". His model implies that individuals choose where they want to settle on the basis of local public goods and services and local tax rates in different counties. Individuals differ in their individual preferences toward different services and their willingness to pay for these services. In this situation, the role of local governments is to create local public goods and services adapted to the preferences of consumers with rational tax rates.

#### **2.1.1.1. Tax mimicking among local governments**

A first series of empirical models study the location choices of firms and households, according to local tax competition as defined in Tiebout's models (Beck, 1983; Wilson, 1986; Zodrow and Mierzkoski, 1986; Oates, 1988; Brueckner and Saavedra, 2001). In these models, the local public decision makers consider the probability of people moving out of a given municipality in case of a tax raise. In a competitive model, jurisdictions take into consideration the policies adopted by their neighbors (Mintz and Tulkens, 1986; Wildasin, 1988; Bucovetsky, 1991).

In the Tiebout's model (1956), tax competition signifies that individuals move to another county if, with the same level of public goods and services, tax rates are much higher than the

tax rates of neighboring counties. In this situation, each local government attempts to do better than the neighboring local governments in terms of local public goods and taxes.

Wilson (1986) defines tax competition as “a situation where public service outputs and tax rates are too low in the sense that a federal government could raise the nation’s welfare by requiring each region to increase its public output”. For Oates (1988), tax competition occurs when each local government decreases local tax rates and set spending below their efficient level. Wilson (1999) develops the tax competition theory and divides the previous models into two categories. First, tax competition models are efficient when tax mimicking among local governments is absent. This means that a local government’s tax policy is controlled by the needs in terms of public provision of services (Richter and Wellisch, 1996). Second, tax competition model is inefficient when tax mimicking among local governments is present. This means that each local government considers the tax policies adopted by its neighbors (Brueckner and Zaavedra, 2001; Lyytikainem, 2012).

Several studies tried to detect the presence of tax mimicking between local governments. Heyndels and Vuchken (1998) present empirical evidence of property tax mimicking among 589 Belgian counties for 1991. In their work, they stipulate that local tax income is spent on education, police, and transport infrastructure. Their result show that the property tax rate of a county is influenced by the property tax rates of the neighboring counties. Their results confirm the presence of property tax mimicking among Belgian counties. They find a positive relationship between population size and property tax rates. They explain that an increase in population size increases local public services.

Following Wilson (1999), Brueckner and Saavedra (2001) argue that tax competition models consider that local public goods and services are often underprovided (inefficient). The explanation of inefficiency is that each county holds its tax rate low in order to conserve its tax base value. They examine the presence of property tax mimicking among 70 counties from the Boston metropolitan area for 1980 and estimate a tax reaction function. This function implies that the property tax rate of a county  $i$  depends on the property tax rates of its neighboring counties and on its characteristics<sup>7</sup>. The slope of the tax reaction function " $\rho$ " indicates the

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<sup>7</sup> The tax reaction function is as follows:

$$t_i = \rho \sum w_{ij} t_j + z_i \theta + \varepsilon_i \quad (2.1)$$

presence or the absence of property tax mimicking. If the coefficient of the slope is different from 0, property tax mimicking is present. Otherwise (if the slope is equal to 0), property tax mimicking is absent. In their results, the slope of the reaction function is positive and significant which confirms the presence of property tax mimicking among the 70 counties of Boston. In other words, a decrease in property tax rate in a county generates a decrease in property tax rates of its neighboring counties<sup>8</sup>.

By considering that the inhabitants in each county feature identical consumption preferences and incomes, Jayet et al. (2002) deliver a model where the utility of the representative agent of a county depends on its private consumption, the level of local public services provided by the county and the level of local taxes (which aim in financing these public services). Jayet et al. (2002) show that in a non-cooperative game between decision makers, local competition between counties may lead to a suboptimal Nash equilibrium. On the opposite, cooperative attitudes may lead to a general increase in tax rates in order to increase local public spending.

In another empirical study, Leprince et al. (2005) detect the presence of tax mimicking among French departments. They work on the department level because they benefit from data on social assistance, roads, secondary education and economic development. In their empirical estimation, they focus on the sign of the slope of the fiscal reaction function. The objective of their paper is to verify the existence of spatial interactions among French departments concerning the determination of the housing tax, business tax, the tax on built property and the tax on non-built property. Their work leads to admit the hypothesis of tax mimicking among French departments.

Gérard et al. (2009) work on the existence of property tax interaction among Belgian counties, but find that property tax mimicking is absent. Buettner (2001) works on the determination of business tax mimicking among 1111 German counties from 1980 to 1996. In

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where  $t_i$  is the property tax rate of the county  $i$ ,  $t_j$  is the property tax rate of the county  $j$  and  $\rho$  is the slope of the tax reaction function.  $w_{ij}$  is the weight matrix,  $z_i$  is a vector regrouping the characteristics of the county  $i$  and  $\theta$  is the corresponding coefficient vector.

<sup>8</sup> Regarding the socio-economic variables used in their reaction function, they find a negative relationship between household income and the property tax rate. They explain that an increase of household income increases the tax base value which decreases the property tax rate. They also stipulate that counties with high households' income have low property tax rates. They also find a positive relationship between state aid and property tax rates. They explain that high level of state aid increase the county spending which increase the property tax rates. In their results, they also explore that education has a positive impact on property tax rate. This result means that there is a high demand for school expenditure in heavily-educated counties.

order to capture the preferences of citizens, he introduces variables such as the age structure of the population and the share of foreigners. He argues that this variable allows to capture the residents' population without voting power. He finds that a county follows the business taxing decisions of its neighboring counties but remains reluctant to business tax increases. Tax mimicking only works for taxes decrease.

Brett and Pinkse (2000) stipulate that the counties' tax rates reflect the choices made by competitive counties in response to the demand for local public goods and services and according to the disposable tax base. They present a model<sup>9</sup> of tax base where they include local characteristics and tax rates of neighboring counties and assume that local public spending is financed only by the county taxes. Their theoretical model shows that tax rates are influenced by the tax base value and the latter depends on the specific characteristics of the county and on the characteristics of its neighbors. In their empirical analysis, Brett and Pinkse work on 142 British Columbia counties for the years 1987 and 1991. They choose to introduce variables such as the households' income, meters of roads, the number of employees in primary industrials, elderly population and show a positive effect of neighbors' tax rates on a county's taxation decisions.

Lyytikainen (2012) studies the existence of property tax mimicking among counties in Finland and if the source of strategic interactions is due to tax competition. He indicates that with a low level of property tax rates, there would be an increase in business capital which could benefit to the population of the county in terms of employment possibilities and which may increase furthermore the income tax revenues of the county. He works on a panel data of Finnish counties from 1993 to 2004. In his model, are included some socio-economic variables such as population, median income and unemployment. He concludes to the non-existence of strategic interactions between counties which could be due to the fact that they compete on property tax rates on a larger geographical level than the neighborhood level studied in the paper. The absence of property tax mimicking could also be due to the fact that consumers believe that tax revenues are not wasted.

<sup>9</sup> The tax base model of Brett and Pinkse (2000) is as follows:

$$\ln TB_i = X_{1i} \theta + \alpha_i (T_i + OT_i) + \sum_{i \neq j} \alpha_{ij} (T_j + OT_j) + \sum_{i \neq j} S_j \beta_{ij} + \mu_i \quad (2.2)$$

The tax rate model is as follows:

$$T_i = \eta \ln TB_i + \xi OT_i + X_{2i} \beta + v_i \quad (2.3)$$

where  $TB_i$  is the tax base of the county  $i$ ,  $T_i$  is the tax rate,  $OT_i$  represents other tax rates,  $S_j$  represents the local characteristics of neighboring counties,  $X_{1i}$  represents the local characteristics of the county  $i$ .

### 2.1.1.2. Yardstick competition

A second series of models consider that local fiscal policy interactions could be due to yardstick competition (Salmon, 1987; Besley and Case, 1995; Delgado et al., 2015; Vermeir and Heydels, 2006) which implies that consumer-voters ignore at a certain degree the quantity of public goods and services supplied by their own county. To judge the performance of their own local politicians, consumer-voters compare the tax policy choices of the neighboring counties to their own county's tax policy. If the neighboring counties' tax rates are lower, then the voters "punish" their local politicians by not re-electing them. The latter maximize their chances to be re-elected by mimicking the most favorable tax strategies of neighboring jurisdictions. In this case, local tax rates are positively related to the tax rates of the neighboring jurisdictions.

Downs (1957a) stipulates that each citizen views elections strictly as a mean of selecting the most beneficial government to him. Each citizen estimates the utility income from government action and from what each candidate would provide him if he were in power in the forthcoming election period. Yardstick competition is characterized by the existence of asymmetric information in favor of the elected politicians. In addition, consumer-voters compare macroeconomic results obtained by their local government with their optimal values (Chappell, 1983; Chappell, and Keech, 1985a). Each local government aims to do better than local governments of neighboring jurisdictions in terms of tax rates and local public goods and services (Salmon, 1987). In a yardstick competition model, incumbents could imitate neighboring tax rates with the goal of being re-elected (Wittman, 1989). Consumer-voters could differentiate between macroeconomic results obtained by other factors than local governments' action and the results of macroeconomic performances due to the policies of their local government (Alesina and Rosenthal, 1995).

Case (1993) works on the U.S. case and finds that the tax rate in a State is impacted by tax rates of neighboring States only when the local government tries to be re-elected. Besley and Case (1995) also work on the U.S. case and estimate the probability for a U.S. local government not to be re-elected when the State tax increases. They show that consumer-voters could accept an increase of State tax rates if they observe that the local governments of neighboring States also increase their tax rates. Revelli (2002) works on the impact of tax policies on local elections for 662 English counties from 1979 to 1990. He finds that an increase in a county's property tax rate by 10% reduces the incumbent's popularity by 4 %, while an

increase in the neighboring property tax rates by 10% increases the popularity of the county's incumbents by 3 %. He explains that an increase in both tax rates and in local public goods and services usually decreases the popularity of an incumbent.

Heyndels and Smolders (1994), use a sample of Flemish counties to show that incumbents fix their tax rates by mimicking the tax rates of neighboring local governments, so that the consumer-voters do not punish them for setting tax rates greater than the neighbors.

Bordignon et al. (2002) find that the hypothesis of yardstick competition is rejected in the case of Italy<sup>10</sup>. Their vote function<sup>11</sup> tests the popularity of an incumbent and its probability to be re-elected in terms of economic, political and fiscal variables. The function was estimated on 97 Italian counties between 1998 and 2000. Bordignon et al. (2003) study if consumer-voters engage in comparative performance evaluation among Italian local government. Their yardstick competition model presents two predictions. The first is that only local governments that wish to be elected should interact strategically with neighboring local government. The second is that electoral performances should be impacted by tax policy in own and neighboring jurisdictions<sup>12</sup>.

Vemeir and Heyndels (2006) work on the presence of yardstick competition among Flemish counties during the period 1982 to 2000, also using a vote function. They find that an increase in property tax rates of neighboring counties has a positive effect on the re-election of incumbents. Allers and Elhorst (2005) provide a spatial econometric analysis of the

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<sup>10</sup> Bordignon et al. (2002) define two types of incumbents; good incumbents and bad incumbents. The good incumbents desire only to furnish the local public goods and services at the undermost possible cost. The bad incumbents want to tax consumers more strongly in order to cumulate rents. This means that bad incumbents are simply incompetent. They indicate that when both jurisdictions are good, they set the same level of local public spending and when both jurisdictions are bad, they always try to maximize their rent less in the first period and more in the second period. When one jurisdiction is good and the second one is bad, this latter tries always to mimic the good jurisdiction in the first period in order to be re-elected and in the second period he maximizes its rent by decreasing the local public spending. Ultimately, in the first period, with the presence of yardstick competition, jurisdictions raise the level of public spending mostly to be re-elected in the second period.

<sup>11</sup> Malderen and Gerard (2013) test the yardstick competition, through a vote function, as follows:

$$V_t = \alpha V_{t-1} + X_t \beta + \delta T_t + \lambda w T_t + \varphi N_t + \varepsilon_t \quad (2.4)$$

where  $V_t$  is a vector of vote shares at the election year  $t$ ,  $V_{t-1}$  is a vector of vote shares at the previous election,  $X_t$  is a matrix of socio-demographic variables and  $T_t$  is a vector of tax rates of counties. In their results, they exclude yardstick competition as a source of tax mimicking in the region of Walloon.

<sup>12</sup> Bordignon, Cerniglia and Revelli (2003) stipulate that yardstick competition theory submits that only incumbents that are uncertain to be re-elected must cooperate strategically with their neighbor local governments. They find that during the election year, tax rates decrease. This means that incumbents with low political majority will take into consideration the tax policy of the neighbors than incumbents with a large majority, who are certain to win the election. This means that mimicking is normally greater in counties where the ruling majority is low (Edmark and Agren, 2008).

determination of property tax rates in Dutch counties in 2002. Their results show that a 10 % higher tax in neighboring counties leads to an increase of 3.5 % of the tax rates in a given county. They also show that Dutch voters penalize their local elected government when they find that the tax rates in neighboring counties are lesser than tax rates of their own county which confirms the presence of yardstick competition among Dutch counties.

Ollé (2003) studies the determinants of property tax rates in Spain counties. He shows that when a county increases its tax rates, this automatically prompts a positive response in the fiscal policy of the neighboring counties. His results also show that yardstick competition is the source of property tax mimicking among Spanish counties. He explains that tax rates are greater when left-parties control the local government. In general, left-wing parties opt for an increase of local public spending and tax rates on the opposite of right-wing parties opt for their reduction (Tellier, 2006). Bosh and Ollé (2007) work on the presence of yardstick competition among Spanish counties and deliver the same results. Costa and Cravalho (2013) work on the presence of tax mimicking among Portuguese counties. The results provide evidence that property tax mimicking exists among Portuguese counties. They also find that left-wing parties set higher property tax rates than right-wing parties.

Delgado et al. (2015) consider that yardstick competition models build on the idea that the consumer-voters compare their tax policy to the tax policies of other jurisdictions to assess the attitudes of their own local government. This means that choices adopted by nearby jurisdictions serve as a benchmark. They work on 2713 Spanish counties with population over 1000 people in 2005. They focus on two important Spanish local taxes which are the property tax and the motor vehicle tax because they represent 66 % of the total tax revenue. To test the strategic interaction hypothesis, they define a tax reaction function. At this level, the majority of empirical papers suggest a spatial lag model and/or a spatial error model which takes into consideration endogenous interaction effects and correlated error interactions. To estimate the tax reaction function, they use structural and socio-demographic variables, fiscal variables and political variables. They also find that leftist incumbents opt for greater tax rates while rightist incumbents opt for the opposite.

In France, different studies examine the presence of yardstick competition, using the vote function (Lafay and Jérôme, 1991; Deffains et al., 1996, Jérôme and Jérôme-Speziari, 2002; Leprince et al., 2005; Farvaque et al., 2007; Dubois and Paty, 2010). Most studies find that the tax rates are a key explanation of electoral outcomes. Jérôme and Jérôme-Speziari (2002) work

on 236 French counties and on two different elections, in 1989 and 1995. They indicate that the property tax rates have a negative impact on the incumbents' vote-share. Leprince et al. (2005) analyze the elected local politicians' dilemma consisting in increasing both the supply of local public goods and tax rates, under the constraint of future elections. Dubois and Paty (2010) test the existence of yardstick competition among 104 French local governments from 1989 to 2001. For that, they estimate a vote function where consumer-voters compare the performance of their incumbents to the one of neighboring local jurisdictions. Consumer-voters could take into consideration the nearby geographical neighbors that are similar in term of socio-economic characteristics. They find that consumer-voters punish their incumbents if their own housing tax rates are higher than the housing tax rates of neighboring jurisdictions. Consumer-voters recompense their incumbents when they discover that neighboring jurisdictions that are similar in term of demographic characteristics have higher local housing tax rates than their own county.

Finally, Bastida et al. (2019) explain that yardstick competition exists when incumbents take into account the tax rates of neighboring jurisdictions before changing their own tax rates because consumer-voters compare tax rates among jurisdictions. They consider that yardstick competition has positive and negative effects. The positive effect is that incumbents try to show their competence via tax policies, which means that consumer-voters who are tax-payers care about the use of the local tax revenues and do not accept the waste of those funds. The negative effect is that to be re-elected, incumbents mimic their neighbors by decreasing the level of tax policies and neglect the real needs of their counties in term of local public goods and services.

### **2.1.1.3. Spillover effects**

A third series of models consider that counties' tax mimicking could be due to spatial spillover effects. Spillover-effect models admit that a new tax policy or a new public equipment in a county induces positive or negative externalities affecting the locational behavior of households in neighboring counties and represent a strategic incentive for the latter to change or to adjust their tax policies (Gordon, 1983; Case et al., 1993; Hanes, 2002; Lundberg, 2006; Ollé, 2006).

Gordon (1983) stipulates that one of the problems for local governments consists in increasing local tax income without decreasing the welfare of their residents. He explains that each local government decides of local taxes and local public spending to maximize the social

welfare of its residents. This decision may impact the welfare of non-residents living in neighboring territories. Gordon argues that generally the sources of tax mimicking among jurisdictions are linked to spillover-effects.

Kelejian and Robinson (1993) explain that an increase in police expenditure in a county has a positive and significant influence on police expenditure in neighboring counties. Ollé (2006) works on the determination of local public spending mimicking among Spanish counties and shows the presence of local public spending mimicking among Spanish counties. Spillover-effects are the main source of local expenditure mimicking.

Revelli (2002) works on the determination of local public expenditure mimicking and property tax mimicking among 296 English counties. He uses two different reaction functions. The first is the property tax reaction function and the second is the local expenditure reaction function<sup>13</sup>. He finds that, for both models the spatial autocorrelation coefficients are positive and significant. This confirms the presence of property tax mimicking and local expenditure mimicking among English counties. Then, he delivers evidence that the spillover-effects drive strategic interactions in property tax rates and local public expenditures decisions.

Stastna (2009) argues that the creation of cultural goods like cinemas and museums in one jurisdiction increases the welfare of residents of neighboring jurisdictions because they can take advantage of these goods and services. The optimal reaction in these neighboring jurisdictions is to decrease their expenditures for these particular types of goods and to reallocate their resources on different public goods. He also indicates that a negative strategic interaction between jurisdictions could be due to spillover-effects because specialization is very uncommon.

Ferraresi et al. (2016) consider that the decisions on local public spending depend not only on household income or on the socio-demographic and political characteristics of each county, but also on local public spending of neighboring counties. They argue that spillovers<sup>14</sup> of local public spending or local tax rates affect the welfare of residents located in neighboring

<sup>13</sup> In his both reaction functions, he uses variables such as the State aid per capita, population size, urbanization rate, elderly individuals and unemployment rate.

<sup>14</sup> In their empirical analysis, they use the following model:

$$PS_{it} = \beta_1 + \beta_2 PS_{i(t-1)} + \beta_3 wPS_{it} + \beta_4 X_{it} + \varepsilon_{it} \quad (2.5)$$

where  $PS_{it}$  is the local public spending supplied in the county  $i$ ,  $X_{it}$  represents the demographic, socio-economic and political characteristics and  $PS_{i(t-1)}$  is the level of local public spending supplied at time  $t-1$ .

counties. They detect the presence of local public spending<sup>15</sup> mimicking among 5564 Italian counties from 2001 to 2011. They explain that an increase of 1 € in local public spending of a county increases the local public spending of neighboring counties by 0.65 €. To test the presence of spillover effects among Italian counties, they introduce into their mimicking model, an interaction term between the neighboring local public spending variable and the population size variable<sup>16</sup>. Their results confirm the presence of spillover-effects among Italian counties. Finally, Ramajo et al. (2020) analyze property tax mimicking among 388 Spanish counties from 2006 to 2015. In their reaction function, they include explanatory variables such as the population size, the share of elderly population and young population, unemployment rate, local public spending per capita, state aid per capita and leftist incumbents as political variable. They also find property tax mimicking among 388 Spanish counties but show that only yardstick competition and not spillover effects is the cause of the property tax mimicking.

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<sup>15</sup> They work on local public spending of counties because Italian counties are responsible for the social welfare services, county development, local transport local police etc.

<sup>16</sup> Their model of spillover effect is as follows:

$$PS_{it} = \beta_1 + \beta_2 PS_{i(t-1)} + \beta_3 wPS_{it} + \beta_4 (wPS_{it} * POPULA_{it}) + \beta_5 X_{it} + \varepsilon_{it} \quad (2.6)$$

where  $(wPS_{it} * POPULA_{it})$  is the interaction between the neighboring local public spending and population size.

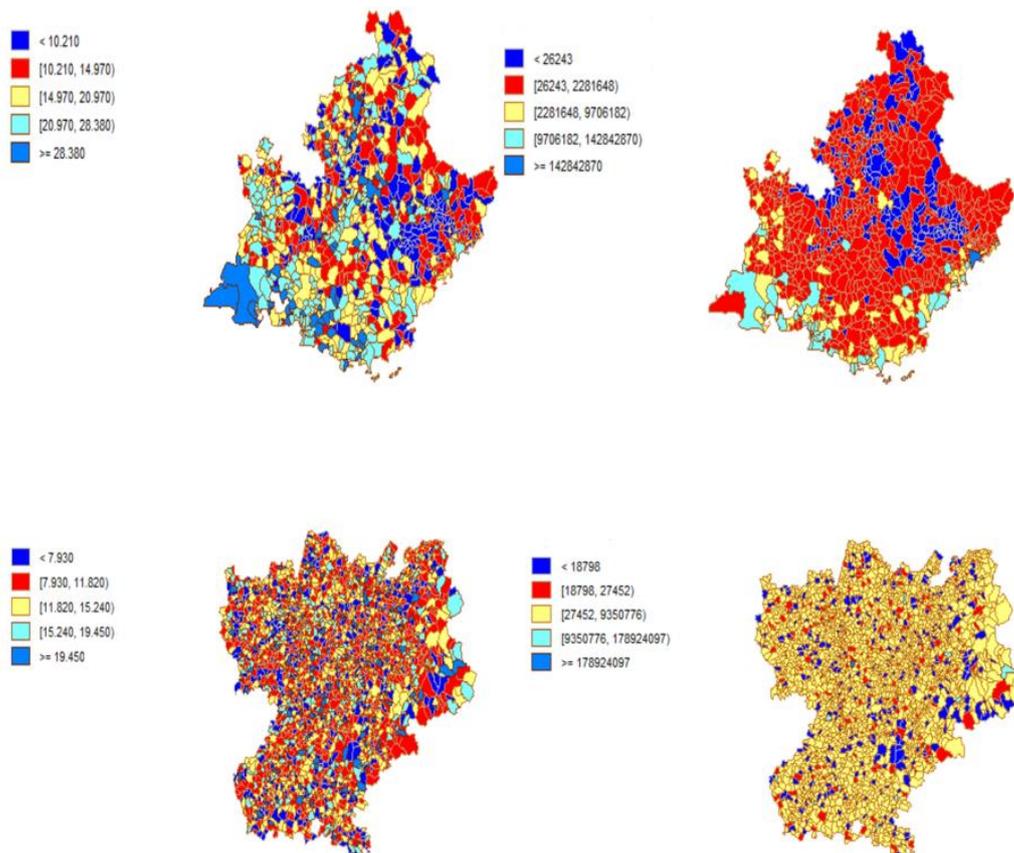
## 2.2. DESCRIPTIVE ANALYSIS AND METHODOLOGY

### 2.2.1. The presentation of database

#### 2.2.1.1. The data

In our empirical analysis, we consider two French regions: Provence-Alpes-Côte-d'Azur and Rhône-Alpes. We work on cross-sectional data for 3865 French counties. The first region contains 978 counties and the second region contains 2887 counties. We focus on the principal and the most important local tax that is the property tax on built properties which account for 48% of local tax revenues. Concerning this tax, we adopt two different indexes. The first is the nominal tax rate and the second is the property tax per receipt amount. The first index is chosen by counties. The second index is used as a proxy of the effective property tax rate. Property tax income does not depend only on the property tax rates but also on the housing value which is determined by the cadastral office.

