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Land and the housing market : three essays on the role of land and its implications for public policies

Guillaume Chapelle

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Institut d'études politiques de Paris
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Programme doctoral en Sciences économiques
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et
Laboratoire interdisciplinaire d'évaluation
des politiques publiques

Doctorat en économie

Land and the Housing Market
**Three essays on the role of land and its implications for
public policies**

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Abstract

This dissertation analyzes the mechanisms of the French housing market documenting its constraints and the impact of several housing policies. It aims to increase our understanding of the mechanisms at work on this very particular market where land has a key role.

The first chapter tries to document the place of land through the past decades. Indeed while agricultural land has been one of the most important component of the national wealth in the XVII and XVIII centuries, some economists have been documenting a steady decline of its importance during the XIX and XX centuries. Such a decline appears to be related with the industrial revolution and the decreasing importance of agricultural activities in our modern economies. Nevertheless, during the second half of the XX century, such decline was progressively balanced by the sharp appreciation of housing wealth and more particularly its land component. Such a return of residential land goes along with the increasing importance of cities and agglomeration mechanisms and opens various interrogations about its origins and consequences. The first part of this dissertation tries to understand more precisely the connection between the rising value of residential land and the growth of cities providing an estimate of the extensive margin supply elasticity. Chapter three and four pay more attention to the consequences of this dramatic rise of residential land which acts as a constraint for housing policies.

The second chapter tries to understand the origin of this rise in residential land value documenting one of the key parameter of the housing market : the supply elasticity of the French urban areas. This chapter starts defining two different concepts related with the supply elasticity. The first one is the intensive margin supply elasticity and designates the reaction of developers following a short run increase in housing prices. It describes how many housing units will be produced if the demand for housing rise. The second one describes an agglomeration cost. In urban economics cities are the result of agglomeration forces : positive production externalities drive households and firms to concentrate on the same place. However cities' development is curbed by agglomeration costs as congestion or an increase in land prices. Indeed the larger the city, the higher the housing prices and the commuting costs. As a consequence, a second key parameter when looking at the housing market is the extensive margin supply elasticity. It describes the magnitude of real estate prices appreciation when the city is grow-

ing. Thanks to an important amount of new data collected and an original estimation strategy, the second chapter estimates and decomposes both parameters. It shows that France is characterized by a very low extensive margin when compared with similar studies for the United States. The gap between both countries appears to be related with the high degree of regulation on the French residential land market. Such a low level of extensive supply elasticity could partially explain why the value of residential land went through a dramatic and sustained increase over the last decades. One can think that a low supply elasticity will favor the capitalization into land prices of demand shocks as an increase in income, a decline in interest rates or public subsidies .

The third chapter uses a natural experiment, the Scellier Housing Tax Credit (STC), to document the consequences of the low level of the supply elasticity on housing policies. The STC is a fiscal subsidy which aims to increase the number of new units dedicated to the private rental sector for the middle class. Chapter 3 takes advantage of the fact that it was unevenly applied on the national territory to analyze implications. Identifying similar areas close to the frontier separating municipalities benefiting from the tax credit from those that didn't, it can disentangle the causal impact of the Tax Credit. It appears that despite its generosity, such a fiscal device couldn't increase the number of units produced but changed the composition of the new units built. More units were dedicated to the private rental but their tenants haven't a lower income. Moreover, the vacancy rate of new dwellings rose. We can also observe a rise in existing dwelling prices probably explained by the low supply elasticity. The STC led to an appreciation of the value of the underlying land parcels of the housing stock even if not directly concerned by the tax credit. This suggests that subsidies tend to be capitalized into land prices.

The fourth chapter documents the impact of a second housing policy which represents a significant amount of the French housing market : the social housing sector. Indeed, while social housing units represent about 17% of the housing stock, little is known about their impact on the private sector. In line with the previous chapter, we try to document the net contribution of these subsidized units to the growth of the housing stock. Using a national law forcing some municipalities to build more social units, as a natural experiment it is possible to measure the causal impact of social housing on private housing starts. This chapter shows that one additional social housing unit tends to crowd out about 2 private units. An alternate specification using the World War II destruction and the national trends to predict an exogenous evolution of the social housing starts confirms these results. It also suggests that competition for land and for tenants might be responsible for such effect. Social housing crowds out more than one unit because social landlords build bigger units. Once again, this chapter documents how land access might constraint public policies generating undesirable side effects. The benefits of the social housing sector should be evaluated more globally accounting for its contribution to cope with spatial segregation or to increase poor household's consumption. Nevertheless, the

crowding out effect could be reduced providing incentives to social landlords to build smaller units and reducing the number of tenants eligible.