Figure 2.1: The spatial distribution of property tax rates (%) and property tax income (€) of the regions of Provence-Alpes-Côte-d'Azur and Rhône-Alpes respectively.



Source: French General Direction of Public Finance (DGFIP) and the maps representation made by the author

Figure 2.1 shows the property tax rates and the property tax per receipt amount per county for both regions. The fiscal variables are provided through the French General Direction of Local Territories (DGCL). The INSEE dataset provides some structural and socio-demographic variables, while political and election variables were collected from the Ministry of the Interior. The electoral data and other dependent variables such as property tax rates and property tax per receipt amount are related to the county (municipal) elections that took place in 2014. Data concerning all the control variables are available for 2016 which allows to avoid endogeneity issues.

### **2.2.1.2. The choice of the spatial scale**

Two modalities of mimicking are considered in the empirical work: yardstick competition and spillover-effects. Both families of models lead to a common conclusion which is the existence of strategic interactions between local authorities of the same rank. In France, the empirical analysis of spatial interdependencies between local jurisdictions has been the subject of interesting work from Jayet et al (2002) who focus on the presence of business tax mimicking among 683 counties of the region Nord-Pas-De-Calais. Leprince et al. (2005) also work on the presence of tax mimicking among French departments. They focus on business tax but also on housing and property tax.

The objective here is to follow this work and to test property tax interactions between the counties of two regions, Provence-Alpes-Côte-d'Azur and Rhône-Alpes. The contribution of our chapter to existing literature relies in the use of a large county-level dataset in the study of fiscal interactions in France.

### **2.2.2. The data set**

We use structural and socio-demographic variables, such as population and area size of each county, the proportion of population over 65 years, unemployment and dummy variables such as the presence of seacoast in PACA, fiscal indicators such as the per capita grants received in each county and political variables: a dummy variable which takes the value 1 if the county is dominated by rightist government and 0 otherwise; a dummy variable which takes the value 1 if the county is dominated by leftist government and 0 otherwise. Finally, the electoral distance, as defined by Santolini (2008), is the difference between a 100 % unique vote for one candidate and the percentage of the mayor' vote.

Tables 2.1 and 2.2 deliver descriptive statistics. Respecting the political variables in Provence-Alpes-Côte-d'Azur, 33 % of counties are governed by right-wing parties whereas 11 % are ruled leftist parties. Concerning the Rhône-Alpes' region, 15% of counties are governed by right wing parties and 24 % by a left-wing party. The average electoral distance in the Provence-Alpes-Côte-d'Azur region's counties is of 31.5 % and in Rhône-Alpes's counties of 17.59 %. The figures 2.2 and 2.3 show the inhabitants by broad age groups in both regions. (Also see figures 6.2.1 and 6.2.2 in appendices for graphics of the evolution of the population of the regions PACA and Rhône-Alpes).

Table 2.1: Descriptive statistics of variables for PACA.

PACA	N	Mean	Std.Dev	Min	Max
Property tax rates (%)	978	15,57	7,32	0,28	44,42
Property tax per receipt (€)	978	1332510	5765084	2348	140000000
Population	978	4715,51	29402,15	7	797491
Unemployment rate (%)	978	9,33	10,21	0	99,31
Area (km <sup>2</sup> )	978	3239,41	3777,81	58	75821
Elderly population (%)	978	29,98	17,28	0,198	1
Grants (€)	978	718965,5	4605021	0	35000000
Righist incumbents	978	0,33	0,47	0	1
Leftist incumbents	978	0,11	0,31	0	1
Electoral distance	978	31,50	18,35	0	78,77
Littoral	978	0,07	0,26	0	1

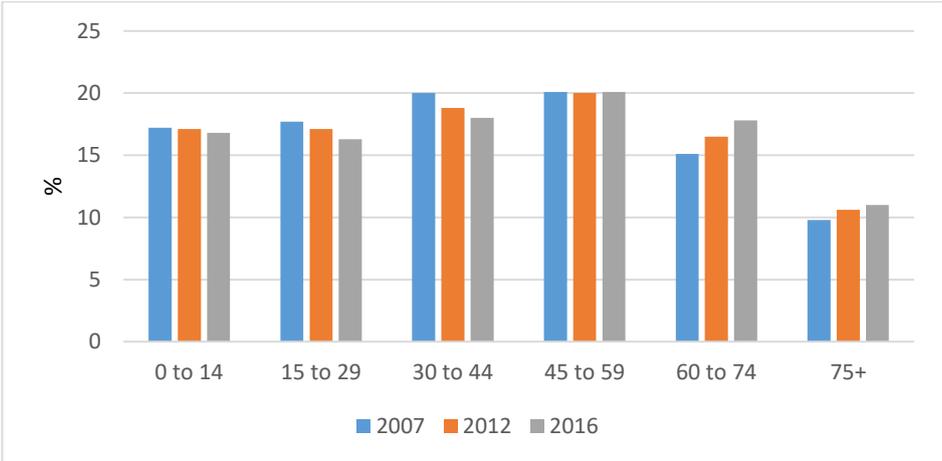
Source: Authors, INSEE, French General Direction of Local Authorities and the interior ministry

Table 2.2: Statistic descriptive of variables for Rhône-Alpes.

Rhône-Alpes	N	Mean	Std.Dev	Min	Max
Property tax rates (%)	2887	17,08	5,54	0,81	56,28
Property tax per receipt €	2887	553104,1	3615365	131	147000000
Population	2887	1962,01	10444,98	1	445274
Unemployment rate (%)	2887	5,61	2,93	0	40
Area (km <sup>2</sup> )	2887	1546,59	1543,49	39	24545
Elderly population (%)	2887	23,18	22,05	0	100
Grants (€)	2887	5051,61	40663,75	0	1344949
Righist incumbents	2887	0,15	0,35	0	1
Leftist incumbents	2887	0,23	0,42	0	1
Electoral distance	2887	21,53	136,71	0	1

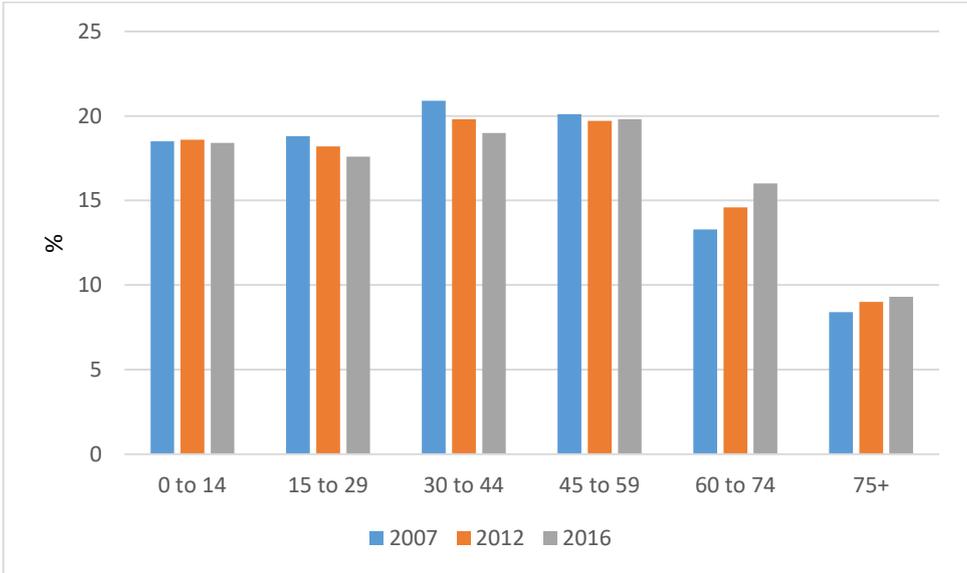
Source: Authors, INSEE, French General Direction of Local Authorities and the Interior Ministry

Figure 2.2: The inhabitants of the region of Provence-Alpes-Côte-d’Azur by age groups



Source: INSEE and the graphic representation made by the author

Figure 2.3: The inhabitants of the region of Rhône-Alpes by age groups



Source: INSEE and the graphic representation made by the author

### 2.2.3. The spatial analysis

We focus now on spatial econometrics methodology to capture tax mimicking among counties and to determine the sources of these interactions (Brueckner, 2001; Leprince et al., 2005; Delgado et al., 2015; Ramajo et al., 2019).

We apply the empirical model of Delgado et al (2015) using the property tax reaction function which links the rate of local property tax in one county to the different rates of neighboring competing counties. The matrix form of the non-spatial model is written as follows

for each region. The index  $i$  represents the county of each region and  $t$  represents the year (which for our sample is an electoral year 2014).

$$PT_{it} = \beta_{0it} + \beta_1 \ln\_POP_{it} + \beta_2 \ln\_AREA_{it} + \beta_3 POP65_{it} + \beta_4 UNEMP_{it} + \beta_5 LITT_{it} + \beta_6 \ln\_GRANT_{it} + \beta_7 RH\_INCU_{it+2} + \beta_8 LEF\_INCU_{it+2} + \beta_9 ELC\_DIST_{it+2} + \varepsilon_{it} \quad (2.7)$$

$$\ln\_TAX\_AMT_{it} = \beta_{0it} + \beta_1 \ln\_POP_{it} + \beta_2 \ln\_AREA_{it} + \beta_3 POP65_{it} + \beta_4 UNEMP_{it} + \beta_5 LITT_{it} + \beta_6 \ln\_GRANT_{it} + \beta_7 RH\_INCU_{it+2} + \beta_8 LEF\_INCU_{it+2} + \beta_9 ELC\_DIST_{it+2} + \varepsilon_{it} \quad (2.8)$$

with  $t = 2014$  and  $\forall i = 1, \dots, 978$ , for PACA and  $\forall i = 1, \dots, 2887$  for Rhones Alpes.

where  $PT_{it}$  is the property tax rate and  $PT\_AMT_{it}$  is the property tax per receipt amount.  $POP_{it}$  designates the population of each county,  $AREA_{it}$  is the area of each county,  $POP65_{it}$  is the share of the population with more than 65 years and  $UNEMP_{it}$  is the unemployment rate.  $LITT_{it}$  is a dummy variable which takes the value 1 if the county is located near to the littoral and 0 otherwise.  $GRANT_{it}$  is the grants received per capita,  $RH\_INCU_{it}$  is a political variable which designates the rightist incumbents (a dummy variable which takes the value 1 if the county is dominated by rightist incumbents and 0 otherwise).  $LEF\_INCU_{it}$  is a political variable which indicates the leftist incumbents (a dummy variable which takes the value 1 if the county is dominated by leftist incumbents and 0 otherwise).  $ELC\_DIST_{it}$  is also a political variable which designates the electoral distance.

Table 2.3 presents the Moran's statistics on tax choices. It confirms the existence of a positive spatial autocorrelation. For both regions, the first order neighbors indicate a high spatial autocorrelation for dependent variables. Then the two regions' counties differentiate when it comes to the Second order neighbors and k-nearest neighbor approximation with  $k = 4$ . To estimate our models, we focus on the first order neighbors for both regions.

Table 2.3: Moran statistics on property tax choices

PACA	Property tax rates	Property tax per receipt amount
First order Neighbors	0.324***	0.239***
Second order Neighbors	0.309***	0.168***
Nearest Neighbors, k = 4	0.201	0.205
RHONE-ALPES	Property tax rates	Property tax per receipt amount
First order Neighbors	0.223***	0.139***
Second order Neighbors	-0.098	0.081
Nearest Neighbors, k = 4	0.135***	0.104***

Notes : \*, \*\*, \*\*\* correspondent respectivement à une significativité aux seuils de 1%, 5%, 10%

After defining the weight matrix, we test whether geographically close territories behave the same way, unlike distant territories, using spatial autocorrelation measures.

Table 2.4 presents the results of the Moran I statistics. The global Moran statistics are positive and significant. They reveal neighborhood effects among PACA and Rhône-Alpes counties which influence their socio-demographic, fiscal and political characteristics. For both regions, the Moran statistics on the property tax rates indicate that counties with high property tax rates are surrounded by counties with high property tax rates, and inversely, counties with low property tax rates are neighbors to counties with low property tax rates. For the region of PACA, the Moran statistics for the population size, unemployment rate and leftist incumbents are close to 0, which mean that there is no spatial autocorrelation. For Rhône-Alpes, the Moran statistics on property tax income, population size, the proportion of elderly and the provision grants are close to 0. (See figures 6.2.3, 6.2.4, 6.2.5 and 6.2.6 in appendices for the graphics of Moran statistics for property tax rate and property tax income for the both regions).

Table 2.4: Moran I statistics

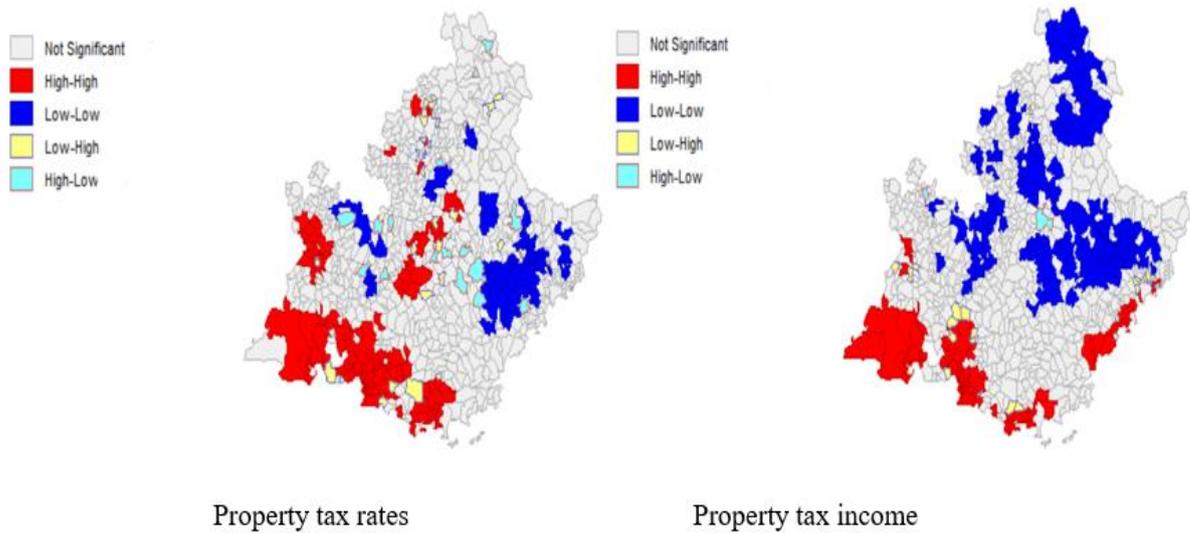
	PACA	Rhône-Alpes
	I	I
Property tax rates	0.323***	0.294***
Property tax income	0.176***	0.054***
Population	0.084***	0.050***
Area	0.427***	0.422***
Elderly people	0.104***	0.082***
Unemployment rate	0.038***	0.284***
Grants	0.758***	0.035***
Rightist incumbents	0.362***	0.308***
Leftist incumbents	0.082***	0.202***
Littoral	0.667***	-

Source: Authors, INSEE, French General Direction of Local Authorities and General Direction of Public Finance.

Figures 2.4 and 2.5 present the Lisa statistics of the property tax rate and the property tax income for the regions of PACA and Rhône-Alpes. The Lisa statistics are significant at a threshold of 5%. For the region of PACA, when looking at the property tax rate some clusters appear. Clusters High-High regroup counties with high property tax rates neighboring other counties with high property tax rates, especially at the Bouches-Du-Rhône and the Var Departments. Clusters Low-Low regroup counties with low property tax rates to neighboring counties with low property tax rates especially counties of the Alpes-Maritimes Department. For the property tax rate of the Rhône-Alpes region, clusters High-High are strongly present in

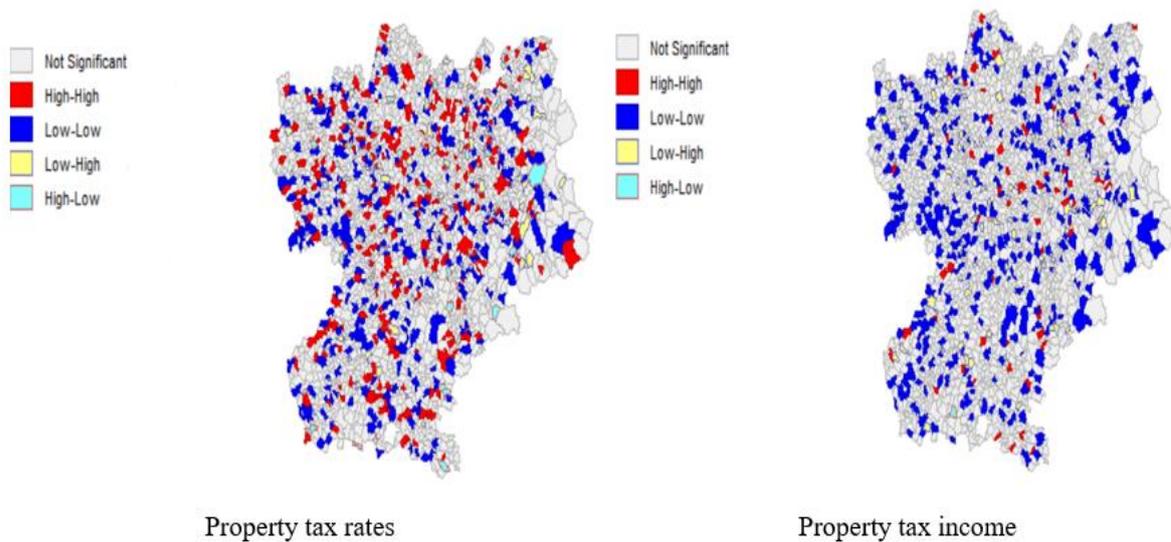
the Rhone, Isère and the Savoie Departments and clusters Low-Low are strongly present in the Rhone, Loire, Isère and Ardèche Departments.

Figure 2.4: Lisa test for property tax rates and property tax income of PACA



Source: Authors, database of General Direction of Public Finance.

Figure 2.5: Lisa test for property tax rates and property tax income of Rhône-Alpes



Source: Authors, database of General Direction of Public Finance.

The sample on property tax income also features some clusters. For the region of PACA, clusters High-High exist in the Bouche-Du-Rhône, Var and Alpes-Maritimes departments and clusters Low-Low appear in the Alpes-De-Hautes-Provence and Hautes-Alpes departments. For

the region of Rhône-Alpes, clusters High-High are observed in the Rhone and Isère departments and clusters Low-Low in the Loire, Ardèche and Ain departments.

## 2.3. RESULTS OF TAX MIMICKING AND IT SOURCES

Our analysis focuses on 3865 counties, with 987 counties located in the Provence-Alpes-Côte-d'Azur's region and 2887 counties in the Rhône-Alpes's region. All estimates use cross-sectional data for 2016. Data on political and fiscal variables concern 2014 which is a year of local elections.

### 2.3.1. A spatial analysis of tax mimicking among French counties

To test the presence of property tax mimicking among PACA and Rhône-Alpes counties, we use a spatial econometric model. Tables 2.5 and 2.7 present the results of tax mimicking among PACA and Rhône-Alpes counties. We will not comment the a-spatial OLS estimation since spatial autocorrelation has been detected.

Two preliminary issues should be discussed: first, the parameter  $\rho$  is significant when studying the property tax mimicking among both Provence-Alpes-Côte-d'Azur counties and Rhône-Alpes counties. The coefficients of the parameter  $\rho$  are consistent with the Moran I findings and imply that spatial interaction is significant for the property tax rates model and property tax per receipt amount model. Second, table 2.9 presents the results of the specifications tests which match the recommendations of Lesage and Pace (2009) and Elhorst (2010). The latter indicates that, in the first step, one should use the SDM model as a general specification. Tables 2.6 and 2.8 present the marginal effects. Which are composed of direct effects, indirect effects and total effects. According to Delgado et al. (2015), the direct effects are the ones from a variable change on the spatial unit itself and the indirect effects the ones that changes in a given spatial unit could have on its neighboring spatial units.

For the Provence-Alpes-Côte-d'Azur, the coefficients of spatial autocorrelation of the reaction functions of the property tax rate (0.50) and the property tax per receipt amount (0.77) are positive and significant which confirms the existence of property tax mimicking among Provence-Alpes-Côte-d'Azur counties. For the region of Rhône-Alpes, the coefficients of spatial autocorrelation of the reaction functions of the property tax rate (0.63) and the property tax per receipt amount (0.55) are positive and significant which also confirms the existence of property tax mimicking among Rhône-Alpes counties. In other words, an increase of the property tax rate in a county has a positive impact on the property tax rates of neighboring

counties. The same thing is observed for the property tax per receipt amount, which confirms the hypothesis of property tax mimicking among Alpes-Côte-d'Azur and Rhône-Alpes counties.

For both regions, the county's population size has a positive effect on the property tax rate and on the property tax income. This positive effect could be explained by the fact that an increase in the population size increases local public spending but also the local tax base value. On the opposite, an increase in the population size of a county has a negative effect on the property tax rates and property tax incomes of neighboring counties. This could be explained by the fact that individuals leave smaller counties to move to the bigger one because of its high level of local public services. Heyndels and Vuchken (1998) explain that an increase in the population increases local public spending which rises tax rates. For the PACA region, an increase of 1 % of the county's population increases the property tax rate by 0.16 % and the property tax per receipt amount by 1.11 % (direct effect) and decreases the property tax rates of neighboring counties by 0.07 % (indirect effect). For the region of Rhône-Alpes, an increase of 1 % of a county's population increase the property tax rates by 0.11 % and the property tax per receipt amount by 0.95 % (direct effect). The increase of 1 % of the population in a county decreases the property tax rates of neighboring counties by -0.03 % (indirect effect).

Turning next to a county's area, for both regions, this variable has a positive and significant effect on property tax rate and on property tax income. Delgado, et al (2015) find that the area of the county has a positive effect on the property tax rate; while Leprince et al. (2005) find the opposite. An increase in the county area is always associated with an increase of local public spending. Our results show that an increase in the area of county decreases the property tax rates and the property tax income of neighboring counties. This negative impact could be explained by the fact that individuals prefer to live within a large county with more diversified local public goods and services. For the PACA region, an increase of 1 % in a county's area increases the property tax income of the county by 0.23 % (direct effect) and decreases the property tax income of neighboring counties by 0.8 % (indirect effect). In a similar way, for the Rhône-Alpes region, an increase of 1 % in the area of a county increases the property tax income of the county by 0.24 % (direct effect) and decreases the property tax income of neighboring counties by 0.44 % (indirect effect). In the same time, this increase decreases the property tax rates of neighboring counties by 0.15 %.

For the region of Provence-Alpes-Côte-d'Azur, the proportion of elderly in a county has a negative effect on the property tax rate of the county. Reschovsky (1993) explains that the

residential property tax rates on elderly decreases. Higher property tax rates increase mobility among homeowners having more than 65 years (Shan, 2010). Bocci et al. (2019), on the opposite, show that the proportion of elderly has a positive impact on the property tax rate because elderly are related to a higher level of demand for local services. In the region of Rhône-Alpes, an increase of 1 % of the proportion of elderly decreases the property tax rates (-0.008 %) and the property tax income (-0.015 %) of neighboring counties. Elderly need more resources and they prefer to reside in counties that offer high local public services.

In both regions, a county's unemployment rate has a positive effect on the property tax rates. This may appear as a controversial result. Most studies admit that the unemployment rate could be handled as a proxy of the local economic situation and of the demand for additional social services (Bastida et al., 2019). Bordignon et al. (2003), Gérard et al. (2009) and Cassette et al. (2012) find a negative effect of unemployment rate on property tax rate. On the opposite, Leprince et al (2005), Edmark and Agren (2008) and Lyytikainen (2012) show that unemployment rate has a positive effect on the property tax rate. The residents in counties with a high level of unemployment need more local public resources which increases the property tax rate. For the PACA region, an increase of 1 % on the unemployment rate in a county, increases the property tax rate by 0.073 % (direct effect). For the Rhône-Alpes's region, an increase of 1% on unemployment rate increases the property tax rate by 0.034 % (direct effect).

The fiscal indicator of per capita grants received has a positive effect on the property tax rate and on the property tax per receipt amount for the counties in both regions. Per capita grants could be handled as a proxy of the influence of central government on the expenditure behavior of a county (Bastida et al., 2019). Delgado et al. (2015) find that capita grants have a negative effect on the property tax, while Leprince et al. (2005) find a positive effect. The latter is due to a "fly paper effect" (Rubinfeld, 1987)<sup>17</sup>. Rubinfeld (1987) explains that the effect of grants on local public spending and on property tax rate is positive and higher than its effect on the tax income. For the Provence-Alpes-Côte-d'Azur, an increase of 1 % on capital grants in a county, increases the property tax rate by 0.008 % and the property tax per receipt amount by 0.032 % (direct effect). For the region of Rhône-Alpes, an increase of 1% on the capita grants of a county increases the property tax rate by 0.00021 % and increases the property tax per

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<sup>17</sup> In the fly paper effect approach, counties with low income increase their tax rates in order to have more resources. Then, when they receive subventions from the Central State, they increase their tax rates because of an increase in local spending. Hines and Thaler (1995) and Bailey and Cannolly (1998) support that the central government gives higher subventions to local governments having low income.

receipt amount by 0.0016 % (direct effect). The results also show that an increase in the amount of subventions in a county does not have an effect on the property tax rates of neighboring counties for both regions.

Next, it clearly appears that the leftist incumbents have a positive effect on the property tax rate of the counties in both regions. Tellier (2006) supports that left-wing parties increase local public spending and property tax rates while right-wing parties decrease them. For the Provence-Alpes-Côte-d'Azur, an increase of 1 % on the leftist incumbents increases the property tax rate by 0.11 % (direct effect) and increases the property tax rates of neighboring counties by 0.36 % (indirect effect).

For the Rhône-Alpes, an increase of 1 % on the leftist incumbents of a county increases the property tax rate by 0.05 % and increases the property tax per receipt amount by 0.201 % (direct effect). The 1 % increase of the leftist incumbents increases the property tax rates of neighboring counties by 0.25 % (indirect effect). Rightist incumbents have a negative effect on the property tax rate because they aim to reduce property tax rates and budget. An increase of 1 % on the rightist incumbents in a Rhône-Alpes county decreases the property tax rate of neighboring counties by 0.171 % (indirect effect) and increases the property tax income of neighboring counties by 0.1155 % (indirect effect).

For both regions, counties dominated by leftist incumbents have higher increase in their property tax income and property tax rates than counties dominated by rightist incumbents. Counties ruled by leftist incumbents have a positive impact on the property tax rates of their neighbors.

Finally, for coastal areas, this variable has a positive impact on the property tax rates and the property tax income of counties of PACA. This positive impact could be due to the fact that counties located near the coast have higher tax base values and higher property tax rates. Because of the higher value of dwellings in the counties located near to the Littoral, the property tax income is higher.

Table 2.5: The results of property tax mimicking for counties of the region of Provence-Alpes-Côte-d'Azur

Variables	Provence-Alpes-Côte-d'Azur					
	Property tax rates			Property tax per receipt amount		
	Non spatial Model	SAR	SDM	Non spatial model	SAR	SDM
Population	0.1454*** (0.0127)	0.1371*** (0.0123)	0.1303*** (0.0315)	1.1568*** (0.0831)	1.0187*** (0.0633)	1.1136*** (0.0632)
Area	0.02071 (0.0169)	-0.0025 (0.0200)	0.0433* (0.0231)	0.3204*** (0.0831)	0.0341 (0.1008)	0.2839** (0.1011)
population over 65	-0.0031** (0.0012)	-0.0030* (0.0017)	-0.0021 (0.0014)	-0.0017 (0.0031)	-0.0014 (0.0078)	-0.0002 (0.0063)
Unemployment rate	0.0721*** (0.0146)	0.0729*** (0.0195)	0.0729*** (0.0179)	0.0386 (0.0283)	0.0432 (0.0977)	0.0246 (0.0789)
Per capital grants	0.0083** (0.0038)	0.0081*** (0.0017)	0.0077*** (0.0016)	0.0331 (0.0211)	0.0306*** (0.0087)	0.0270*** (0.0071)
Leftist incumbents	0.1152** (0.0357)	0.1054** (0.0504)	0.0908* (0.0465)	0.2268** (0.1118)	0.1655 (2513)	0.3651* (0.2041)
Rightist incumbents	0.0554* (0.0335)	0.0540 (0.0415)	0.0588 (0.0386)	-0.2747* (0.1562)	-0.2831 (0.2073)	-0.1499 (0.1694)
Electoral distance	0.0020** (0.0008)	0.0021** (0.0008)	0.0012* (0.0007)	-0.0023 (0.0035)	-0.0071 (0.0041)	-0.0022 (0.0033)
Littoral	0.1880*** (.0482)	0.1425** (0.0666)	0.1662* (0.0871)	3.468** (1.0205)	2.657*** (0.3445)	1.6522*** (0.3819)
Spatial						
$\rho$	-	0.0602*** (0.0211)	0.5003*** (0.0418)	-	0.1578*** (0.0235)	0.7725*** (0.0334)
$W_x$						
population	-	-	-0.1344*** (0.0248)	-	-	-0.8660*** (0.1118)
Area	-	-	-0.0812*** (0.0221)	-	-	-0.4633*** (0.0929)
population over 65	-	-	-0.0054 (0.0039)	-	-	-0.0087 (0.0173)
Unemployment rate	-	-	-0.0257 (0.0719)	-	-	-0.1330 (0.3145)
per capita grants	-	-	-0.0013 (0.0045)	-	-	0.0107 (0.0197)
rightist incumbents	-	-	0.0296 (0.0903)	-	-	0.2659 (0.3961)
leftist incumbents	-	-	0.1842 (0.1123)	-	-	-0.2154 (0.4938)
electoral distance	-	-	0.0015 (0.0020)	-	-	-0.0034 (0.0087)
Littoral	-	-	-0.0233 (0.1686)	-	-	-0.7743 (0.7782)
Intercept	1.3822*** (0.1425)	14747*** (0.1554)	1.2058*** (0.1498)	1.8661** (0.6584)	3.2708*** (0.7867)	2.6094*** (0.6555)
Observations	978	978	978	978	978	978
Log likelihood	-	-649.26	-580.038	-	-2222.57	-2060.17

Notes: \*, \*\*, \*\*\* correspond respectively to a significance at the thresholds of 1%, 5%, 10%

Source: Authors, (INSEE), French General Direction of Local Authorities (DGCL) and the Interior Ministry.

Table 2.6: Direct and indirect effects of the property tax mimicking among Provence-Alpes-Côte-d'Azur counties

Effects	Variables	Property tax rate		Property tax per receipt amount	
		SAR	SDM	SAR	SDM
Direct Effects	Population	0.1372*** (0.0123)	0.1666*** (0.0141)	1.0225*** (0.0632)	1.1126*** (0.0646)
	Area	-0.0025 (0.0200)	0.0384* (0.0231)	0.0342 (0.1011)	0.2381** (0.1076)
	population over 65	-0.0030* (0.0015)	-0.0026* (0.0015)	-0.0014 (0.078)	-0.0019 (0.0078)
	Unemployment rate	0.0730*** (0.0195)	0.0738*** (0.0198)	0.0433 (0.0980)	0.0031 (0.1082)
	per capital grants received	0.0081*** (0.0017)	0.0080*** (0.0016)	0.0307*** (0.0087)	0.0329*** (0.0083)
	rightist incumbents	0.0540 (0.0415)	0.0640 (0.0404)	-0.2841 (0.2080)	-0.1217 (0.2021)
	leftist incumbents	0.1054** (0.0504)	0.1108** (0.0488)	0.1661 (0.2522)	0.3776 (0.2454)
	electoral distance	0.0021** (0.0008)	0.0014* (0.0007)	-0.0007 (0.0041)	-0.0032 (0.0039)
Indirect effects	Littoral	0.1425** (0.0666)	0.1754** (0.0813)	2.666*** (0.344)	2.0372*** (0.3549)
	Population	0.0075** (0.0027)	-0.0786** (0.0344)	0.1619*** (0.0265)	-0.0189 (0.3032)
	Area	-0.0001 (0.0011)	-0.0957** (0.0314)	0.0054 (0.0156)	-0.8176** (0.3082)
	population over 65	-0.0001 (0.0001)	-0.0103 (0.0064)	-0.0002 (0.0012)	-0.0301 (0.0600)
	Unemployment rate	0.0040** (0.0018)	0.0172 (0.1163)	0.0068 (0.0155)	-0.3819 (1.0754)
	per capital grants received	0.0004** (0.0001)	0.0041 (0.0071)	0.0048** (0.0015)	0.1058 (0.0671)
	rightist incumbents	0.0029 (0.0025)	0.0951 (0.1464)	-0.0449 (0.0339)	0.5028 (1.3640)
	leftist incumbents	0.0058* (0.0034)	0.3692** (0.1842)	0.0263 (0.0400)	0.2232 (0.0296)
Total effects	electoral distance	0.0001* (0.0006)	0.0034 (0.0031)	-0.0001 (0.0006)	-0.1745 (0.02964)
	Littoral	0.0078* (0.0041)	0.1713 (0.2271)	0.4223*** (0.0744)	6.8701*** (1.9428)
	Population	0.1448*** (0.0126)	0.0879** (0.0357)	1.1842*** (0.0698)	1.0936** (0.3231)
	Area	-0.0026 (0.0211)	-0.0576 (0.0395)	0.0397 (0.1167)	-0.5795 (0.3691)
	population over 65	-0.0031* (0.0016)	-0.0129* (0.0395)	-0.0016 (0.0090)	-0.0321 (0.0652)
	Unemployment rate	0.0771*** (0.0207)	0.0911 (0.1262)	0.0502 (0.1135)	-0.3787 (1.1537)
	per capital grants received	0.0085*** (0.0018)	0.0121 (0.0077)	0.0356*** (0.1012)	0.1387 (0.0719)
	rightist incumbents	0.0570 (0.0438)	0.1591 (0.1641)	-0.3291 (0.2411)	0.3811 (1.4907)
leftist incumbents	0.1112** (0.0531)	0.4801** (0.2055)	0.1925 (0.2925)	0.6008 (1.8632)	
electoral distance	0.0022** (0.0008)	0.0049 (0.0035)	-0.0008 (0.0047)	-0.0206 (0.0320)	
Littoral	0.1504** (0.0696)	0.3467 (0.2075)	3.0890*** (0.3804)	8.9073*** (1.9395)	

Notes: \*, \*\*, \*\*\* correspond respectively to a significance at the thresholds of 1%, 5%, 10%

Source: Authors, (INSEE), French General Direction of Local Authorities (DGCL) and the Interior Ministry.

Table 2.7: The results of the property tax mimicking for counties of the region of Rhône-Alpes

Variables	Rhône-Alpes					
	Property tax rates			Property tax per receipt Amount		
	Non spatial model	SAR	SDM	Non spatial model	SAR	SDM
Population	0.136*** (0.008)	0.111*** (0.007)	0.113*** (0.007)	1.043*** (0.0261)	1.011*** (0.017)	0.95*** (0.019)
Area	-0.018* (0.0104)	-0.064*** (0.010)	0.028** (0.011)	0.134*** (0.0269)	0.086** (0.024)	0.268*** (0.028)
population over 65	-0.00006 (0.0007)	0.0001 (0.0005)	-0.00001 (0.0005)	0.00062 (0.0022)	0.00075 (0.0014)	0.00027 (0.0012)
Unemployment rates	0.037** (0.014)	0.035* (0.018)	0.0368** (0.0162)	0.0403** (0.0201)	0.0378 (0.0443)	0.0311 (0.0403)
Per capita grants	0.0002*** (0.00004)	0.0001*** (0.00006)	0.0002** (0.00)	0.0016*** (0.00038)	0.0016*** (0.00016)	0.0016*** (0.00015)
Leftist incumbents	0.056** (0.0201)	0.0504** (0.022)	0.0384* (0.019)	0.157** (0.0558)	0.154** (0.097)	0.189*** (0.189)
Rightist incumbents	-0.075*** (0.0183)	-0.071*** (0.019)	-0.0175 (0.018)	0.1058** (0.0518)	0.0977** (0.0479)	0.11** (0.045)
Electoral distance	-0.0000063 (0.00001)	-0.0000003 (0.00)	0.00000295 (0.0000)	-0.000034* (0.00002)	-0.000032 (0.00008)	-0.0000004 (0.00007)
Spatial						
$\rho$	-	0.14*** (0.077)	0.63*** (0.022)	-	0.034*** (0.0065)	0.558*** (0.0252)
$W_x$						
population	-	-	-0.088*** (0.0135)	-	-	-0.518*** (0.0438)
area	-	-	-0.15*** (0.012)	-	-	-0.446*** (0.0314)
population over 65	-	-	-0.004* (0.0021)	-	-	-0.009* (0.0053)
unemployment rate	-	-	-0.046 (0.048)	-	-	-0.0087 (0.121)
per capita grants	-	-	0.00016 (0.00017)	-	-	-0.00083** (0.00042)
leftist incumbents	-	-	0.11** (0.045)	-	-	0.0189 (0.1131)
rightist incumbents	-	-	-0.078** (0.039)	-	-	-0.0075 (0.095)
electoral distance	-	-	-0.0007 (0.000008)	-	-	-0.00038* (0.00021)
Intercept	1.81*** (0.082)	2.003*** (0.011)	1.66*** (0.071)	3.73*** (0.21)	3.94*** (0.188)	3.505*** (0.177)
Observations	2887	2887	2887	2887	2887	2887
Log likelihood	-1215.32	-941.36	-	-	-3756.75	-3550.81

Notes: \*, \*\*, \*\*\* correspond respectively to a significance at the thresholds of 1%, 5%, 10%

Source: Authors, INSEE, French General Direction of Local Authorities (DGCL) and the and Interior Ministry

Table 2.8: The direct and indirect effects of the tax mimicking among Rhône-Alpes counties

Effects	variables	Property tax rates		Property tax per receipt amount	
		SAR	SDM	SAR	SDM
Direct effects	Population	0.1116*** (0.0071)	0.1115*** (0.0075)	1.011*** (0.0175)	0.9514*** (0.0187)
	Area	-0.065*** (0.0102)	0.0134 (0.0117)	0.086** (0.0247)	0.241*** (0.0289)
	population over 65	0.0001 (0.0005)	-0.0004 (0.0006)	0.00075 (0.0014)	-0.00057 (0.0014)
	Unemployment rate	0.0351* (0.0184)	0.0342* (0.0182)	0.0378 (0.0443)	0.0318 (0.0439)
	Per capita grants	0.00019** (0.00006)	0.00021** (0.0006)	0.0016*** (0.00016)	0.0016*** (0.00016)
	Leftist incumbents	0.0505** (0.022)	0.0533** (0.021)	0.154** (0.0531)	0.201*** (0.051)
	Rightist incumbents	-0.0708*** (0.0198)	-0.0275 (0.0189)	0.0977** (0.0479)	0.1155*** (0.0464)
	Electoral distance	-0.000003 (0.0000332)	-0.000005 (0.00)	-0.000032 (0.00008)	-0.00004 (0.000079)
Indirect effects	Population	0.0149*** (0.0014)	-0.0315 (0.0217)	0.0300*** (0.0057)	0.020 (0.0461)
	Area	-0.0087*** (0.0018)	-0.252*** (0.0239)	0.0025*** (0.00071)	-0.489*** (0.049)
	population over 65	0.000014 (0.00007)	-0.008* (0.0041)	0.0000225 (0.000042)	-0.015* (0.009)
	Unemployment rate	0.0047* (0.024)	-0.045 (0.095)	0.0011 (0.0013)	0.0143 (0.2038)
	Per capita grants	0.00025** (0.000009)	0.00053 (0.0003)	0.00005*** (0.00001)	0.00013 (0.0007)
	Leftist incumbents	0.0067** (0.003)	0.256** (0.085)	0.0045** (0.00181)	0.2057 (0.1831)
	Rightist incumbents	-0.0094** (0.0027)	-0.171** (0.071)	0.0028* (0.0015)	0.0897 (0.1531)
	Electoral distance	-0.000 (0.0000037)	-0.0001 (0.00017)	-0.000 (0.00)	-0.00063* (0.00036)
Total effects	Population	0.126*** (0.0077)	0.079** (0.0232)	1.041*** (0.0169)	0.971*** (0.049)
	Area	-0.0738*** (0.0119)	-0.239*** (0.027)	0.0887*** (0.0253)	-0.248*** (0.0574)
	population over 65	0.0001 (0.0006)	-0.0084* (0.0045)	0.00077 (0.0014)	-0.0159 (0.0097)
	Unemployment rate	0.039* (0.0208)	-0.011 (0.105)	0.0389 (0.0456)	0.0461 (0.2261)
	Per capita grants	0.00021** (0.0007)	0.0007** (0.00037)	0.0017*** (0.00017)	0.0017** (0.00079)
	Leftist incumbents	0.0573** (0.025)	0.31** (0.0932)	0.1593** (0.0547)	0.4064** (0.2007)
	Rightist incumbents	-0.0803*** (0.0225)	-0.199** (0.0781)	0.101** (0.049)	0.205 (0.1684)
	Electoral distance	-0.000003 (0.00)	-0.00014 (0.00019)	-0.000033 (0.00008)	-0.00067* (0.0004)

Notes: \*, \*\*, \*\*\* correspond respectively to a significance at the thresholds of 1%, 5%, 10%

Source: Authors, INSEE, French General Direction of Local Authorities (DGCL) and the and Interior Ministry

Table 2.9: The results of specification tests

	Provence-Alpes-Côte-d'Azur		Rhône-Alpes	
	Property tax rates	Property tax per receipt amount	Property tax rates	Property tax per receipt amount
LM-Lag	302.23***	24.17***	325.43***	29.36***
LM-Error	747.51***	19.53***	801.25***	25.93***
RLM-Lag	1.72	6.59***	0.99	9.28***
RLM-Error	467.24***	0.003	511.36***	0.016
LR ( $H_0: \alpha' = \beta' = 0; SLM$ )	413.58***	481.05***	382.78***	414.29***
LR( $H_0: \alpha' + \rho\alpha = 0; \beta' + \rho\beta = 0; SEM$ )	34.25***	43.96***	26.35***	38.81***

Notes: \*, \*\*, \*\*\* correspond respectively to a significance at the thresholds of 1%, 5%, 10%

### 2.3.2. The sources of mimicking behavior

The results presented in the previous section confirm the existence of property tax mimicking among the 978 counties of the region of Provence-Alpes-Côte-d'Azur and the 2887 counties of the region of Rhône-Alpes. This means that an increase in the property tax rate in a county has a positive impact on the property tax rate of neighboring counties. In other words, the determination of the property tax rates is affected by the tax behavior of neighboring counties and also by socio-economic features. According to the related literature, three mechanisms may explain the presence of strategic interaction among local governments: tax competition (Tiebout, 1956), yardstick competition (Salmon, 1987) and the spillover effects (Case et al., 1993; Manski, 1993). Bordignon et al. (2003) reveal that tax mimicking could be due to one or to two among the sources cited above.

#### 2.3.2.1. Yardstick competition effects

In this section, we investigate if tax interaction is due to yardstick competition which focuses on the idea that consumer-voters don't have any information about the cost of public goods and services. Subsequently, they compare the tax rate of their county to the tax rates of neighboring counties. If they find that the property tax rates of neighboring counties are lower than the property tax rate of their own county, for a similar public good endowment, they will not re-elect the local politicians. In sum, consumer-voters judge their local incumbents by comparing their tax policies with those of neighboring counties. Following Ferraresi et al. (2016) and Bocci et al. (2019) to test the yardstick competition model, we modify the reaction function by including a specific interaction term between the variable electoral distance and the average neighboring tax wt as follows:

$$t = \rho wt + X\beta + \delta_1(\text{electoral}_{distance} \cdot wt) + \varepsilon \quad (2.9)$$

If the coefficient of the interaction term is significant and different from zero, then counties mimic each other concerning the fiscal decisions. On the opposite, if the coefficient of the interaction

is not significant, then we conclude that there is no evidence of yardstick competition between counties. In other words, the non-significance of the interaction term signifies that there is no relation between the political variable “electoral distance” and the property tax rates of neighbors. In that case, incumbents apply tax decisions without taking into consideration the property tax rates of their neighbors.

In terms of expectation, we expect to find a negative interaction between neighboring tax choices policies and the political variables electoral distance. Moreover, when the electoral distance increases, the mayor tries to decrease taxes in order to preserve its place and to be re-elected. A negative interaction between neighboring property tax policies and the electoral distance shows that incumbents are interested in mimicking the property tax policies of neighboring counties in order to be re-elected. On the opposite, a positive interaction between neighboring property tax policies and electoral distance implies that incumbents are less interested in mimicking the property tax policies of neighboring counties because they know that they can’t be re-elected.