In conclusion, we explore a research agenda closely related with the different research questions addressed during the dissertation. First, the low supply elasticity characterizing residential land raises questions on the heterogeneity of capital and the way these different types of wealth should be taxed. Second, the low supply elasticity and the strong crowding out effect identified when studying the Scellier Tax Credit and the social housing sector, open new research questions on the role of local authorities to control the access to developable land. Third, as our study on the social housing sector only investigates its quantitative impact on the housing stock, it might be very interesting to document other potential benefits as its contribution to cope with spatial segregation. Finally, the different techniques developed to collect the data for some of these chapters, also open new possibility in order to study the housing market dynamics. Analyzing the rental sector through the lens of the recent rent control set in Paris and Lille combining big data methods and administrative datasets could also be an interesting project.

Chapter 1

Introduction

This Phd dissertation is composed of three successive papers trying to understand the reasons and consequences of the rising importance of residential land in our modern economies. In this introduction, we propose to survey briefly the way economic analysis has been trying to disentangle the importance of land through the history. We then argue that if the decline of agricultural land has reduced the importance of land in the economic framework, it is worth noting that residential land tends to represent an increasing share of national wealth in several developed countries raising new research questions. Finally, we briefly summarize the way each paper tries to enhance our understanding of the contemporaneous role of residential land conditioning the impact of housing and fiscal policies.

1.1 Agricultural land has been a major concern for early economists

Land has always attracted the attention of economic scholars. Indeed, many economists have been dedicating a lot of attention to agricultural activities in order to understand the main economic mechanisms of their time. The apogee of such a movement can probably be found in the work of Quesnay and its followers commonly designed as the physiocrat movement. For these early economists, agricultural land was at the origin of most of the value produced in the economy while manufacturing was considered as "infertile" (ie a simple combination of raw materials). Such theory showed rapidly its limits but many authors acknowledged its contribution to the development of economic thoughts.

One of the most important contributions came from the classical economist Ricardo who developed a theory on land rent. Insisting on two particular properties of land : its fixity and its decreasing returns, he developed the concept of rent differential in order to provide a first definition of a "Rent" : the premium over social value due to ownership of a scarce asset. One interesting feature arises from the fact that Ricardo pointed already the interest of taxing land

rent given that its quantity couldn't be adjusted.

A last notable legacy from early economists is due to the work of Thunen (1826) on land use that is considered by the economist Joseph Schumpeter as one of the most notable advance in the genesis of economic analysis :

*"Thunen's contributions may be summed up as follows. (I) He was the first to use the calculus as a form of economic reasoning. (II) He derived his generalizations, or some of them, from numerical data, spending ten laborious years (1810–20) in carrying out in detail a comprehensive scheme of accounting for his farm in order to let the facts themselves suggest the answers to his questions. This unique piece of work, undertaken in the spirit of the theorist, makes him one of the patron saints of econometrics. Nobody, before or after, ever understood so profoundly the true relation between theory and facts. (III) Nevertheless, this man who was so fact-minded knew at the same time how to frame ingenious and fertile hypothetical schemata. His peak achievement in this art is his conception of an isolated domain of circular form and uniform fertility, free from all obstacles to or special facilities for transport, with a town (the only source of demand for agricultural products) in the center. Given techniques, cost of transportation, and relative prices of products and factors, he deduced from this the optimal locations (which under those assumptions would be ring-shaped zones) for the various kinds of agrarian activities—dairying, forestry, and hunting included. A theory of rent, in some points superior to that of Ricardo, results as a by-product. Though many people objected to such bold abstraction, this was the part of his work that was understood and recognized in his time. For us, it is important to realize its brilliant originality."*¹

While Thunen's framework was initially developed in order to understand land use, it is worth noting that this model is now the workhorse to understand cities' development (Alonso (1964), Muth (1969), Mills (1972)). Such a shift in the research agenda can probably be linked with the growing importance of urban areas during the XXth century as illustrated in Table 1.1. In addition, as the next section tries to document, while the importance of agricultural land went through an important decline during the last century in developed economies, the growing importance of residential land rose several new research questions.