Table 2.10: Results of the yardstick competition

Variables	Provence-Alpes-Côte-d’Azur		Rhône-Alpes	
	Property tax rates	Property tax per receipt amount	Property tax rates	Property tax per receipt amount
$\rho$	0.104*** (0.029)	0.273*** (0.241)	0.141*** (0.111)	0.0347*** (0.0347)
Population	0.146*** (0.0126)	0.904*** (0.0618)	0.111*** (0.0071)	1.011*** (0.0175)
Area	0.0009 (0.0202)	0.245** (0.0987)	-0.064*** (0.0102)	0.0897*** (0.0248)
population over 65	-0.0032** (0.0015)	-0.006 (0.0074)	0.0002 (0.005)	0.0007 (0.0014)
Unemployment rate	0.071*** (0.0193)	0.043 (0.0931)	0.0351* (0.0183)	0.0379 (0.0443)
Per capita grants	0.0081*** (0.0017)	0.0284** (0.0083)	0.0002** (0.000068)	0.0016*** (0.00016)
Leftist incumbents	0.1015** (0.049)	0.301 (0.2400)	0.0504** (0.022)	0.155** (0.0530)
Rightist incumbents	0.0448 (0.0412)	-0.313 (0.197)	-0.0708*** (0.0198)	0.0967** (0.0478)
Electoral distance	0.0023** (0.0008)	0.0019 (0.004)	-0.000003 (0.0000)	-0.00003 (0.00007)
W*electoral distance	-0.0048** (0.00204)	-0.067*** (0.0089)	-0.00016 (0.00009)	-0.0006 (0.0002)
Littoral	-0.0897 (0.067)	-3.043*** (0.343)	-	-
Intercept	2.652*** (0.381)	6.214*** (1.87)	1.996*** (0.077)	3.927*** (0.188)
Observations	978	978	2887	2887
Log likelihood	-640.02	-2179.43	-1213.98	-3753.53

Notes: \*, \*\*, \*\*\* correspond respectively to a significance at the thresholds of 1%, 5%, 10%

Source: Authors, INSEE, French General Direction of Local Authorities (DGCL) and the Interior Ministry.

Table 2.10 presents the estimation results for the yardstick competition models of both regions. However, for the region of Provence-Alpes-Côte-d’Azur, the interaction coefficients of the property tax and the political variable electoral distance is negative and significant. This means that Provence-Alpes-Côte-d’Azur’s incumbents imitate each other in order to capture the consumer-voters preferences and therefore the spatial property tax mimicking is responsive to the electoral cycle. This

implies that property tax policy choices are influenced by the neighboring property tax choices because of electoral campaign. This is not the case for the counties of the Rhône-Alpes region because of the non-significance of the coefficient of the interaction term between the political variable and the neighboring property tax rates. The result shows that incumbents do not imitate each other's in order to capture consumer-voters preferences and therefore the spatial property tax mimicking is non responsive to the electoral cycle.

The non-existence of yardstick competition among Rhône-Alpes counties could be due to the fact that the property tax income is the main source of revenue for Rhône-Alpes counties and as a consequence, the local policy choices concerning this tax are determined by the property tax policy choices of the neighboring counties whatever are their political parties. The absence of yardstick competition among Rhône-Alpes counties could also be due to the fact that consumer-voters trust their local incumbents by thinking that they are not keeping rents, but rather, they are spending the totality of the local tax revenues by providing local public goods and services. Thereby, we suppose that property tax mimicking behavior among Rhône-Alpes counties is supported by spillover-effects.

### 2.3.2.2. The spillover effects

In the previous section, we find that property tax mimicking among Provence-Alpes-Côte-d'Azur's counties is due to yardstick competition which is not the case for the Rhône-Alpes' counties. We test in this section if tax mimicking among Rhone-Alpes's counties is due to the spillover-effects but also verify if the spillover effect is also a source of property tax mimicking for PACA counties, since this behavior can be a combination of different sources. The existence of spillover-effects means that tax choices and local public expenditures for a local government could create positive or negative externalities affecting the welfare of consumers of neighboring local governments. Otherwise, a change in the tax policy of a local government produces a strategic incentive for neighboring local governments to also modify their tax policies.

Following Ferraresi et al. (2016) and Bocci et al. (2019), to test the spillover effects model, we modify the reaction function by including a specific interaction term between the demographic variable and the average neighboring tax wt as follows:

$$t = \rho wt + X\beta + \delta_2(\text{population.wt}) + \varepsilon \quad (2.10)$$

We introduce the interaction term between population size and the average neighboring tax in the reaction function to verify whether county size influences the spatial interdependencies. Table 2.11 presents the results for spillover-effects in the counties of both regions.

Table 2.11: Results for the spillover effects

Variables	Provence-Alpes-Côte-d'Azur		Rhône-Alpes	
	Property tax rates	Property tax per receipt Amount	Property tax rates	Property tax per receipt amount
$\rho$	0.4044*** (0.0384)	0.706*** (0.0322)	0.507*** (0.0201)	0.3442*** (0.0236)
Population	0.2018*** (0.013)	1.265*** (0.0549)	0.1631*** (0.0071)	1.087*** (0.0178)
Area	-0.015 (0.018)	-0.001 (0.082)	-0.0722*** (0.0094)	0.0065 (0.024)
population over 65	-0.002 (0.0014)	0.0015 (0.0063)	0.00024 (0.0005)	0.001 (0.0013)
Unemployment rate	0.081*** (0.018)	0.0887 (0.0792)	0.0341** (0.017)	0.0295 (0.0427)
Per capita grants	0.0084*** (0.0016)	0.0309*** (0.0070)	0.00021** (0.00006)	0.0017*** (0.0001)
Leftist incumbents	0.1012** (0.047)	0.405** (0.2041)	0.0451** (0.0204)	0.168** (0.0512)
Rightist incumbents	0.081** (0.038)	-0.0083 (0.168)	-0.0151 (0.0185)	0.1593** (0.046)
Electoral distance	0.0016** (0.0007)	-0.0024 (0.0033)	0.00001 (0.00003)	0.0000036 (0.00007)
W*population	-0.1638*** (0.015)	-1.219*** (0.0601)	-0.178*** (0.009)	-0.5617*** (0.0414)
Littoral	-0.143** (0.0642)	-2.377*** (0.291)	-	-
Intercept	1.61*** (0.3747)	7.07*** (1.58)	1.897*** (0.0719)	4.081*** (0.181)
Observations	978	978	2887	2887
Log likelihood	-594.12	-2058.48	-1043.74	-3670.81

Notes: \*, \*\*, \*\*\* correspond respectively to a significance at the thresholds of 1%, 5%, 10%

Source: Authors, INSEE, French General Direction of Local Authorities (DGCL) and the and Interior Ministry

The results for Rhône-Alpes show that the coefficients of the interaction terms between the property taxes of neighboring counties and the demographical variable of a given are negative and significant which implies that property tax mimicking between a county and its neighbors gets weaker when its population increases. Counties with a large population guarantee a higher provision of local public goods and services to all their population even if they are not all taxpayers. Therefore, they are less interested on imitating the tax policies of their neighbors because they have higher expenditures needs. Smaller counties mimic tax policies of neighboring jurisdictions because they are more sensitive to the tax choices of their neighbors since they dispose of similar levels of local revenues and local public expenditures.

For the region of Provence-Alpes-Côte-d'Azur, the coefficients of interaction between the demographical variable and the neighboring property tax is also negative and significant. This result implies that property tax mimicking among the counties of Provence-Alpes-Côte-d'Azur is due both to yardstick competition and to the spillover effects. For the property tax amount, the coefficient of the interaction between the property tax income and the demographic variables is negative and significant for both regions. This means that small counties, in both regions, mimic neighboring property tax policies in order to increase their property tax income.

## CONCLUSION

The first objective of this chapter is to explore the existence of property tax mimicking among French counties in two different regions Provence-Alpes-Côte-d'Azur and Rhône-Alpes. The second is to detect the source of property tax mimicking among French counties. According to the literature, tax mimicking could be due to tax competition, yardstick competition or to the spillover effect. We focus of the two last sources which are the yardstick competition and the spillover effect.

To detect the presence of property tax mimicking among French counties, we use the property tax reaction function. The results confirm that the counties of the regions of PACA and Rhône-Alpes mimic their neighboring counties' policies in terms of property tax rates. Several socio-demographic, fiscal and political variables such as population size, area size, unemployment rate, per capita grants and leftist incumbents are statistically significant. To explore if property tax mimicking is due to yardstick competition, we modify the property tax reaction function by introducing an interaction term between the electoral distance and the property tax rates of the neighbors. The results show that yardstick competition could be a source of property tax mimicking among PACA counties. We do not find any evidence of yardstick competition for Rhône-Alpes counties.

To explore if tax mimicking is due to spillover effect for Rhône-Alpes counties and a possible second source of tax mimicking for PACA counties, we introduce into the property tax reaction function an interaction term between the population size and the property tax rates of neighbors. The results show that spillover effects are the source of property tax mimicking for Rhône-Alpes counties but also for PACA counties.

This chapter could be extended towards several directions. First, tax interaction could be compared for large cities and for small town in order to test if they react differently in terms of mimicking. Second, other variables could be taken into consideration such as the urban or rural characteristics of the county, the property price per square meter in each county and the level of local public spending per capita of each county. Third, this work could be extended on the totality of the French counties.



### **Chapter 3.**

## **THE RESIDENTIAL MOBILITY OF YOUNG INDIVIDUALS IN FRANCE**



## INTRODUCTION

Residential mobility has a slow but steady impact on the transformation of French counties. In France, every year, one inhabitant out of 10 changes his residence. The French mobility rate is higher than the European average (11 % per year in France against 9 % in Europe). More than two-third of the people who move relocate near their previous residence (same county or same department). Only one third of the migrants moves out of their Department or their Region (Haran et al., 2019).

Gobillon (2001) considers that the causes of residential mobility mainly depend upon three factors which are employment, housing and elements of the cycle of life. Many empirical studies show that age is the main determinant of residential mobility while the other factors are the income of the household, education and its housing status (Becker, 1962; Dieleman, 2001; Li and Siu, 2001; Huang and Clark, 2002; Li, 2003; Helderma et al., 2004). Some studies focus on different individual characteristics such as the family status which plays an important role since the decision to migrate is not decided at the individual level but rather at the household one (De Jong et al., 2005).

This chapter focuses on the residential mobility of young people, aged between 15 and 29 years. Young people migrate because they are looking for a suitable job, better life conditions and higher education. We provide a study on young people migration and we examine the eventual impact of property tax and housing tax on their migration and location choices. Moreover, we focus on the residential mobility of young people within the social housing. This chapter aims to complete the previous chapters on tax competition and tax mimicking by showing how young mobile households adapt to changes in local policies including housing taxes' rates and social housing provision.

Social housing aims to accommodate low and middle-income classes when the housing market prices are high. In France, there are territories where the housing situation is particularly tense, such as the Paris region, the South-East and other metropolitan and tourist areas. These areas are characterized by high real estate prices and households often face significant difficulties in finding accommodation. A large number of young adults live in their parents' home, others have to move away from their hometowns to find affordable rental accommodation. Social housing is a solution to help them get started in their career. Social housing plays an important role in favor of social and generational diversity in different territories.

The chapter concentrates on two questions: the first is how individual attributes and territorial characteristics affect the migration of young aged between 15 and 29 years. The second concern the characteristics of young people that migrate in social housing establishments. For the first question,

we use a dataset of 14 million French individuals and for the second one an original data set of 2 297 000 of individuals, which are both provided by the French National Institute of Statistics (INSEE). This database features individual characteristics such as age, educational level, gender, the family status, nationality and the socio-professional category of the migrants (and the non-migrants). It also includes the county of origins and the county of arrival for all individuals between 2012 and 2017.

The data features migration flows between French counties and represents a unique spatial level of analysis, since previous studies only worked on larger institutionally defined spatial levels such as the Departments, the Regions or the « Zones d'emploi ». The chapter uses an original database for the territorial characteristics of each county with socioeconomic characteristics such as the population' size, the median household income and the unemployment rate. It contains data which provides information about the environmental characteristics of each county after migration. It also includes fiscal data which are the property tax and the housing tax. Results are delivered for young individuals and also for the working population in order to test eventual interactions.

The chapter is organized as follows: section 3.1 delivers a brief literature review about residential mobility theory. It focuses on the migration of young people and on residential mobility in social housing units. Section 3.2 presents data, some descriptive analysis and the probit model methodology. Section 3.3 provides the results of several probit models for the migration of young people between French counties and towards social housing.

### **3.1. A BRIEF LITERATURE REVIEW**

Several studies deal with residential mobility. The latter can be defined as the change of residence of a household independently of the distance between the original and the final accommodation. Clark et al. (2014) stipulate that residential mobility is infused with the notion that “we move to improve” and also appears as “a mechanism that enables households to adjust their housing, neighborhood and locational consumption to meet their changing needs and preferences”.

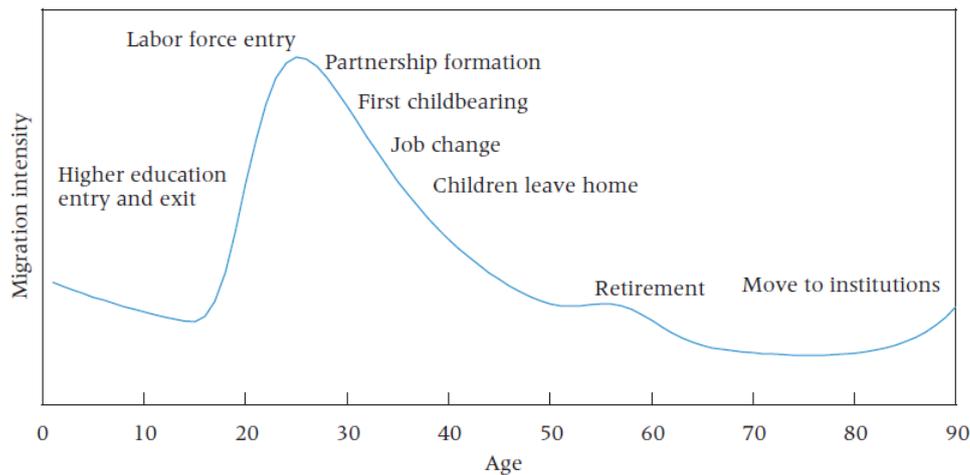
Studies on residential mobility show that individuals decide upon their location because of a series of different reasons such as labor market opportunities, human capital improvement, access to amenities, environmental preferences, etc. (Rossi, 1955; Leslie and Richardson, 1961; Strassmann, 1991; Hooimeijer and Oskamp, 1996; Strassmann, 2001; Winstanley et al., 2002; Van der Vlist et al., 2002 ; Zondag and Pieters, 2005; Fattah, et al., 2015). Some researchers show that residential mobility is strongly connected to the households’ change of life issues like divorce (Feijten, 2005; De Jong and Graefe, 2008), personal dissatisfaction (Nowok et al., 2013) or retirement (Schaffar et al., 2019).

#### **3.1.1. Young people residential mobility**

Many empirical studies confirm that age is the main determinant of residential mobility (Becker, 1962; Dieleman, 2001; Li and Siu, 2001; Huang and Clark, 2002; Li, 2003; Helderma et al., 2004; Baccaïni and Levy, 2009). Single young individuals move more than large households: 20 % of young single individuals left their home between 2005 and 2007, while this rate decreases to 1.8 % for 5-persons households.

Abraham and Hunt (1997) and Clark and Huang (2003) emphasize that it exists an important connection between residential mobility rates and the life cycle of household. Young households in their twenties or thirties are the most mobile people. Figure 3.1 presents the age profile of migrants associated to life-course. It shows that young people migrate in order to acquire a high education diploma or to find an adequate job. However, from the age of 27 or 28 years, the probability that an individual migrates decreases when he finds a job and this probability decreases even more when he has his first children (Bernard et al., 2014).

Figure 3.1: The age profile of migrants linked to life-courses



Source: Bernard, Bell and Charles-Edwards (2014). Life-course transitions and the age profile of internal migration. *Population and Development Review*, 40(2), 213-239.

Some studies link the age of migrants to factors such as education, demographic structure (Milne, 1993) or to their income situation (Pandit, 1997). Young people migrate for different reasons. Their migration is frequently connected to important life cycle's changes such as getting higher education, finding and beginning a job, getting married or divorcing.

Mills and Hazarika (2001) support that the education level of young people impacts the decision of migration through the comparison of the costs of employment realization if they migrate to the costs of forgoing migration. They also support that gender and ethnicity of young people could have an impact on the migration's decision. For example, young women could suffer of more pressure than men to stay in their hometown so as to take care of family problems. Finney (2011) works on the residential mobility of young students. He attests that the residential mobility of white British and Chinese students is important while the residential mobility of Black and South Asian students is low.

Almost all recent economic studies on young people residential mobility support that, over the recent years, the spatial mobility of young individuals has raised in the advanced industrialized countries. Tatsiramos (2006) observes a correlation between the GDP per capita and the country's youngster residential mobility rate. Across European countries, the youth unemployment rates are also quite different. Nearly 50 % of young people are unemployed in Spain and Greece. In Croatia and Portugal, youth unemployment rate is between 30 % and 35 %, while, in the Netherlands, the youth unemployment rate is less than 10 %.

Kulu et al. (2018) focus on the residential mobility of young (adults) aged between 18 and 29 years in Sweden. Their results show that the migration rate of young aged between 18 and 29 years

increased by 7 %. They also find that for young people aged between 18 and 22 years, the residential mobility rate also increased which could be related to seeking education moves.

Smith and Sage (2014) work on the residential mobility of young adults aged between 16 and 24 years in England and Wales between 2002 and 2008. In their results, they find that the migration rate of young adults aged between 16 and 24 years increased by 9.3 %, while, the migration rate of other age groups decreased. From the age of 25 years, the residential mobility rate follows a decreasing curve.

### **3.1.2. Social housing and residential mobility**

Residential mobility affects rental costs and housing prices. It disturbs the rent levels and the local housing market. Several factors affect the location choices of the French young households and individuals, such as access to higher education, jobs or services (Laferrère et al., 2017). However, rental housing in France is characterized by low supply and high mobility, leading to excessively high rents and a commitment to social housing in the most economically dynamic areas (Trannoy and Wasmer, 2013). In 2013, in France, out of 28 million main metropolitan residences, 4.6 million are social houses, 6.5 million are private rental houses and 16.2 million are houses lodged by owners. Graeffly (2006) stipulates that social housing is supplied by the intervention of the public authorities.

The history of social housing in France is linked to the industrial revolution. Between 1875 and 1974, the urban population increased from 12 to 18 million, while the total population remained stable. In 1910, social rental housing becomes a new social conquest. During this period, the deplorable housing conditions of workers is worrying. One in four Parisians lived in a half-room and in the cities of more than 50,000 inhabitants, one third of households lived in over-populated or insufficient spaces because the price of rents increased. In 1923, the Deputy Louis Loucheur creates two projects in order to encourage the building of social houses, but in 1932, the world crisis negatively impacts the country and construction collapses. In 1939, France built 300,000 social housing and 900,000 people benefited.

After World War II, France is in ruins: 45 % of housing is overcrowded and 10 % of the population lived in completely unsanitary premises, 90 % of the population does not have a bath or shower, 80% do not have a toilet inside their homes and 48 % do not have running water. After the repatriation of the French from Indochina, Morocco, Tunisia and Algeria, the State built 100,000 temporary dwellings. In 1953, a law required that all companies with more than ten employees to pay 1 % of the wage bill to build 240,000 housing units per year, during a 5 years period (Clanché and Le Blanc, 1999).

The first constructions of social housing began in 1958. Between 1968 and 1999, the proportion of social housing increased from 7.5 % to 16 %. In 1974, 16 million French people were poorly housed and 39 % of main residences were still uncomfortable. In 1998, social housing is at the heart of the housing chain because it must integrate the most disadvantaged people and in the same time it must allow the middle classes to prepare for home ownership (Simon, 2003). After the decentralization laws, the construction of social housing is established at the municipality level. Each municipality with more than 50,000 inhabitants must have a social housing stock which must represents 20 % of all housing in the municipality, otherwise the latter pays a penalty (Verdugo, 2014). This means that in France, the municipal level is the main decision-maker for the construction of social housing at the local level.

Ghekière (2008) defines social housing as a response from the public authorities to the structural failure of the housing market to meet all the needs and to guarantee access for all individuals to a decent and financially accessible housing. In the European Union, the housing budget represents 25 % of household spending: nearly 20,000,000 European households live in social housing, especially in European cities where real estate speculation is growing (Ghekière, 2008).

Empirical observations (Gobillon, 2001; Debrand and Taffin, 2005; Laferrère, 2008; Arnault et al., 2015) confirm that the turnover rate in social houses in 2013 is equal to 9.6 %. The average annual turnover rate increases since 2001 in the private rental sector but seems to decline in social housing. The turnover rate in social housing in the Paris region is less than 5 %. It reached 5.3 % in the Provence-Alpes-Côte-d'Azur region and 6.7 % in Languedoc-Roussillon and Corsica. The residential mobility is less important when living in social housing. Households living in social housing do not abandon their dwellings because they fear of not finding new places in social housing in the county of destination (Hughes and McCormick, 1981).

When studying residential mobility to social housing units in France, Jacquot (2007) shows that there is a positive and significant relationship between the income of the household renting social housing and seniority. Burrows (1999) presents some interesting results regarding to the income of households leaving and entering social housing in England. He finds that the income of households leaving social housing is higher than the income of households entering it. Amzallag (2009) carried out a similar study and finds that the probability for a household to leave social housing increases sharply with income. According to the study of Laferrère (2008), households living in social housing have an average of 10 years of seniority, while renter households in the private rental sector have an average seniority of 7.8 years.

In social housing, the probability of moving is 1.3 times higher among single people than among households with more than three people. According to Trevien (2013), in 2006, 318,900 households left their homes to occupy a social housing unit for less than 4 years in France, while in 2013, 249,300 households moved to occupy a social housing unit for less than 4 years. Between 2006 and 2013, the rate of residential mobility in social housing fell from 28.5 % to 20 %.

Bourgeois (2018) argues that in France, social housing represents 17 % of the housing stock and accommodates nearly 10 million individuals. It is one of the largest and most important public parks in Europe. The European countries which overtake France are the Netherlands and the United Kingdom where the social housing represents 33 % and 18 % of the total housing stock, respectively. Social housing is complementary to the housing supply available on the market and aims to meet a demand excluded from the private sector. According to Gobillon (2001), in France, 19 % of young people are tenants in social housing and 53 % are housed in the private rental sector.

## 3.2. DATA AND METHODOLOGICAL ISSUES

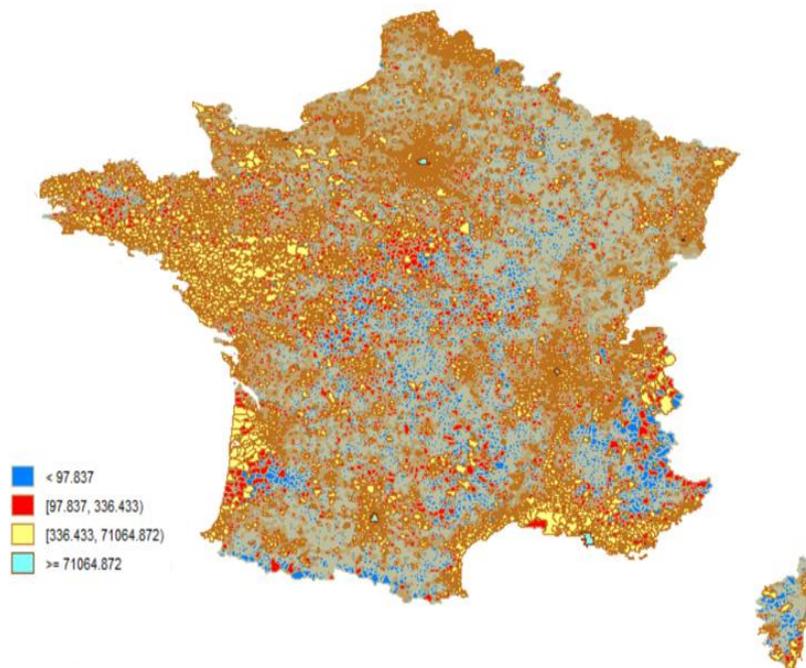
### 3.2.1. A descriptive analysis of French counties

#### 3.2.1.1. Demographics

According to the INSEE, in 2017, the French population aged under 14 represented 18.1 %, the one between 15 and 29 represented 17.6 % and they represent the young people studied in this chapter. People between 30 and 44 represented 18.8 % of the French population and the one between 45 and 59 years old represented 19.9 %. Finally, elderly and people aged over 60 represent 25.5 % of the total population. The French population is getting older at a rhythm of 4 % every 15 years. In 2002, people over 60 years old only represented 21 % of the total French population.

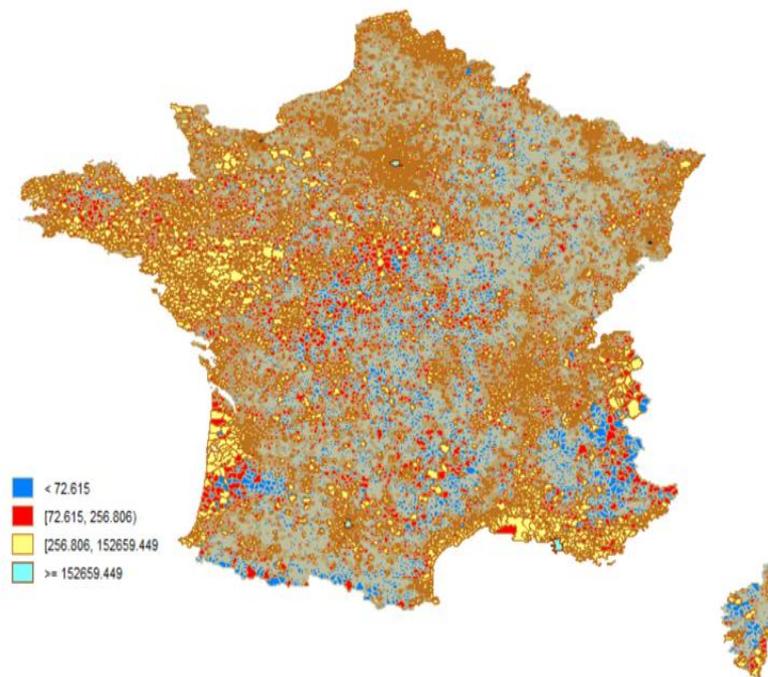
Figures 3.2 to 3.6 show the proportion of individuals of different age groups in 2017 in every county. In the appendices, the figures 6.3.1, 6.3.2, 6.3.3, 6.3.4 and 6.3.5 present the proportion of individuals of different age groups in 2012.

Figure 3.2: Individuals having less than 14 years in 2017



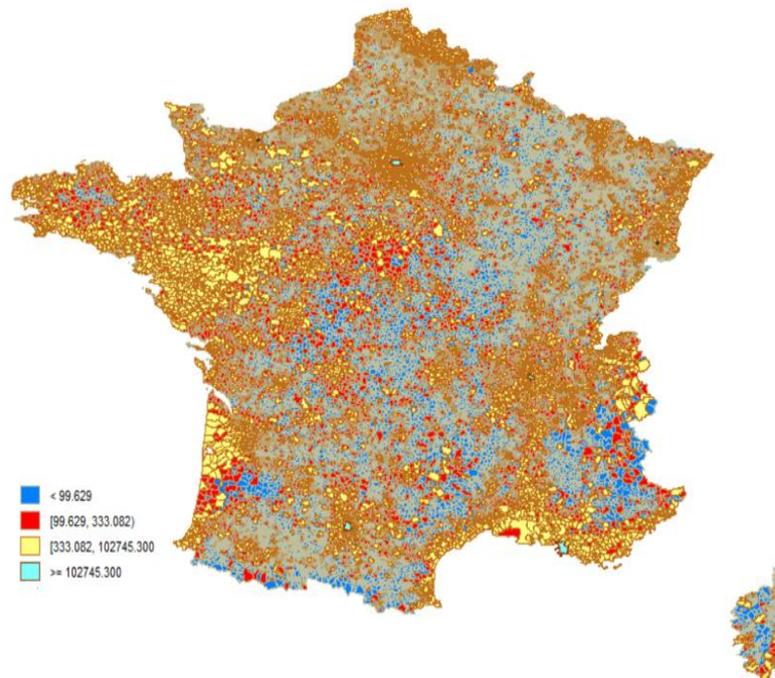
Source: INSEE, maps representation made by the author

Figure 3.3: Individuals aged between 15 and 29 years in 2017



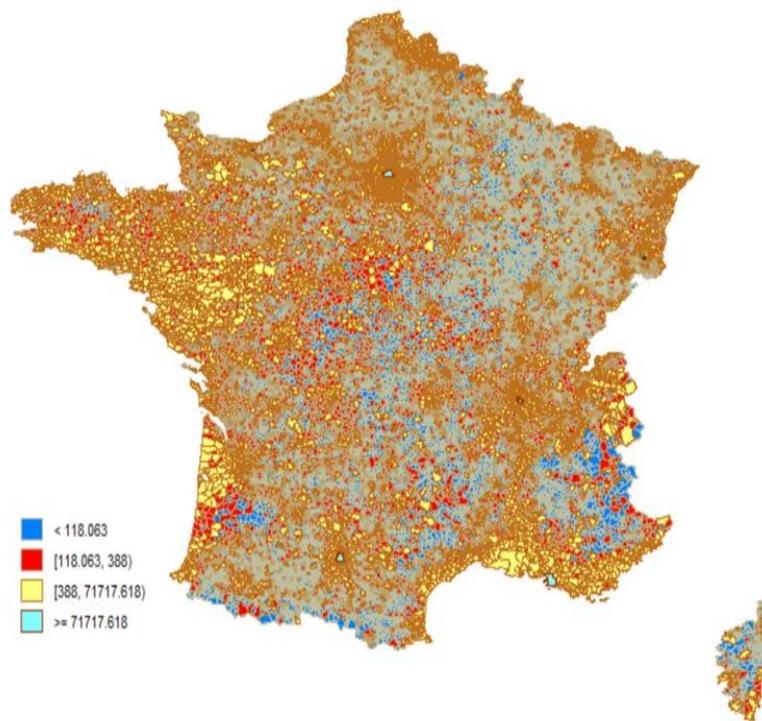
Source: INSEE, maps representation made by the author

Figure 3.4: Individuals aged between 30 and 44 years in 2017



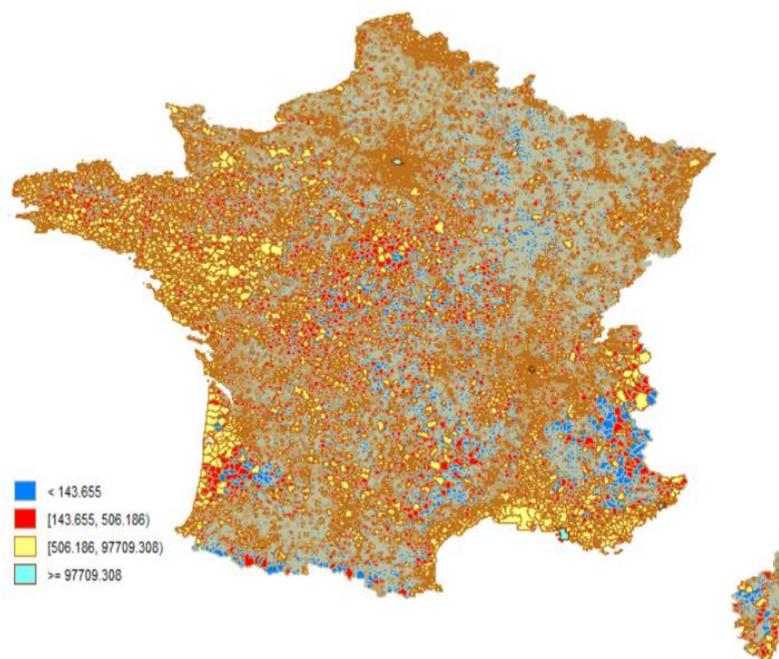
Source: INSEE and the maps representation made by the author

Figure 3.5: Individuals aged between 45 and 59 years in 2017



Source: INSEE and the maps representation made by the author

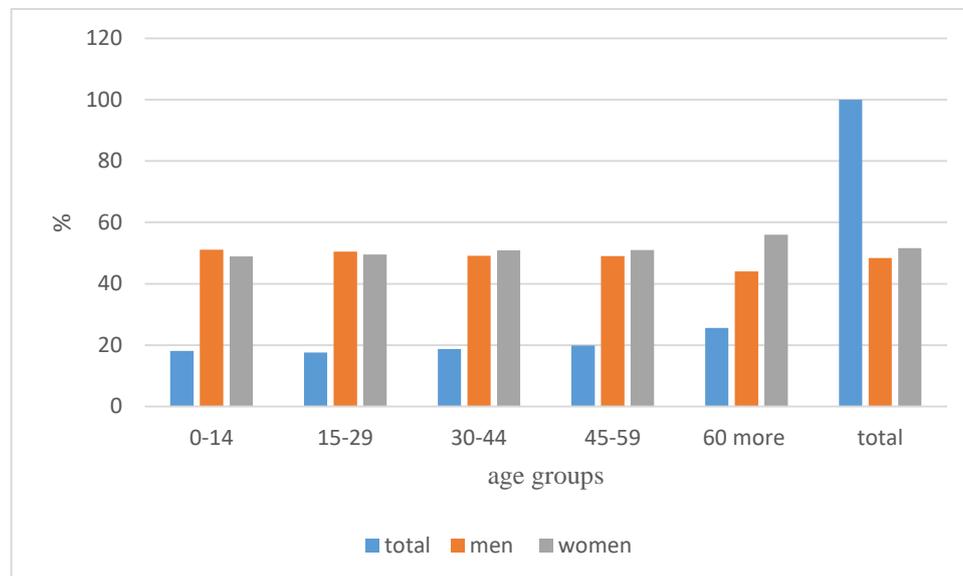
Figure 3.6: Individuals aged more than 60 years in 2017



Source: INSEE and the maps representation made by the author

The proportion of elderly people is highest in 2017. However, still France and Ireland have the highest proportion of young, aged under 14, because they have the highest fertility rate in Europe.

Figure 3.7: The proportion of the main age groups in function of gender



Source: INSEE and the graphic representation made by the author

In 2017, the active population in France is estimated to 29.8 million people aged 15 or over. It includes 27.1 million active people with a job and 2.7 million people looking for a job. The activity rate of people aged between 15 and 64 years was 71.5 %.

### 3.2.1.2. Individual characteristics

The database used in this chapter comes from the 2015 Population Census published by the French National Institute of Statistics and Economic Studies (INSEE) in 2018. It analyzes the residential mobility of 19.4 million of individuals and their location in 2012 and 2017. The information is provided for the 34 973 French counties and also for the 304 employment zones (ZE) in metropolitan France. Two different measurable flows appear: inter-county flows and intra-county flows. The first concern the flows when the individuals migrate between two different counties and the second when the individuals move within their own counties. We only consider inter-county flows in this chapter.

The aim of this chapter is to study the migration of young, aged between 15 and 29 years between French counties and also to study their migration to the social housing establishments. Focusing on young people which are more mobile than other categories allows to get closer to the preliminary conditions of Tiebout's voting with feet model that implies a perfect non-costly mobility of individuals among different territories.

First, we analyze the behavior of migrants and non-migrants, according to their age groups. We group individuals in three categories: 15-29 years, 30-59 years and over 60 years. In 2017, 2,324 million of individuals included in this dataset have moved out of their county of residence from 2012 which represents 14.51 % of individuals listed. On the other side, 13,691 million of individuals included in this dataset have not moved out of their county of residence, which represents 85.49 % of the individuals listed. Table 3.1 describes the French inhabitants' migration, according to their ages, out of their own county to those not migrating.

Table 3.1: The French migrating and not migrating population according to age

	<b>15 to 29 years</b>	<b>30 to 59 years</b>	<b>+ 60 years</b>	<b>Total</b>
Migrant	1 157 417	513 887	653 108	2 324 412
Non- migrant	394 0772	3 364 386	6 386 728	13 691 886
Total	5 098 189	3 878 273	7 039 836	16 016 298

Source: INSEE, MIGCOM file, Author's calculations

Among the individuals who migrated, 49.79 % are aged between 15 and 29 years, 22.10 % between 30 and 59 and 28.09 % over 60 years. The statistics of the table 3.1 show that individuals aged between 15 and 29 years migrate more than the rest of the population. As stated in the literature review, the level of education plays an important role in the decision to migrate. Our sample reveals that the more a young individual has a high level of education, the more he migrates. Table 3.2 lists the type of diploma of the migrants according to their ages. Among the individuals who migrate, 34.8 % appear without a diploma, 23.5 % with only the baccalaureate diploma and 41.5% individuals with more than the baccalaureate diploma.

Table 3.2: The diploma level of French migrants according to their ages

	<b>15 to 29 years</b>	<b>30 to 59 years</b>	<b>+ 60 years</b>	<b>Total</b>
No diploma	306 438	305 797	169 580	808 785
Baccalaureate	320 446	84 0256	96 868	501 570
Bac +	530 533	260 006	223 718	1 014 056

Source: INSEE, MIGCOM file, Author's calculations

The housing status also affects the residential mobility of individuals. Table 3.3 describes the type of accommodation for French migrants according to their ages.

Table 3.3: The type of accommodation of French migrants according to their ages

	<b>15 to 29 years</b>	<b>30 to 59 years</b>	<b>+ 60 years</b>	<b>Total</b>
Owners	233 924	228 629	302 022	764 575
Renters	859 160	415 972	299 683	1 574 815

Source: INSEE, MIGCOM file, Author's calculations

Among individuals who have migrated, 32.68 % are owners and 67.32 % are renters, after the migration movement which implies that renters migrate more than owners. Owners face the price risk for selling their dwellings, while renters face the variations of the rental price, if they decide to move (Sinai and Souleles, 2005). Young people are rather renters - only 21.40 % of individuals aged between 15 and 29 years are owners of their dwelling – while 50.19 % of individuals with more than 60 years are owners.

Table 3.4 presents the French migrants who are tenants in social housing units, according to their ages: 8.31 % of the people that have undertaken residential mobility are tenants in social housing units (after mobility). Among them, 81.53 % of individuals are of age between 15 and 29 years, 10.58 % between 30 and 59 years and 7.89 % more than 60 years. This denotes that youth are the most concerned by social housing.

Table 3.4: The French migrants renting or not into the social housing according to their ages

	<b>15 to 29 years</b>	<b>30 to 59 years</b>	<b>+ 60 years</b>	<b>Total</b>
Non renting in social housing	999 913	493 431	637 897	2 131 241
Rent in social housing	157 504	20 456	15 211	193 171

Source: INSEE, MIGCOM file, Author's calculations

Other individual characteristics such as the gender and nationality seem to impact migration. Table 3.5 shows how these attributes characterize the French regional migrant flows. A bit unexpectedly, young men are more mobile than young women, while female residential mobility is higher for working population. Concerning, nationality, 86.6 % of the migrants are French natives while 13.4 % are foreigners. Immigrants count for 10.2 % of the French population, so one can see that they represent a slightly higher percentage in the migration flows. As Dimou et al. (2021) have shown, immigrants tend to be more mobile than natives since they have already undertaken residential mobility by quitting their home country. Nevertheless, young immigrants are less mobile than the immigrants between 30 and 59 years old.

Table 3.5: Gender and nationality of French migrants according to their ages

	15 to 29 years	30 to 59 years	60 years	Total
Women	553 030	260 019	288 186	1 101 235
Men	604 387	253 868	364 922	1 223 177
Native	1 024 667	437 359	587 827	2 049 853
Foreigners	132 750	76 528	65 281	274 559

Source: INSEE, MIGCOM file, Author's calculations

Finally, a last important characteristic is the socio-professional category of the individual. Table 3.6 shows the socio-professional category of French migrants according to their ages. The groups of Employees and higher professions each feature 17.4 % of the migrants, followed by intermediate professions (16.8 %). Retirees represent 14.26 % of the migrants while as expected. Farmers and craftsmen, only count respectively for 0.11 % and 3.08 % of the migrants. It is however clear, that managers are the most mobile group when looking at the percentage of the managers migrating among the stock of managers in France. The aim of our representation here is not to see which category is the most mobile but to characterize the flows of residential inter-county mobility in France.

Table 3.6: Socio-professional category of French migrants according to their ages

	15 to 29 years	30 to 59 years	60 years	Total
Farmers	1 157	894	628	2 679
Craftsmen, shopkeepers	21 060	28 914	21 734	71 708
Managers - higher intellectual jobs	179 680	136 288	81 823	397 791
Intermediate professions	218 269	113 984	58 896	391 149
Employees	226 744	112 151	64 571	403 466
Workers	128 496	68 922	34 594	232 012
Retirees	34	862	330 722	331 618
Others	381 977	51 872	60 140	493 989

Source: INSEE, MIGCOM file, Author's calculations

### 3.2.1.3. Territorial characteristics

Territorial characteristics feature different types of information. First, they represent the conditions in the local labor markets, with data on employment and unemployment rates. Table 3.7 presents a descriptive analysis of the territorial variables associated to the French counties. The population (POP) variable measures the concentration of the population in each county and aims to characterize the urban degree of each county. The most populated county are Paris (2,187 million of inhabitants), Marseille (863 thousand inhabitants), Lyon (516 thousand inhabitants) and Toulouse (479 thousand inhabitants).

The unemployment rate (UNEM) provides information on the proportion of the population that is unemployed. In 2017, France had 2.7 million unemployed with an unemployment rate particularly high among young workers. The variable INCOME describes the median household' income in each county. The annual median household' income in Paris, Marseille, Lyon, Nice and Toulouse is respectively of 28157 Euros, 18248 Euros, 22806 Euros, 19533 Euros and 20430 Euros. We also take into account an interesting territorial characteristic to measure the real estate pressure, that of the share of social housing in the main residences (SH) in each county. The social housing represents 17.87 % of the main residences in Paris, 16.06 % in Marseille, 16.14 % in Lyon and 11.98 % in Nice.

SUN is a climatic variable which measures the average annual number of hours of sunshine in each French county. Data is collected on the French weather forecast agency (France Météo). With more than 2800 hours of sunshine (Arles, Salon, Marseille, Draguignan, Fréjus, Toulon, Avignon), the most sunny French counties are located in the Provence-Alpes-Côte d'Azur region. Conversely, the counties with the fewest hours of sunshine per year are located in the North of France. We also try to characterize, for each county, the supply of cultural infrastructure available to individuals through the variables ETABLIS which features the number of cultural establishments such as cinema, theater, museum and conservatory. This has been a long-term data collecting process. Finally we consider local fiscal variables such as property tax (PROPERTY TAX) and housing tax (HOUSING TAX) collected from the French General Direction of Local Authorities.

Table 3.7: Descriptive statistics of territorial variables

	<b>N</b>	<b>Mean</b>	<b>Std. Dev</b>	<b>Min</b>	<b>Max</b>
POP	34970	1905.91	15077	13	2187526
UNEM	34970	9.99	4.48	5.3	24.3
INCOME	34970	20012.31	3780.86	7382	48390
SH	34970	3.45	6.29	0	67.30
SUN	34970	1912.29	309.62	1100	2725
ETABLIS	34970	0.11	1.04	0	159
PROPERTY TAX	34970	12.495	4.96	0	50.09
HOUSING TAX	34970	14.45	6.73	0	59

Source: INSEE, French weather forecast agency, French General Direction of Local Authorities Author's calculations

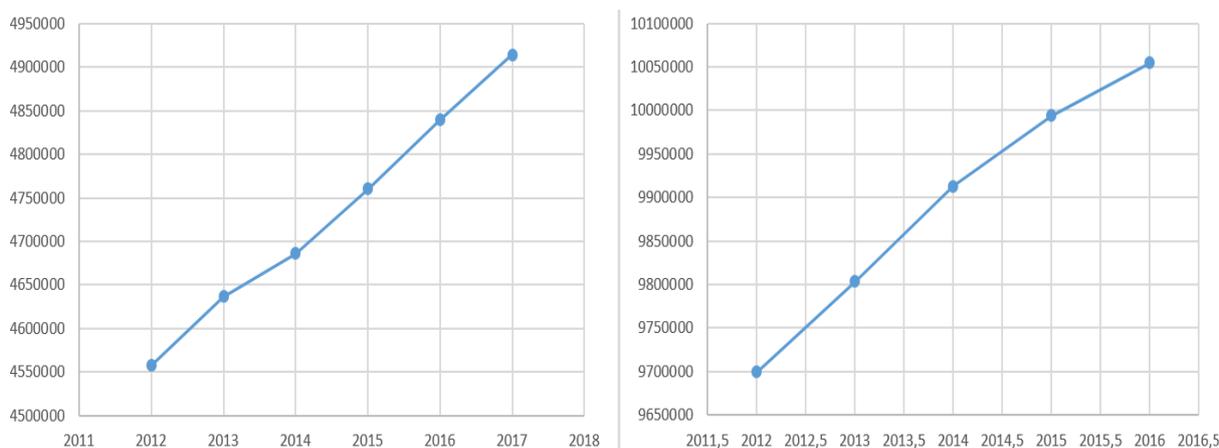
All territorial variables feature data for the arrival counties. It would have been interesting to work on the differentials between the counties of departure and arrival but this required a huge data analysis treatment (a matrix of 34973 to 34973) not possible at this level of work. Obviously, this is a methodological limit of this work since it considers that migrants don't take into account the

differentials between their original domiciliation and their future residence but only the characteristics of the latter. On the same time, this is often the case when migration is decided. This means that we can draw conclusions on the characteristics of the counties that attract (or not) migrants but not on the characteristics of the counties from which migrants leave.

### 3.2.2 Focusing on social housing

Figure 3.8 focuses in a more particular way to the trends of social housing in France. Let us remind, at this stage, that social housing appears as an important contribution of counties in terms of provision of local public services. This variable should be taken into account with respect to housing and propriety local taxes in the location choices of young households.