1. Schumpeter (1954)

Country	1800	1850	1910	1950	2005
Germany	9	15	49	53	88.5
England	23	45	75	83	89.2
Belgium	20	34	57	64	97.3
France	12	19	38	48	76.7
Italy	18	23	40	56	67.5
The Netherlands	37	36	51	75	66.8
Portugal	16	15	16	25	55.6
Sweden	7	7	23	45	83.4
Europe	12	19	41	51	73
US	5	14	42	57	80.8
Canada	6	9	32	46	81.1

Source : Véron (2006)

Table 1.1: Change in Urbanization Rates of Developed Countries

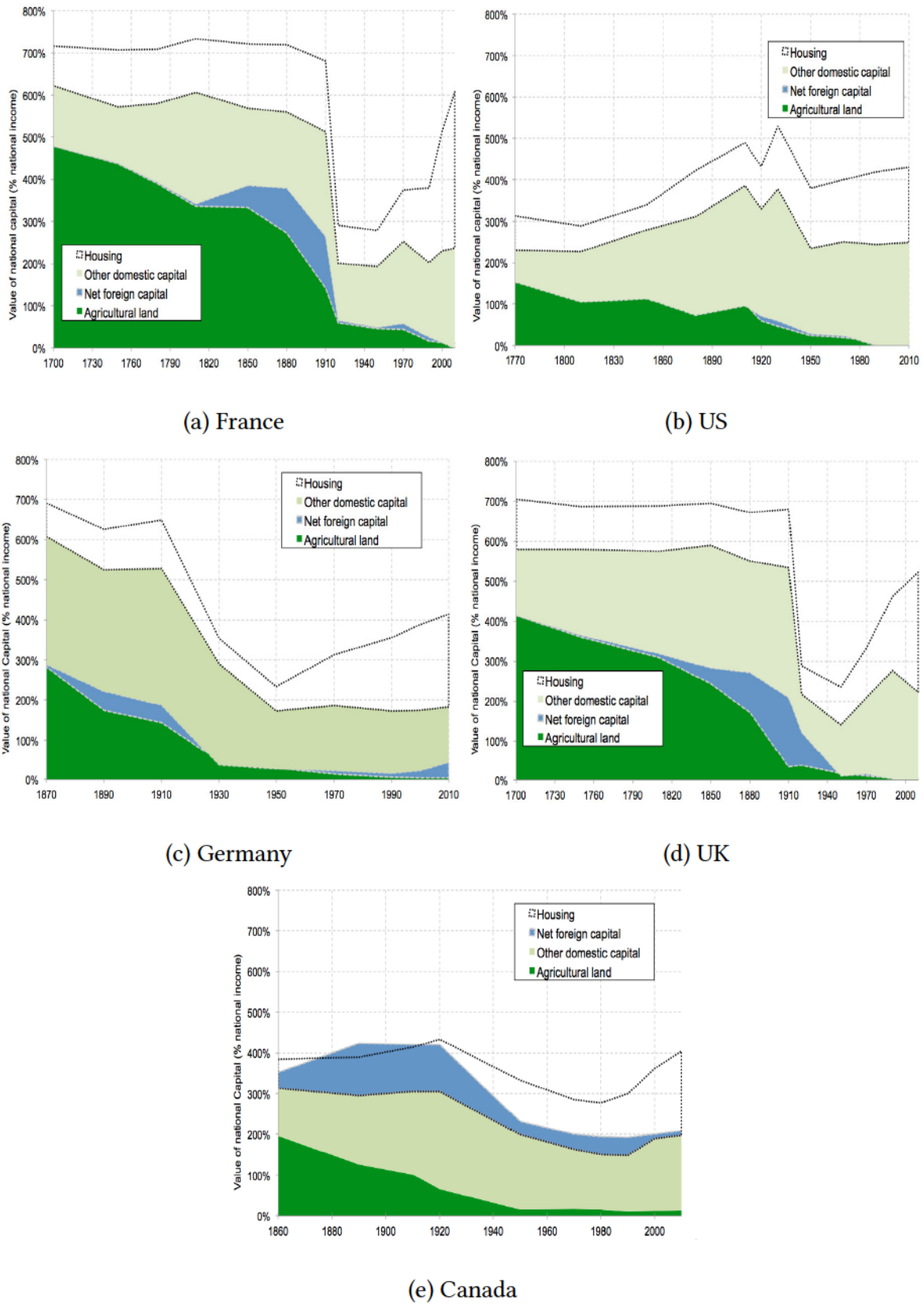
1.2 From the decline of agricultural land to the rise of residential land

The relative importance of agriculture in economic activities have been steadily declining since the beginning of the XIXth century (from 45% of the GDP in 1820 to 30% in 1900², 10% in 1960 and 1.7% nowadays³ for France). More interestingly, Piketty and Zucman (2014) recently documented that such a decline went along with a drop in the share of agricultural land in National wealth as illustrated in Figure 1.1 . This phenomenon is particularly striking, for example while in France Agricultural Land represented 2/3 of the National Wealth in 1700, its share shrank to stabilize around 2% at the beginning of the XXIst century. This dramatic decline probably bears an important share of the secular decline of the wealth income ratio observed until 1950. It is worth noting that Piketty (2013) considers such a decline as an important symptom of decreasing wealth and income inequalities observed during the XXth century.

However, while the importance of agricultural land has been dramatically reduced, Piketty 2013 noted a new rise of the wealth income ratio likely to increase the share of capital income and subsequently inequalities. For the author, the uneven distribution of the capital stock between households could generate a divergence between the income of workers and of capital holders. One important remark left aside in his analysis is the fact that most of the new rise of the capital stock seems to come from housing and in particular its land component as illustrated in Figure 1.3 for France. There was thus a substitution of agricultural land by residential Land over the last century due to a rise of residential land value as illustrated in Figure 1.2. The causes of such a rise in residential land price remain an open question , some invoke the role of the decline in interest rates , others the rise of urban population already mentioned combined with the restrictions for land use limiting urban sprawl. Moreover the consequences are not obvious neither given that residential and agricultural land have very different use and distribution between households. Durantou and Puga (2015) pointed the need for additional empirical works in particular in Europe to improve our knowledge on the consequences of this rising importance of land. Grounded on the urban, housing and public economics literature, this dissertation tries to bring some partial answers to such questions using the French example to understand the way the modern housing sector is working. One can hope that these contributions could help economists and policymakers to enhance their comprehension of land and housing markets in order to design the adequate policies to cope with the forthcoming challenges.

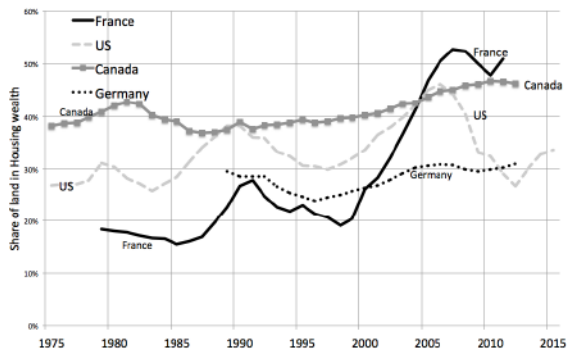
2. Lévy-Leboyer and Bourguignon (1985)

3. Desriers (2007)

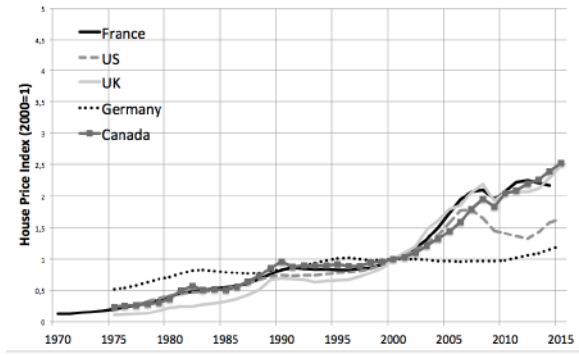


Source :Bonnet et al. (2016) after Piketty and Zucman (2014)