Figure 3.8: The evolution of the number of social housing residences and the number of inhabitants



Source: INSEE and the graphics representation made by the author

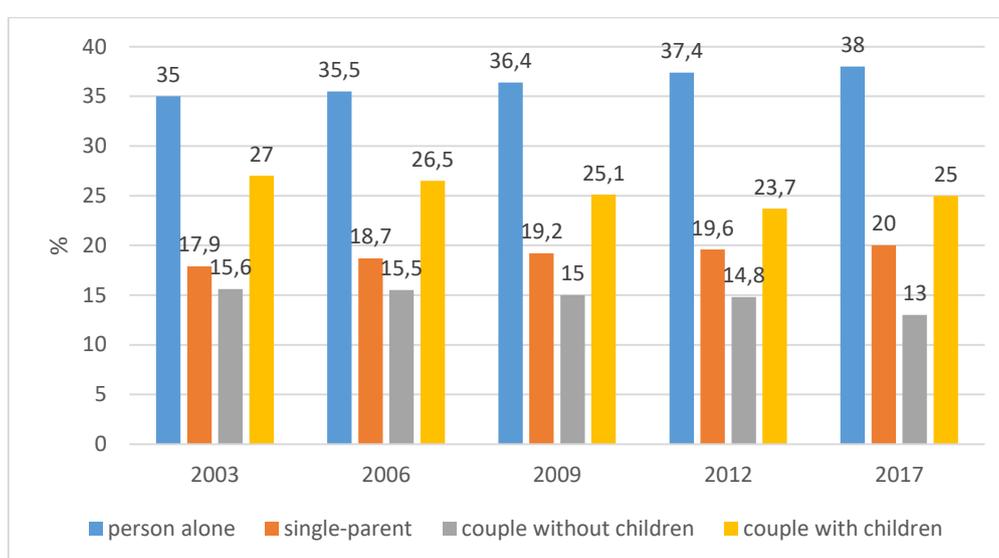
According to the INSEE, in 2017, social housing represents 4.9 million dwellings (16 % of the total occupied housing stock) with 10.7 million people living there. The social housing park increased by 71,000 units between 2015 and 2017. 18.3 % of social housing tenants were under 30 years, 19.2 % were aged between 30 and 39 years and 12.8 % were aged over 65 years. Between 2011 and 2015, 872,000 households renting social houses left their dwelling which represents 22 % of the total households renting in the social housing park. Among the households who moved out of a social dwelling, 54 % remained renters in social housing located in another area (so they moved from a former to a new social dwelling), 23 % became tenants in the private rental sector and 19 % became owners (Arnault et al., 2015).

Moreover, 88 % of the social housing tenants have resources below the ceiling for access to the social housing park. Average renter households in the social housing units are younger than real estate owners (57 years on average), but older than renter households in the private rental sector (44

years) (Delance, 2018). In 2017, 31 % of immigrant households occupied social housing, compared to 14 % of native households. Foreign households from Sub-Saharan Africa, Turkey and the Maghreb countries are over-represented in the social housing park with respectively 50 %, 39 % and 38 % of these households occupying a social dwelling (Delance, 2018).

Figure 3.9 represents the evolution of the family status of households living in social housing units. In 2017, according to the INSEE statistics, 38 % of social housing tenants are single, 17 % are single-parents with 1 or 2 children, 3 % are single-parents with 3 or more children, 13 % are couples without children, 17 % are couples with 1 or 2 children and 8 % are couples with 3 or more children.

Figure 3.9: The evolution of the family status of households living in the social housing

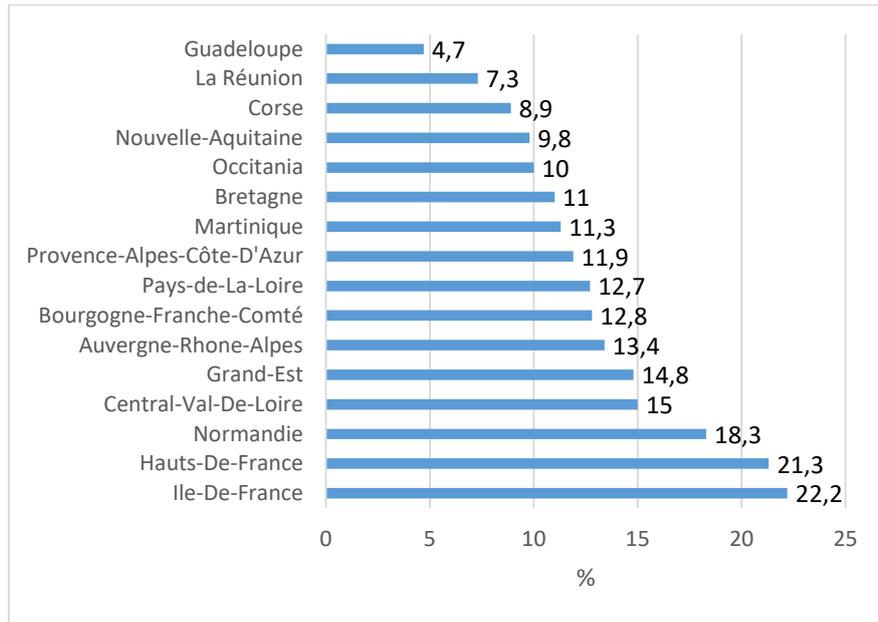


Source: INSEE, calculation and the graphics representation made by the author

According to the INSEE, 22.2 % of the population of the Ile-De-France region are social housing tenants. This rate falls to 14.8 % in the Grand-Est region, 13.4 % of individuals in Auvergne-Rhône-Alpes and 11.9 % in Provence-Alpes-Côte-d'Azur. Figure 3.10 shows the proportion of social housing tenants in the French regions in 2017.

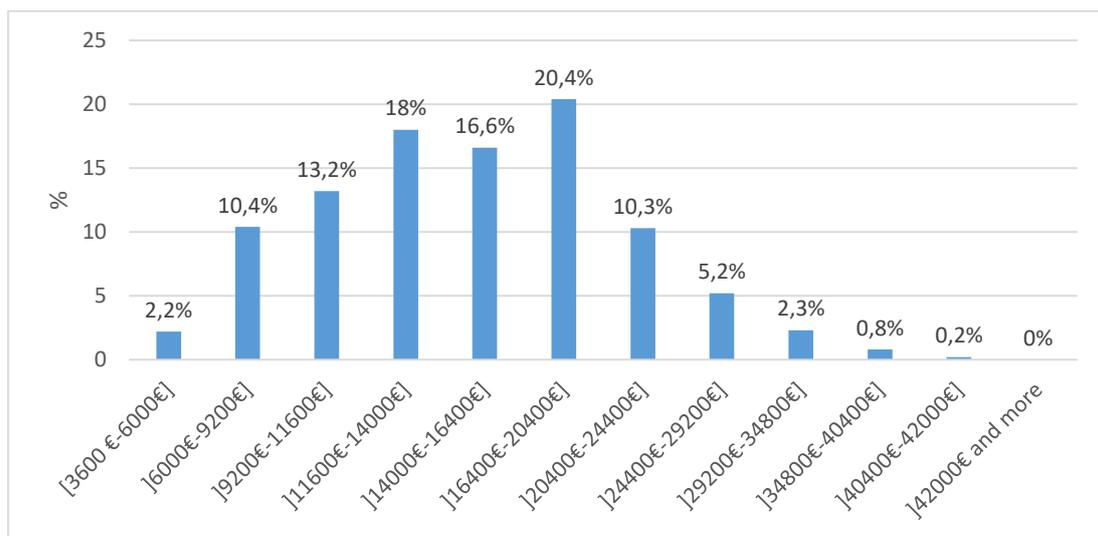
In 2017, according to the INSEE, 25 % of the tenants of social housing units are manual workers, 26 % are retired and 10 % have no professional activity. Finally, the level of income is one of the main criteria for the allocation of social housing. As expected, the resources of tenants of social housing units are lower than those of tenants in the private. In 2017, the median income of tenants of social housing units was of 15,100 euros per person per year, against 17,900 euros for tenants in the private sector and 23,300 euros for owners. In the social housing park, the poverty rate reached 35 % in 2017 against 23 % for tenants in the private sector and 7 % for owners (Figure 3.11).

Figure 3.10: The proportion of social housing tenants in the French' regions



Source: INSEE, graphic representation made by the author

Figure 3.11: Income distribution of people living in social housing



Source: INSEE and the graphic representation made by the author

To analyze migration within the category of young people aged between 15 and 29 years, we use a series of probit models that allow us to test the probability of migrating individuals between counties in 2015. We also test the probability of migration of the working population from 30 to 59 years old.

### 3.3. THE MIGRATION OF YOUNG PEOPLE BETWEEN FRENCH COUNTIES

#### 3.3.1. The results of the probit model

Table 3.8 presents the results of the Probit model by examining the way in which individual characteristics affect the migrations of individuals, separated into three categories, those of 15-29 years, those of 30-59 years and those of over 60 years. Age shows that young people aged between 15 and 29 years are more likely to migrate than older ones (30-59 years and +60 years). For young people, the probability of migrating increases by 1.7 % each year of his/ her life, while this rate falls to -1.01 % for individuals aged between 30 and 59 years and increases to 0.37 % for individuals aged more than 60 years. The positive correlation between young individuals, aged between 15 and 29 years, and the probability of migrating among counties is consistent with Beckers's assumption (1964).

The level of education clearly indicates that more an individual has a higher diploma than the baccalaureate, more his probability of migrating increases, independently from age. However, the marginal effects vary substantially and are higher for young aged between 15 and 29 years than for individuals having more than 60 years and those aged between 30 and 59 years.

Family type also affects the likelihood of migration. Singles are the most likely to migrate, especially among young people aged between 15 and 29 years compared to individuals whose household consists of one or more children. Marginal effects are higher for single young individuals aged between 15 and 29 years than for single individuals aged between 30 and 59 years and those having more than 60 years.

Being a house or a flat owner decreases the likelihood of migrating for all age categories. Migration appears riskier for owners than for tenants (Barois, 2020) especially if the latter have high housing costs. With regard to marginal effects, they are higher for individuals over the age of 60 than for young and those aged between 30 and 59 years. A probable explanation is that people over the age of 60 years may choose to combine a change in location with a change in the size or the type of the property.

As expected, the socio-professional categories of young show that managers, employees and entrepreneurs are more likely to migrate than workers and farmers for all ages. Finally, young native individuals tend to migrate less than foreigners. This changes for people over 30 and for elderly. A plausible explanation could be that foreigners feature a more socially and economically fragile

situation after 30 and are less eager to assume the risks related to residential mobility. Young foreigners are eager however to take higher risks.

Table 3.8: Probit of migration between French counties (individual characteristics)

	15-29 years		30-59 years		+60 years	
	Probit coef	Marg. effects	Probit coef	Marg. effects	Probit coef	Marg. Effects
AGE	0.601*** (0.002)	0.017*** (0.00001)	-0.052*** (0.0008)	-0.0101*** (0.00015)	0.026*** (0.0015)	0.0037*** (0.0002)
AGE <sup>2</sup>	-0.002*** (0.0004)	-0.0004*** (0.0003)	0.0004*** (0.000009)	0.00009*** (0.0000018)	-0.0001*** (0.00001)	-0.00021*** (0.000001)
BAC-	-0.269*** (0.0001)	-0.077*** (0.0005)	-0.147*** (0.0017)	-0.028*** (0.0003)	-0.325*** (0.0026)	-0.051*** (0.0004)
BAC+	0.171*** (0.002)	0.051*** (0.0006)	0.183*** (0.0018)	0.036*** (0.0003)	0.276*** (0.0029)	0.045*** (0.0005)
SINGLE	0.058*** (0.0028)	0.017*** (0.0008)	-0.003 (0.0031)	-0.0005 (0.0006)	-0.081*** (0.0041)	-0.011*** (0.0005)
FAMILY	-0.259*** (0.0027)	-0.077*** (0.0008)	-0.187*** (0.0030)	-0.037*** (0.0006)	-0.123*** (0.0057)	-0.0162*** (0.0007)
OWNER	-0.631*** (0.0026)	-0.170*** (0.006)	-0.632*** (0.0025)	-0.128*** (0.0005)	-0.518*** (0.0045)	-0.086*** (0.0007)
FOREIGNERS	0.150*** (0.0209)	0.046*** (0.0008)	-0.239*** (0.0019)	-0.052*** (0.0004)	-0.189*** (0.003)	-0.0304*** (0.0006)
MANAGERS	0.336*** (0.002)	0.108*** (0.00105)	0.322*** (0.0017)	0.0709*** (0.0004)	0.281*** (0.0054)	0.048*** (0.0011)
EMPLOYEES	0.021*** (0.002)	0.0061*** (0.0006)	-0.033*** (0.0016)	-0.0065*** (0.0003)	0.034*** (0.0088)	0.005*** (0.0008)
WORKERS	-0.022*** (0.002)	-0.0065*** (0.0007)	-0.145*** (0.0019)	-0.026*** (0.0003)	-0.068*** (0.0078)	-0.0094*** (0.0010)
RETIREEES	-	-	-	-	-0.116*** (0.0032)	-0.017*** (0.0005)
NB OBS	5 098 189		3 878 273		7 039 836	

Notes: \*, \*\*, \*\*\* correspond to a significance at the thresholds of 1 %, 5 %, 10 % values in parentheses the "standard errors".

Source: Authors, French National Institute of Statistics and Economic Studies data.

Table 3.11 presents the results from the Probit model for migration between counties, time associating personal attributes and location characteristics for young aged between 15 and 29 years and for the working population with more than 30 years. The  $\beta$  parameters and robust standard errors are estimated for both young people and the working individuals with the maximum likelihood method. All usual statistical tests (Wald test, likelihood ratio test) have been performed. The  $\beta$  parameters for young and working individuals are significantly different for all variables at the level  $0.01 > \rho$ .

Table 3.9 displays the probit model results for the migration between counties for the young and working people, by combining individual characteristics and territorial characteristics. In this

model, we estimated the probit coefficients and the marginal effects. The first results explain the way personal attributes impact the probability to migrate and simply confirm the results from Table 3.10; the second ones concern the way the territorial characteristics of the French counties affect residential mobility.

Table 3.9: Results from the probit models for residential mobility between French counties

	Young (15-29)		Working population (30-65)	
	Probit coef	Marg effects	Probit coef	Marg effects
AGE	0.148*** (0.0015)	0.578*** (0.0006)	-0.066*** (0.0008)	-0.021*** (0.00027)
AGE <sup>2</sup>	-0.003*** (0.00003)	-0.0013*** (0.00001)	0.0005*** (0.000006)	0.0001*** (0.00000)
BAC-	-0.246*** (0.0021)	-0.096*** (0.00081)	-0.104*** (0.0022)	-0.0353*** (0.0007)
BAC+	0.339*** (0.0022)	0.132*** (0.00089)	0.1717*** (0.00202)	0.0574*** (0.00068)
SINGLE	0.317*** (0.0025)	0.125*** (0.0010)	0.095*** (0.0027)	0.0319*** (0.00093)
FAMILY	0.045*** (0.0031)	0.017*** (0.0012)	-0.0037*** (0.0033)	-0.0012*** (0.0011)
OWNER	-0.444*** (0.0029)	-0.169*** (0.00071)	-0.4604*** (0.0018)	-0.154*** (0.00061)
FRENCH	-0.01431*** (0.0029)	-0.0562*** (0.00116)	0.0915*** (0.0027)	0.0309*** (0.00095)
EMPLOYEES	0.1434*** (0.0029)	0.0564*** (0.00116)	0.114*** (0.0022)	0.0387*** (0.00078)
WORKERS	0.007** (0.0024)	0.003** (0.00095)	0.0428*** (0.0022)	-0.014*** (0.00073)
POPULATION	0.194*** (0.0006)	0.0756*** (0.00027)	-0.2016*** (0.00058)	-0.066*** (0.00023)
UNEMP RATE	-0.0194*** (0.0003)	-0.0075*** (0.00014)	-0.0143*** (0.00034)	-0.0047*** (0.00012)
INCOME	0.058*** (0.058)	0.0227*** (0.0022)	-0.0731*** (0.0056)	-0.0241*** (0.0018)
SH	0.169*** (0.0078)	0.0959*** (0.00304)	0.286*** (0.0075)	0.0247*** (0.0025)
SUN	-0.597*** (0.0083)	-0.232*** (0.00327)	-0.549*** (0.0083)	-0.181*** (0.0027)
ETABLI	0.097*** (0.00017)	0.0781*** (0.00008)	-0.124*** (0.00014)	-0.0412*** (0.00008)
PROPERTY TAX	-0.001 (0.00015)	-0.00062 (0.00006)	-0.0003** (0.00014)	-0.00011** (0.00005)
HOUSING TAX	0.154*** (0.00018)	0.01002*** (0.00007)	0.017*** (0.0001)	0.0056*** (0.00006)
CONST	3.049 (0.0956)	-	5.394*** (0.0955)	-
NB OBS	4 251 118		7 154 172	

Notes: \*, \*\*, \*\*\* correspond respectively to a significance at the thresholds of 1%, 5%, 10% in parentheses the "standard errors".

Concerning the effects of the counties' territorial characteristics of on the young and working migration decision, several conclusions can be drawn. The unemployment rate negatively impacts the probability of migrating of the two sub-groups; individuals do not go to counties where unemployment rate is high. At this level, the marginal effects are slightly stronger for young people.

The county's median income positively impacts the probability of migrating for young people but negatively for working population. The marginal effects vary substantially and are higher for working population than for young. Schaffar et al. (2019) consider that the median income is also a probable proxy for real estate and housing prices but also for city-center counties and neighborhoods.

The size of a county's population positively affects the residential mobility of young people but negatively affects the ones of older workers. Young people aim to locate to urban areas while workers over 30 seem to prefer less populated counties. The latter correspond to people for whom a stable job and the birth of their children led them to locate from central city neighborhoods to the suburbs or to less populated peripheral counties where real estate prices are lower.

The property tax rates are negatively correlated with the decision to migrate for the working population. Counties with a high property tax are often the ones that feature high real estate prices. Owners counterbalance the capitalization of property taxes to property prices by higher rents. This lead migrants in avoiding these areas. For young people, property taxes are not significant, since a high proportion still live with their parents

The housing tax impacts positively and significantly the decision to migrate of young and working population. This doesn't seem to match with the voting with feet theory if we admit that local public services are the same everywhere. However, if we admit that people consider that housing taxes match to a given level of local public goods and services, then the theory holds. It is important here to remind that property taxes are only paid by owners while housing taxes are paid by every inhabitant. Although the latter are progressively disappearing they seem to better fit to the households' comparison between local taxes and local public services. On the contrary, property taxes are rarely compared to local public services and appear to most households being owners as a simple decrease of their income. The households' negative feelings about property taxes are much higher than the housing taxes' ones.

When examining the residential mobility of young people and working population to the provision of cultural services and social housing, two conclusions can be made. First, young people are very eager to move to counties where cultural establishments, such as cinemas, theaters, conservatories are present. On the opposite, working people between 30 and 59 years old move away from the areas where such services exist, since their family and working status don't allow them to consume such services.

Finally, the provision of social housing services is important in the young people's decision to migrate. It is also important for the choices of working people but to a much lesser extent, since the marginal effects are much lower. This means that young people compare housing taxes and local public services – they often don't pay property taxes- and prefer locating to city-center counties where real estate prices are higher but also where unemployment is lower.

### 3.3.2. MIGRATING TO SOCIAL HOUSING UNITS

Tables 3.10 presents the results from the Probit model that compares residential mobility only in social housing units to residential mobility to other types or of units (private, family). We calculate the results for young people from 15 to 29 and for working individuals having more than 30 years. We only focus on personal attributes. For the probit, the  $\beta$  parameters and robust standard errors are estimated with the maximum likelihood method. All usual statistical tests (Wald test, likelihood ratio test) have been performed. The  $\beta$  parameters for young people and working individuals are significantly different for all variables at the level  $0.01 > \rho$ . For every model, we have estimated the probit coefficients and the marginal effects.

Several conclusions can be made: the variable age positively affects the probability of migrating to a social housing unit for young people. On the opposite the variable age negatively affects the probability of migrating to a social housing unit for workers over 30. Age and Age<sup>2</sup> don't feature interesting information here since the results corroborate for migrating in a social housing unit or elsewhere.

Turning next to education, young and working population having less than a baccalaureate diploma are more likely to migrate to a social housing unit or not to migrate by staying in a social housing unit. Education clearly plays a negative role for locating in social housing. This is also consistent with the results obtained for the residential mobility of young people out of social housing units. Young highly educated people migrate more and locate in the private housing sector as renters or more rarely as owners. Young less educated people are more likely to move (or to remain but not to migrate) to social housing units. Both for young people and working individuals over 30, a graduate degree leads not a higher probability to migrate but not to social housing units.

Table 3.10: Results from the probit models for residential mobility between counties in social housing and in the private sector

<b>Young (15-29)</b>				
	Migrate to the social housing		Migrate to private housing	
	Probit coef	Marg effects	Probit coef	Marg coef
AGE	0.084*** (0.0031)	0.019*** (0.00074)	0.1501*** (0.0014)	0.044*** (0.00044)
AGE <sup>2</sup>	-0.0019*** (0.00006)	-0.0004*** (0.00002)	-0.0034*** (0.00003)	-0.001*** (0.00001)
BAC-	0.137*** (0.0041)	0.033*** (0.00103)	-0.232*** (0.0020)	-0.072*** (0.00066)
BAC+	-0.3207*** (0.0046)	-0.082*** (0.0013)	0.426*** (0.0020)	0.132*** (0.0006)
SINGLE	0.208*** (0.0073)	0.052*** (0.00199)	0.528*** (0.0024)	0.173*** (0.00085)
FAMILY	-0.0371*** (0.0100)	-0.0085*** (0.0022)	-0.0932*** (0.0033)	-0.0271*** (0.00095)
FOREIGNER	0.108*** (0.0052)	0.126*** (0.0013)	0.314*** (0.0027)	0.103*** (0.00097)
EMPLOYEE	0.056*** (0.0146)	0.0127*** (0.0032)	0.0563*** (0.0051)	0.0165*** (0.00149)
WORKER	-0.151*** (0.0051)	-0.033*** (0.00107)	-0.0851*** (0.0025)	-0.0848*** (0.00072)
CONSTANT	0.041*** (0.0362)	-	-2.507*** (0.0166)	-
OBS	833 245		3 627 613	
<b>Working population (30-65)</b>				
	Migrate to the social housing		Migrate to private housing	
	Probit coef	Marg effects	Probit coef	Marg coef
AGE	-0.111*** (0.0015)	-0.0022*** (0.0003)	-0.069*** (0.00069)	-0.01402*** (0.00014)
AGE <sup>2</sup>	0.00012*** (0.000016)	0.00002*** (0.00000)	0.00061*** (0.00000)	0.00012*** (0.000000)
BAC-	-0.182*** (0.0038)	-0.0401*** (0.0009)	-0.095*** (0.0019)	-0.198*** (0.00043)
BAC+	-0.429*** (0.0035)	-0.101*** (0.00095)	0.349*** (0.0015)	0.0724*** (0.00034)
SINGLE	-0.0009 (0.0046)	-0.00019 (0.00095)	0.384*** (0.0023)	0.0881*** (0.0006)
FAMILY	0.0151** (0.0064)	0.0013*** (0.0013)	0.0641*** (0.0031)	0.0124*** (0.00059)
FOREIGNER	0.131*** (0.0038)	0.0783*** (0.00087)	-0.448*** (0.0023)	-0.111*** (0.00067)
EMPLOYEE	-0.0156 (0.0084)	-0.0031 (0.0017)	-0.0327*** (0.0027)	-0.0064*** (0.00054)
WORKER	-0.205*** (0.0038)	-0.039*** (0.0007)	-0.152*** (0.0021)	-0.028*** (0.00039)
MEN	-0.865*** (0.0035)	0.182*** (0.00074)	0.061*** (0.0154)	0.012*** (0.00031)
CONSTANT	-0.864*** (0.0333)	-	0.414*** (0.0154)	-
OBS	1 320 960		6 243 564	

Notes: \*, \*\*, \*\*\* correspond respectively to a significance at the thresholds of 1%, 5%, 10% in parentheses the "standard errors".

Family status also impacts the probability of migrating both to a social housing unit or to a private sector dwelling or house. Single young people and single workers have a higher probability of move either to a social housing unit or to another type of lodging than families and single parent families. The probability for a single young person to move and locate to a social housing unit is much higher than that of a worker.

However, couples or families without children are less present in social housing, because these households are not always eligible to such type of housing (Delance, 2018). According to the INSEE, in 2017, individuals living alone represent 38 % of the population living in social housing, single-parent families represent 20 %, couples without children represent 13% and couples with at least one child represent 25 % of the total population living in the rental stock. The probability that a family of at least 3 people migrates to new social housing is lower than that of a person living alone

The nationality of individuals has an important impact on the decision to move and locate to a new social housing park. Young foreigners are more eager to undertake residential mobility and especially within social housing units. In all cases, foreigners are strongly present in the social housing park: either they strongly move to it (young people) or they don't quit it (older workers). This confirms a study from Delance (2018) who shows that households whose reference person was born in Sub-Saharan Africa, Turkey or the Maghreb are over-represented in the social housing stock with a percentage of 50 %, 39 % and 38 % respectively.

Finally, in terms of professional categories, for both young and working population, managers are positively correlated with the probability to move but not in social housing units. Older workers move less than other categories. Young employees are the more likely to move to social housing units.

### **3.3.3. THE POLICY RECOMMENDATION ON SOCIAL HOUSING FOR LOCAL AUTHORITIES**

The aim of social housing is to support of all those who are struggling to find dwellings and homes in a housing market which features a high level of prices. Social housing providers must anticipate changes in the territories, in order to adapt their responses to expectations that are not necessarily linked to the quantitative production of new housing. Local authorities must review the missions of social housing to face future developments such as changes in the social practices of families, the distortions linked to employment or the variation of the household resources. Short-term preoccupations should focus on understanding the different demographic changes that take place in a territory to prepare the scenarios that seem preferable in a general undergoing profound change.

In a social media intervention, Christian Pierret, the mayor of Saint-Dié-des-Vosges, affirms that "social housing is an element of attractiveness". He further affirms that "social housing is an element of reconquest of employment, economic activity and attractiveness". According to him, "social housing is one of the elements that can contribute to the attractiveness of a city: employees, workers, technicians, executives from the private or public sector cannot follow a movement of installation of small and medium-sized firms in the territory, if the quality of the housing offer is not good". Social housing can strengthen the economic development of territories by fulfilling various social functions.

According to the statistics of the French National Institute of Statistics and Economic Studies (INSEE), 500 000 jobs were refused by job seekers in 2016 because of the difficulty of finding affordable housing near to their new job location. On the other hand, the firms realize that their development is directly hampered by the obstacle of their employees' housing solutions. A large number of social housing units exists in the Ile-De-France region and the Auvergne-Rhône-Alpes region and this enabled the development of industrial firms. The choice of firm's location may be linked to the future housing conditions of its employees and to the quality and the cost of housing. In another way, social housing promotes the establishment and the expansion of productive firms by facilitating the reception of employees.

The residential strategy of a county could be a strategy to control its demographic changes. Attractive residential mobility policies build on social housing supply to attract new profiles, to retain existing households and to compete with other areas. Finally, through social housing policies, local authorities pay more attention to young people and their difficulties to access independent housing solution.

## CONCLUSION

This chapter aims to study young people migration in France between 2012 and 2017. This chapter manages a very large amount of data from different original datasets. It uses a French National Institute of Statistics and Economic Studies' dataset with information on individual characteristics for individuals over 15 years old, which also indicates whether a person moved or not between 2012 and 2017. It uses also an original dataset with territorial characteristics at the county level, which represents a quite thin geographical level for regional economic analysis in France. This chapter provides a series of empirical probit. Territorial characteristics information appears only for arrival communities in 2017 which is a methodological limit of this work. By focusing on young people, the aim of the chapter is to somehow test a voting with feet type empirical model where population is rather mobile which is clearly not the case when we look at the all-ages French residential mobility.

This work is divided into two sections. In the first section, we study the residential mobility of young and working population between French counties in the period 2012-2017. In the second part, determine the characteristics of young individuals and working population that migrate in the social housing units.

The results, of this section can be summarized as follows: first, young migrate more than working people. Their probability to migrate increases of 3.45% each year, while this rate decreases to 1.45% for a working person with more than 30 years old. Second, regarding educational level, young and working people with a high level of diploma are more likely to migrate. Third, in the way the territorial characteristics of counties affect residential mobility, unemployment and the weather negatively influence young people migration, while median income positively affects their choices.

When it comes to public taxes and public goods, as expected a higher provision of cultural goods and social housing strongly increases the probability for a young person to move to such a county (or to stay there, if already settled). Property taxes don't influence young people migration since they are rarely owners. However, housing taxes positively affect their migration. This may appear as counterintuitive to voting with feet models. It may however show that young people are able to compare local taxes to the provision of local goods and move to the county which allows them to better satisfy their needs under a budget constraint. This means that young households prefer paying higher housing taxes if associated to a corresponding level of public goods. Nevertheless, the progressive disappearance of housing taxes to the benefit of only property taxes seems not justified from a theoretical point of view.

When it comes to the residential mobility of young people to social housing units, the results could be summarized as follows: first, the variable age of young has a positive effect on the probability of migrating to a new social housing while, the age of the working population is negatively correlated to the probability of migrating within the social housing. Second, young and working individuals with more than a baccalaureate degree have a greater probability to move but young people with lower education are more eager to live in a social housing unit. Finally, foreigners are more likely to move to social housing parks.



## **4. CONCLUSION**



The objective of this thesis is to study the relation between property tax, property tax interaction and households' behavior, mainly analyzed through the young people residential mobility.

In the first chapter, we study the effects of property taxes on property prices in France. We collect data, for 2018, and built an original database for property prices, property tax rates and several control variables for 978 French counties of the region of Provence-Alpes-Côte-D'Azur. To take into consideration the presence of the spatial autocorrelation, we built a spatial econometric model.

We show that the local policies adopted by the Provence-Alpes-Côte-D'Azur counties to increase the property tax rates may lead to changes in the housing market by decreasing the property values. Local tax policies feature three negative effects: the first one is that an increase in the property tax rates impacts negatively the wealth of household' owners. The second one is related to the decrease of consumer spending which is due to the decrease of the owners' available income. The third one is related to the decrease of population because an increase of the property tax. However, the later barely seems to be the case in France.

The results of our chapter confirm the hypothesis of the existence of a negative relationship between the property taxes and the property prices. Our results correspond to those of the theoretical models developed by Charlot et al. (2013) and Cao and Hu (2016). The negative effect confirms the existence of the negative capitalization of property tax on the price of properties of Provence-Alpes-Côte-D'Azur counties. When the property rate increases, tax burden is may shift on the price of rent. On the opposite, an increase of local public goods and services, holding the property tax rates constant, could have a compensatory effect by decreasing the negative property tax capitalization on the property prices.

This chapter could expand to new empirical developments by analyzing the impact of the property taxes on the property prices for the 34 973 French counties. This project was the initial idea of this chapter, however, due to the lack of accurate data on the property prices per square meter in French counties, we have decided to focus our study on the 978 counties of the region of Provence-Alpes-Côte-D'Azur.

This chapter can expand by comparing the effect of property taxes on the property prices of counties with more than 10 000 inhabitants to those having less than 10 000 inhabitants. This would confirm or infirm the assumption that the negative effect of property tax rates on the property prices is higher for smaller counties (in term of population) and weaker for the large ones.

Finally, this chapter could further developed by analyzing the effect of an increase of property tax rates on the rent prices. This study would allow to study whether when the property tax rate increases, the tax burden is shifted on the rent prices.

The second chapter addresses the question of property tax mimicking and its sources among French local governments using the reaction function. We collect data for 2014 and built an original database for the socioeconomic, fiscal and political characteristics of the 978 counties of the region of Provence-Alpes-Côte-D'Azur and 2887 counties of Rhône-Alpes. We use a spatial model since it's the only method that allows and leads to detect the presence of tax mimicking among counties.

In our work, we deliver evidence of property tax mimicking among Provence-Alpes-Côte-D'Azur and Rhône-Alpes counties. This result signifies that the counties' property tax policy choices are influenced by the neighboring counties' property tax choices. We detect the sources of property tax mimicking and show that for counties of Provence-Alpes-Côte-D'Azur, property tax mimicking is due to yardstick competition and to spillover effect, while for counties of Rhône-Alpes, property tax mimicking is due only to the spillover effect.

When studying the counties of the region of Provence-Alpes-Côte-D'Azur, we discover that incumbents imitate each other in order to capture the consumer-voters preferences and therefore the spatial property tax mimicking is responsive to the electoral cycle. The absence of yardstick competition among Rhône-Alpes counties could be due to the fact that property tax income is the principal source of revenue for those counties. Incumbents do not mimic property tax decision of neighboring counties and consumer-voters seem to trust their incumbents by considering that they are spending the totality of the local tax revenues by providing local public goods and services.

The presence of spillover effect among Provence-Alpes-Côte-d'Azur and Rhône-Alpes counties implies that property tax mimicking between a county and its neighbors becomes feeble when its population is larger than its neighbors' ones. Counties with an important population seem more eager to guarantee a higher provision of local public goods and services independently from what neighbors do.

In the economic theory, tax mimicking could be due to yardstick competition, spillover effect or to tax competition. In our chapter, we did not test for the existence of tax competition among Provence-Alpes-Côte-d'Azur and Rhône-Alpes counties. We suppose that, as Delgado et al. (2015), the migration of individuals among counties is not sustained by an increase in the property tax rate.

In this chapter, different possible extensions could be taken into consideration. Other variables could have been taken into consideration such as the urban and rural characteristics of the county, the property price per square meter of each county and the local public spending per capita of each county. This chapter could also extend by working on the totality of French counties.

In the third chapter, we focus on two questions. The first is how the individual attributes and the territorial characteristics affect the migration decision of young aged between 15 and 29 years. The second concerns the characteristics of young people that migrate within social housing units. The original database used in this chapter comes from the 2015 population Census published by the INSEE in 2018.

We work on the migration of young people between 34 973 French counties which represents a unique spatial level of analysis. Their residential mobility is compared to the one of workers with more than 30 years. This chapter provides a series of empirical probit. Basically, this chapter allows to empirically test the Tiebout's voting with feet model in France. While in a general way, residential mobility is low so it is hard to meet the model's assumptions, when working on the young population only, the migration rate is high enough to consider such as hypothesis.

Several conclusions are drawn concerning the residential mobility of young people between French counties. Young migrate more than the older working population. Age is positively correlated with the migration of people until 29 and negatively afterwards. Regarding the education level, young and working individuals with a high level of diploma are more likely to migrate.

Our findings show that young people prefer to migrate to counties where cultural establishments are present and where social housing is important. While property taxes don't seem to interfere with the young people decision to migrate, housing taxes positively impact this decision. This means that young people prefer to live in places with a high provision of social goods, especially in housing and in cultural equipment even if local taxes are high. This situation is quite different for older workers who are less attracted to areas highly equipped in cultural goods. The latter also prefer counties with lower property taxes since they are negatively capitalized to the housing values as proved in chapter one.

Finally, some conclusions are delivered concerning the migration of young people to social housing units.

This chapter delivers several policy recommendations on social housing policies. Social housing appears an interesting solution allowing to support young people who are struggling to find

housing solutions, especially within areas with high real estate prices. Building social houses depends upon local decisions; a strategy of development of social housing may enhance economic development since it may attract firms looking for cheap housing solutions for their workers. However, social housing may also negatively affect real estate prices. This is an issue that has not been addressed in this thesis but should be studied in further analysis (Sequeira and Filippova, 2020).

Residential mobility within the social housing may attract new profiles but seems quite determined by the foreigners' mobility. This may create "ghettos" neighborhoods so local institutions should be very careful in diversifying the residential mobility towards social housing units. Finally, an extension to the work undertaken in this chapter could be the study of the link between territorial characteristics and migration distance

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## 6. APPENDICES

### 6.1. CHAPTER 1

#### 6.1.1. The theoretical model of Cao and Hu (2016)

We suppose that an economy has  $J$  cities where each city  $j$  contains  $N_j$  households, and we presume that the capital is mobile<sup>18</sup>. Each household  $i$  consumes  $x_{1ij}$  housing services,  $x_{2ij}$  numeraire non-housing goods and  $LG_{ij}$  local public goods. We assume that  $\varepsilon_{ij}$  is the taste term for location preferences, i.e. household  $i$  has a preference for city  $j$ . we also suppose that the household  $i$  has the same income in all the cities. The goal of the consumer is to maximize his utility within a budget, as shown in the following:

$$\text{Max } U_{ij} = \theta \ln x_{1ij} + (1 - \theta) \ln x_{2ij} + \mu \ln LG_{ij} + \varepsilon_{ij} \quad (6.1)$$

$$\text{with } e_i = (z_j + \tau_j p_j) \cdot x_{1ij} + x_{2ij} \quad (6.2)$$

where  $z_j$  is the amount of rent for housing services,  $\tau_j$  is the rate of the property tax rate,  $p_j$  is the price of houses per unit,  $e_i$  is the total household expenditure and  $r$  is the discount rate. The first step is to model the behavior of the consumer. To obtain the optimal value of  $x_{1ij}$  and  $x_{2ij}$ , we use the Lagrangian method as follows:

$$L = U_{ij} - \gamma((z_j + \tau_j p_j)x_{1ij} + x_{2ij} - e_i) \quad (6.3)$$

$$\Leftrightarrow L = \vartheta \ln x_{1ij} + (1 - \vartheta) \ln x_{2ij} + \mu \ln LG_{ij} + \varepsilon_{ij} - \gamma(z_j + \tau_j p_j)x_{1ij} + x_{2ij} - e_i$$

The first order condition is:

$$\frac{\partial L}{\partial x_{1ij}} = 0 \Leftrightarrow \frac{\partial L}{\partial x_{1ij}} = \frac{\theta}{x_{1ij}} - \gamma(z_j + \tau_j p_j) = 0 \Leftrightarrow \vartheta - x_{1ij}\gamma(z_j + \tau_j p_j) = 0$$

$$\Leftrightarrow \vartheta = x_{1ij}\gamma(z_j + \tau_j p_j) \Leftrightarrow x_{1ij} = \frac{\vartheta}{\gamma(z_j + \tau_j p_j)} \quad (6.4)$$

$$\frac{\partial L}{\partial x_{2ij}} = 0 \Leftrightarrow \frac{\partial L}{\partial x_{2ij}} = \frac{(1-\vartheta)}{x_{2ij}} - \gamma = 0 \Leftrightarrow (1 - \vartheta) - \gamma x_{2ij} = 0 \Leftrightarrow (1 - \vartheta) = \gamma x_{2ij}$$

$$\Leftrightarrow x_{2ij} = \frac{(1-\vartheta)}{\gamma} \quad (6.5)$$

To remove the Lagrangien, we replace the values of  $x_{1ij}$  and  $x_{2ij}$  in the equation (6.2).

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<sup>18</sup>The assumption that capital is mobile means that property tax in one city leads to positive externalities in the other cities, or rather, the outflow of capital in a given city appears as an inflow for other cities (Bird, 2006).

$$e_i = (z_j + \tau_j p_j) \frac{\vartheta}{\gamma(z_j + \tau_j p_j)} + \frac{(1-\vartheta)}{\gamma} \Leftrightarrow e_i = \frac{\vartheta}{\gamma} + \frac{(1-\vartheta)}{\gamma} \Leftrightarrow e_i = \frac{1}{\gamma} \Rightarrow \gamma = \frac{1}{e_i} \quad (6.6)$$

After replacing the value of  $\gamma$  in the equations (6.4) and (6.5), we will have:

$$x_{1ij} = \frac{\vartheta}{(z_j + \tau_j p_j)} e_i \quad \text{and} \quad x_{2ij} = (1 - \theta) e_i \quad (6.7)$$

$$\text{and} \quad \sum_{t=0}^{\infty} \frac{z_j}{(1+r)^t} = p_j \Leftrightarrow \frac{z_j}{r} = p_j \Leftrightarrow z_j = p_j \cdot r \quad \text{where } r \text{ is the discount rate.} \quad (6.8)$$

The second step focuses on the production of houses and assumes that capital (K) and land (L) are the two primary inputs. The producer seeks to maximize its profit within constraints:

$$\text{Max } \Pi_j = p_j K_j^\alpha L_j^{1-\alpha} - r K_j - r_j L_j \quad (6.9)$$

where  $K_j$  is the capital invested on construction in city j,  $r_j$  is the price of land in city j and  $L_j$  is the land which is fixed. The first order conditions of equation (6.9) is:

$$\frac{\partial \Pi_{ij}}{\partial K_{1j}} = 0 \Rightarrow \frac{\partial \Pi_{ij}}{\partial K_{1j}} = \alpha p_j L_j^{1-\alpha} K_{1j}^{\alpha-1} - r = 0 \Leftrightarrow \alpha p_j L_j^{1-\alpha} K_{1j}^{\alpha-1} = r \Leftrightarrow K_{1j}^{\alpha-1} = \frac{r}{\alpha p_j L_j^{1-\alpha}}$$

$$\Leftrightarrow K_{1j} = \left( \frac{r}{\alpha p_j L_j^{1-\alpha}} \right)^{\frac{1}{\alpha-1}} \Leftrightarrow K_{1j} = L_j \left( \frac{\alpha p_j}{r} \right)^{\frac{1}{1-\alpha}} \quad (6.10)$$

$$\frac{\partial \Pi_{ij}}{\partial L_j} = 0 \Leftrightarrow \frac{\partial \Pi_{ij}}{\partial L_j} = (1 - \alpha) p_j K_{1j}^\alpha L_j^{-\alpha} - r_j = 0 \Leftrightarrow (1 - \alpha) p_j K_{1j}^\alpha L_j^{-\alpha} = r_j$$

$$\Leftrightarrow L_j^{-\alpha} = \frac{r_j}{(1-\alpha) p_j K_{1j}^\alpha} \Leftrightarrow L_j = \left( \frac{r_j}{(1-\alpha) p_j K_{1j}^\alpha} \right)^{\frac{1}{-\alpha}} \Leftrightarrow L_j = K_{1j} \left( \frac{r_j}{(1-\alpha) p_j} \right)^{\frac{1}{-\alpha}}$$

$$\Leftrightarrow L_j = K_{1j} \left( \frac{(1-\alpha) p_j}{r_j} \right)^{\frac{1}{\alpha}} \quad (6.11)$$

Cao and Hu (2016) claim that the impact of property tax on property values is different in the short, medium and long term. In the short term households are unable to estimate the amount of housing services used. In the medium term, households clarify their consumption choices. In the long-term, households are eager to move to another city that will best satisfy their preferences regarding public services and taxes.

In the medium term, the equilibrium of the housing market depends on the total demand for houses during a period t, compared to the total supply of houses during the same period. The total demand<sup>19</sup> for houses is:  $\frac{\vartheta}{p_j(r+\tau_j)} e_i N_j$  and the total supply of houses is  $L_j \left( \frac{\alpha p_j}{r} \right)^{\frac{1}{1-\alpha}} + (1 - \delta) F_j$  where  $\delta$  is the depression rate and  $F_j$  is the houses volume in city j I the most recent period. The equilibrium of the housing market is given by:

<sup>19</sup> It's equal to housing services  $x_{1ij}$  multiplied by the number of households  $N_j$ .

Regarding the total supply of houses, it depends on the capital and houses volume in city  $j$  at the last period. Houses volume is equal to  $(1 - \delta)F_j$  where  $\delta$  is the depression rate and  $F_j$  is the houses volume in city  $j$  last period. Then the total supply is:

$$\frac{\vartheta}{p_j(r+\tau_j)} e_i N_j = L_j \left( \frac{\alpha p_j}{r} \right)^{\frac{1}{1-\alpha}} + (1 - \delta) F_j \quad (6.12)$$

The third step aims to determine the property price  $p$ . To define  $p$  we use the derivative of the property value with respect to the tax rate. The derivative of the total demand for houses with respect to the tax rate is as follows:

$$\begin{aligned} \left( \frac{\vartheta}{p_j(r+\tau_j)} e_i N_j \right)' &= \vartheta e_i N_j \left( \frac{1}{p_j(r+\tau_j)} \right)' = \vartheta e_i N_j \frac{\left( 1' (p_j(r+\tau_j)) - 1 (p_j(r+\tau_j)) \right)'}{(p_j(r+\tau_j))^2} \\ &= \vartheta e_i N_j \frac{-(p_j'(r+\tau_j) + p_j(r+\tau_j)')}{(p_j(r+\tau_j))^2} = \vartheta e_i N_j \frac{-(p_j'(r+\tau_j) + p_j)}{(p_j(r+\tau_j))^2} \end{aligned} \quad (6.13)$$

Second, we derive the total supply of houses with respect to the tax rate as follows:

$$\begin{aligned} \left( L_j \left( \frac{\alpha p_j}{r} \right)^{\frac{1}{1-\alpha}} + (1 - \delta) F_j \right)' &= \left( L_j \left( \frac{\alpha p_j}{r} \right)^{\frac{1}{1-\alpha}} \right)' = L_j \left( \frac{\alpha}{r} \right)^{\frac{1}{1-\alpha}} \left( p_j^{\frac{1}{1-\alpha}} \right)' \\ &= \frac{1}{1-\alpha} L_j \left( \frac{\alpha}{r} \right)^{\frac{1}{1-\alpha}} p_j^{\frac{\alpha}{1-\alpha}} \end{aligned} \quad (6.14)$$

The derivative of the equilibrium of the housing market with respect to the tax rate is:

$$\begin{aligned} -\vartheta e_i N_j \frac{(p_j'(r+\tau_j) + p_j)}{(p_j(r+\tau_j))^2} &= \frac{1}{1-\alpha} L_j \left( \frac{\alpha}{r} \right)^{\frac{1}{1-\alpha}} p_j^{\frac{\alpha}{1-\alpha}} \\ \Leftrightarrow \frac{-\vartheta e_i N_j p_j'(r+\tau_j)}{(p_j(r+\tau_j))^2} &= \frac{\vartheta e_i N_j p_j}{(p_j(r+\tau_j))^2} + \frac{1}{1-\alpha} L_j \left( \frac{\alpha}{r} \right)^{\frac{1}{1-\alpha}} p_j^{\frac{\alpha}{1-\alpha}} \\ \Leftrightarrow -\vartheta e_i N_j p_j'(r+\tau_j) &= \vartheta e_i N_j p_j + \frac{1}{1-\alpha} L_j \left( \frac{\alpha}{r} \right)^{\frac{1}{1-\alpha}} p_j^{\frac{\alpha}{1-\alpha}} (p_j(r+\tau_j))^2 \\ \Leftrightarrow -\vartheta e_i N_j p_j'(r+\tau_j) - \frac{1}{1-\alpha} L_j \left( \frac{\alpha}{r} \right)^{\frac{1}{1-\alpha}} p_j^{\frac{\alpha}{1-\alpha}} (p_j(r+\tau_j))^2 &= \vartheta e_i N_j p_j \\ \Leftrightarrow p_j' (-\vartheta e_i N_j (r+\tau_j) - \frac{1}{1-\alpha} L_j \left( \frac{\alpha}{r} \right)^{\frac{1}{1-\alpha}} p_j^{\frac{\alpha}{1-\alpha}} (p_j(r+\tau_j))^2) &= \vartheta e_i N_j p_j \\ \Leftrightarrow p_j' &= \frac{\vartheta e_i N_j p_j}{(-\vartheta e_i N_j (r+\tau_j) - \frac{1}{1-\alpha} L_j \left( \frac{\alpha}{r} \right)^{\frac{1}{1-\alpha}} p_j^{\frac{\alpha}{1-\alpha}} (p_j(r+\tau_j))^2)} = \frac{\vartheta e_i N_j p_j}{(r+\tau_j) (-\vartheta e_i N_j - \frac{1}{1-\alpha} L_j \left( \frac{\alpha}{r} \right)^{\frac{1}{1-\alpha}} p_j^{\frac{\alpha}{1-\alpha}} p_j(r+\tau_j))} \\ &= - \frac{p_j}{(r+\tau_j) \left( 1 + \frac{1}{1-\alpha} \frac{L_j}{N_j} \left( \frac{\alpha}{r} \right)^{\frac{1}{1-\alpha}} p_j^{\frac{1}{1-\alpha}} (r+\tau_j) \right)} \\ \Leftrightarrow p_j' &= - \left( \frac{1}{r+\tau_j} \right) \left[ \frac{1}{p_j} + \frac{L_j}{N_j} \left( \frac{\alpha}{r} \right)^{\frac{1}{1-\alpha}} \frac{1}{1-\alpha} p_j^{\frac{\alpha}{1-\alpha}} \frac{(r+\tau_j)}{\vartheta e_i} \right]^{-1} < 0 \end{aligned} \quad (6.15)$$

The last step of our models defines an indirect utility functions; we use the optimal value of  $x_{1ij}$  and  $x_{2ij}$  that we found in the both equations (6.4) and (6.5).

$$\begin{aligned}
 V_{ij} &= \vartheta \ln \left( \frac{\vartheta}{p_j(r + \tau_j)} e_i \right) + (1 - \vartheta) \ln((1 - \theta)e_i) + \mu \ln LG_{ij} + \varepsilon_{ep} \\
 \Leftrightarrow V_{ij} &= \vartheta \left( \ln \frac{\vartheta}{p_j(r + \tau_j)} + \ln e_i \right) + (1 - \vartheta) (\ln(1 - \theta) + \ln e_i) + \mu \ln LG_{ij} + \varepsilon_{ep} \\
 \Leftrightarrow V_{ij} &= \vartheta (\ln \vartheta - \ln p_j - \ln(r + \tau_j) + \ln e_i) + (1 - \vartheta) (\ln(1 - \theta) + \ln e_i) + \mu \ln LG_{ij} + \varepsilon_{ep} \\
 \Leftrightarrow V_{ij} &= \vartheta \ln \vartheta - \vartheta \ln p_j - \vartheta \ln(r + \tau_j) + \vartheta \ln e_i + (1 - \vartheta) \ln(1 - \theta) + (1 - \vartheta) \\
 &\quad + \ln e_i \mu \ln LG_{ij} + \varepsilon_{ep} \\
 \Leftrightarrow V_{ij} &= \ln e_i - \vartheta \ln p_j - \vartheta \ln(r + \tau_j) + \vartheta \ln \vartheta + (1 - \vartheta) \ln(1 - \theta) + \mu \ln LG_{ij} + \varepsilon_{ep} \quad (1.16)
 \end{aligned}$$

The variation of the indirect utility function of household is:

$$\Delta V_{ij} = -\vartheta \frac{\Delta p_j}{p_j} - \vartheta \frac{\Delta \tau_j}{r + \tau_j} + \mu \frac{\Delta LG_{ij}}{LG_{ij}} + \varepsilon_{ep} \frac{\Delta p_j}{p_j} \quad (6.17)$$

The last equation shows that the impact of property tax on the utility of a household can be divided into four different effects. The first effect is the household's pocket effect  $-\vartheta \frac{\Delta \tau_j}{r + \tau_j}$ . As the property tax increases, households must pay higher taxes which negatively impact their consumption. The second effect is the price effect  $-\vartheta \frac{\Delta p_j}{p_j}$ . When the property tax increases, the rent and the property values decrease. The third effect is the housing wealth effect  $\varepsilon_{ep} \frac{\Delta p_j}{p_j}$ . When the property tax increases, the property values decrease which cause households to feel that their overall wealth decreases. The last effect is the redistribution effect  $\mu \frac{\Delta LG_{ij}}{LG_{ij}}$ . Local government use the revenue from property taxes to finance local expenditures that supply public goods and services to the inhabitants. For some households, this appears as a positive externality due to the development of local welfare state. For others, this results in a negative externality as these households are affected by the increase in local taxes, while receiving no benefit from the changes in local services.

The model is similar to Tiebout's long-term voting with feet model since households ultimately migrate to areas that satisfy their expectations in terms of local property taxes and local public services. We compare the potential utility changes in different cities by using the variation of the indirect utility function, and as a result the tax rate is the same in all cities.

$$\begin{aligned}
 \Delta V_{ij} - \Delta V_{iy} &= -\vartheta \frac{\Delta p_j}{p_j} - \vartheta \frac{\Delta \tau_j}{r + \tau_j} + \mu \frac{\Delta LG_{ij}}{LG_{ij}} + \varepsilon_{ep} \frac{\Delta p_j}{p_j} \\
 &\quad - \left( -\vartheta \frac{\Delta p_y}{p_y} - \vartheta \frac{\Delta \tau_j}{r + \tau_j} + \mu \frac{\Delta LG_{ij}}{LG_{ij}} + \varepsilon_{ep} \frac{\Delta p_y}{p_y} \right)
 \end{aligned}$$

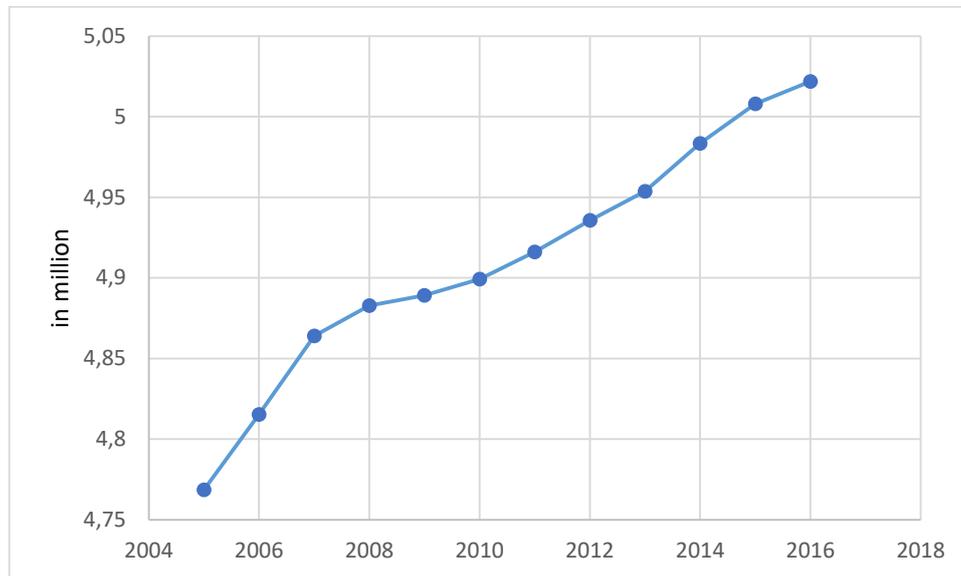
$$\begin{aligned}
\Leftrightarrow \Delta V_{ij} - \Delta V_{iy} &= -\vartheta \frac{\Delta p_j}{p_j} + \varepsilon_{ep} \frac{\Delta p_j}{p_j} + \vartheta \frac{\Delta p_y}{p_y} - \varepsilon_{ep} \frac{\Delta p_y}{p_y} = \vartheta \left( -\frac{\Delta p_j}{p_j} + \frac{\Delta p_y}{p_y} \right) + \varepsilon_{ep} \left( \frac{\Delta p_j}{p_j} - \frac{\Delta p_y}{p_y} \right) \\
&\Leftrightarrow \Delta V_{ij} - \Delta V_{iy} = (\varepsilon_{ep} - \vartheta) \left( \frac{\Delta p_j}{p_j} - \frac{\Delta p_y}{p_y} \right) \\
&\Leftrightarrow \Delta V_{ij} - \Delta V_{iy} = (\varepsilon_{ep} - \vartheta) \frac{\Delta \tau}{r+\tau} \left[ \frac{1}{p_j} + \frac{L_j}{N_j} \left( \frac{\alpha}{r} \right)^{\frac{1}{1-\alpha}} \frac{1}{1-\alpha} p_j^{\frac{\alpha}{1-\alpha}} \frac{(r+\tau)}{\vartheta+e_i} \right]^{-1} \\
&\quad - \left[ \frac{1}{p_y} + \frac{L_y}{N_y} \left( \frac{\alpha}{r} \right)^{\frac{1}{1-\alpha}} \frac{1}{1-\alpha} p_y^{\frac{\alpha}{1-\alpha}} \frac{(r+\tau)}{\vartheta+e_i} \right]^{-1} \tag{6.18}
\end{aligned}$$

If  $\varepsilon_{ep} < \vartheta$ , a city with lower level of  $\frac{L_y}{N_y} p_y^{\frac{\alpha}{1-\alpha}}$  will become more attractive for households when it comes to housing prices. Nevertheless, public goods and services also affect the preferences of some households. As Tiebout (1956) argue, some households with high demands for public goods and services choose to locate to cities with large amount of public services, regardless of the high property taxes, while households with a lower demand for such services choose cities with low property taxes.

From the equation (6.17) of the theoretical model of Cao and Hu (2016), we deduce that the property tax has a negative effect on the price of properties, which means that an increase in the property tax decreases the property price. This negative relationship between property tax and property price cause households to feel that their overall wealth decreases.

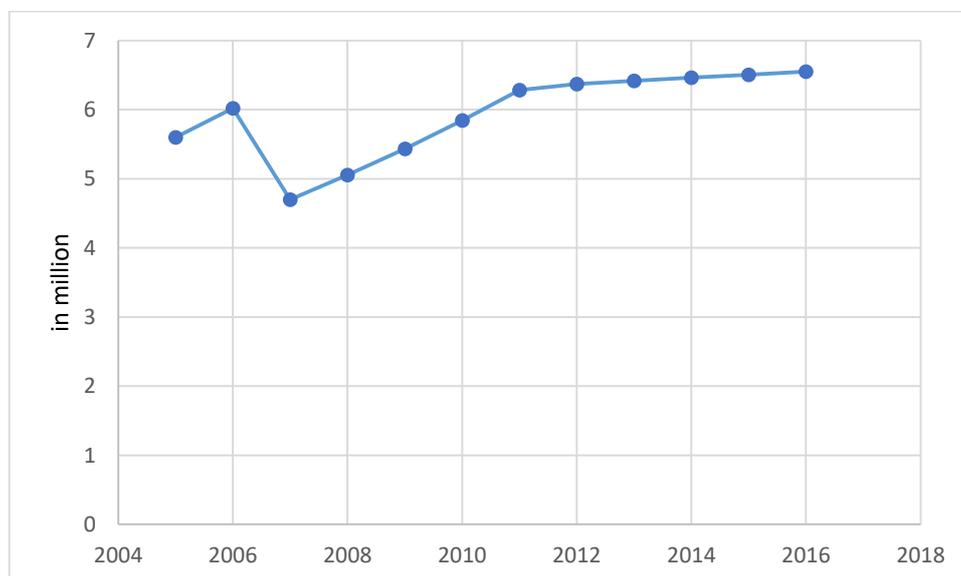
## 6.2. CHAPTER 2

Figure 6.2.1: The population of the region of Provence-Alpes-Côte-D'Azur



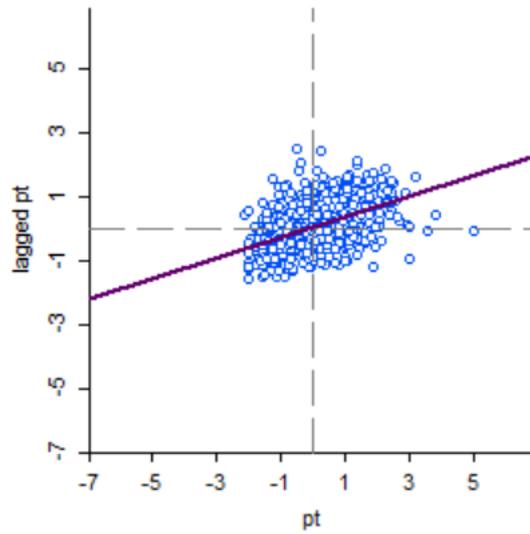
Source: National Institute of Statistics and Economic Studies and the graphic representation made by the author

Figure 6.2.2: The population of the region of Rhône-Alpes



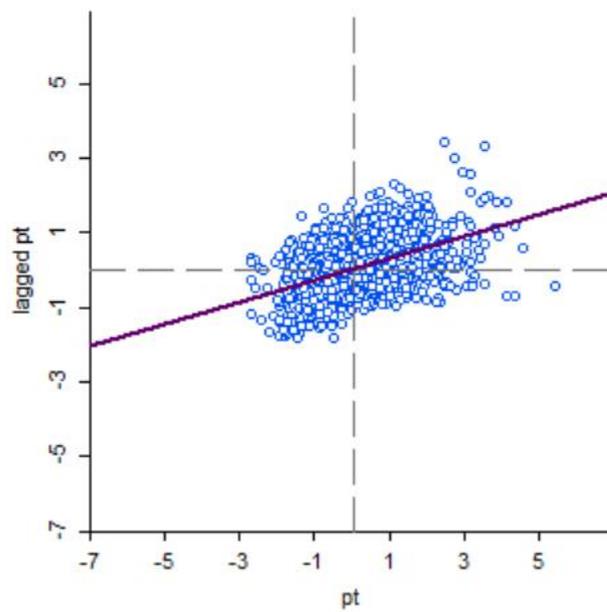
Source: National Institute of Statistics and Economic Studies and the graphic representation made by the author

Figure 6.2.3: The Moran statistics of property tax rates of PACA



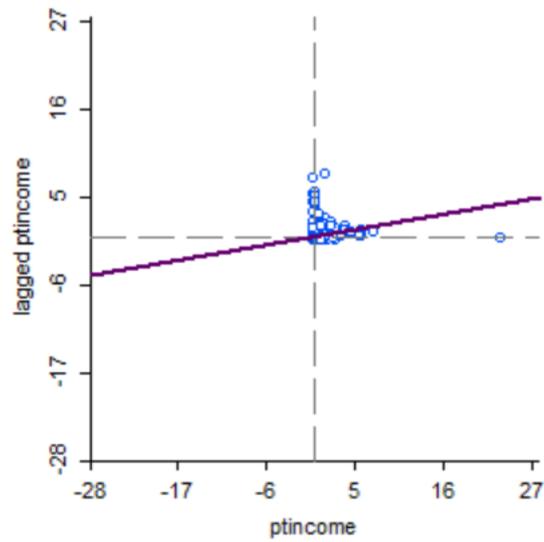
Source: Authors, database of General Direction of Public Finance.

Figure 6.2.4: The Moran statistics of property tax rates of Rhône-Alpes



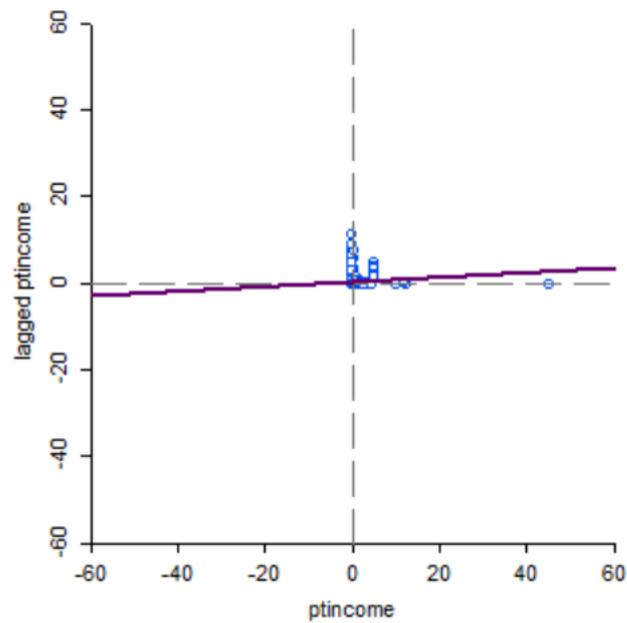
Source: Authors, database of General Direction of Public Finance.

Figure 6.2.5: The Moran statistics of property tax income of PACA



Source: Authors, database of General Direction of Public Finance.

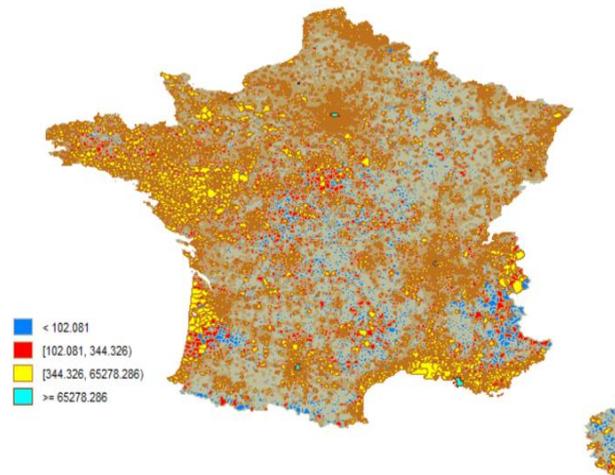
Figure 6.2.6: The Moran statistics of property tax income of Rhône-Alpes



Source: Authors, database of General Direction of Public Finance.

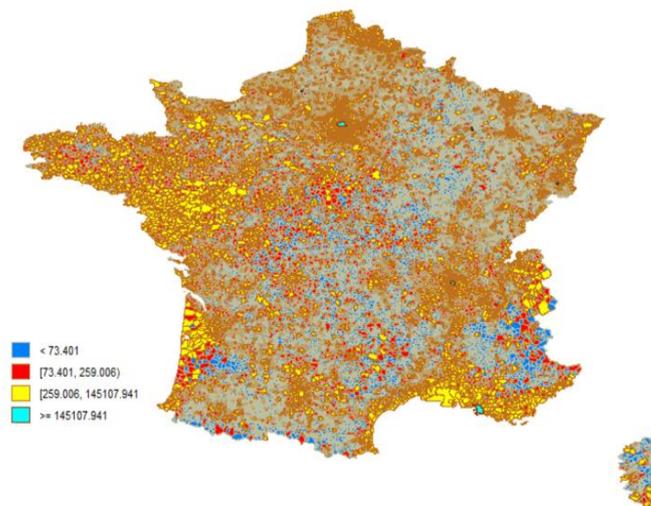
### 6.3. CHAPTER 3

Figure 6.3.1: Individuals having less than 14 years in 2012



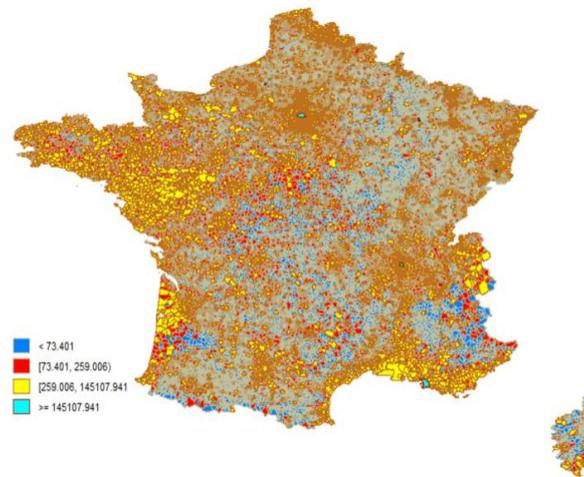
Source: The National Institute of Statistics and Economic Studies and the maps representation made by the author

Figure 6.3.2: Individuals aged between 15 and 29 years in 2012



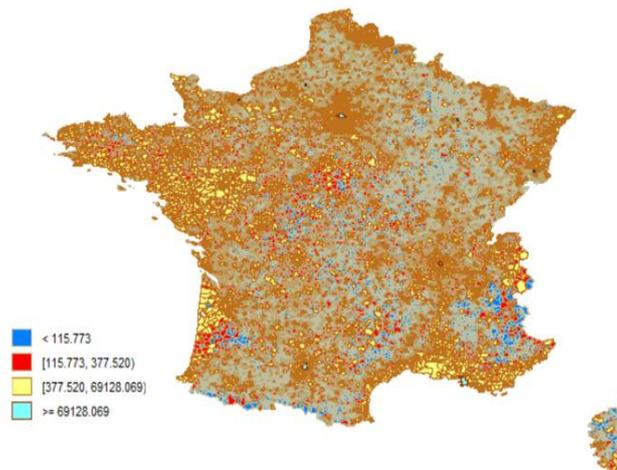
Source: The National Institute of Statistics and Economic Studies and the maps representation made by the author

Figure 6.3.3: Individuals aged between 30 and 44 years in 2012



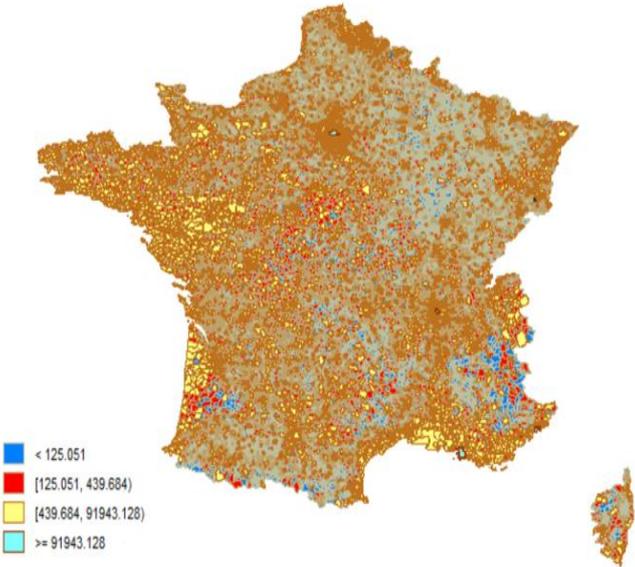
Source: The National Institute of Statistics and Economic Studies and the maps representation made by the author

Figure 6.3.4: Individuals aged between 45 and 59 years in 2012



Source: The National Institute of Statistics and Economic Studies and the maps representation made by the author

Figure 6.3.5: Individuals having more than 60 years in 2012



Source: The National Institute of Statistics and Economic Studies and the maps representation made by the author

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