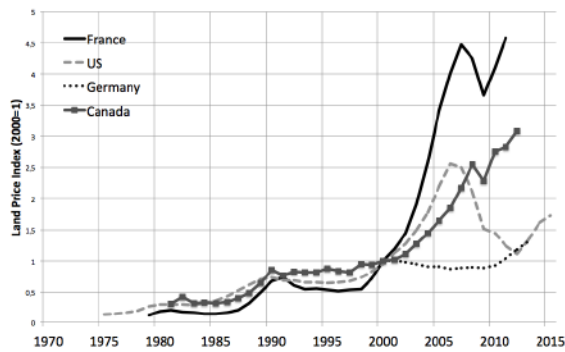
Figure 1.1: Secular decline in the capital/income ratio in 5 OECD countries



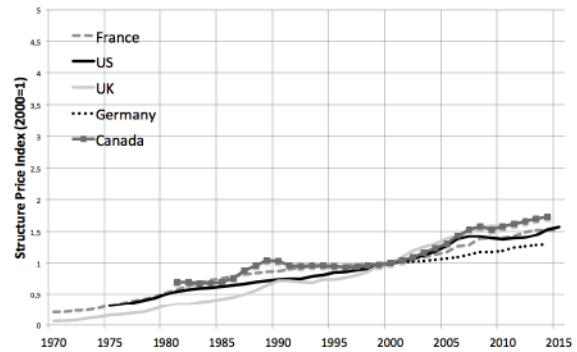
(a) Share of Land in Housing Capital



(b) House Price Index



(c) Land Price Index



(d) Construction Cost Index

Figure 1.2: Time evolution of the subcomponent of housing capital (Bonnet et al : 2016)

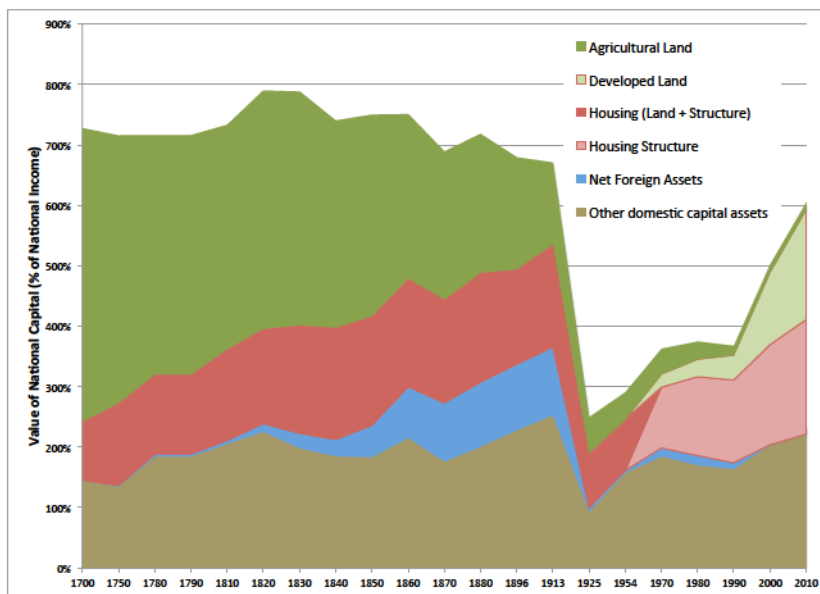


Figure 1.3: Decomposition of the national wealth in France : the rise of residential land (Bonnet et al : 2016)

1.3 Land and the Housing Market

This dissertation is composed of three chapters trying to highlight the particular features of the french housing market and their consequences for local housing policies answering empirical questions. These three chapters bring answers to understand the rise in land prices pinpointed in the introduction suggesting that (I) the French Housing Market is inelastic probably because of a relatively strong level of regulation for land access (II) consequently demographic shocks, public subsidies, low interest rates tend to increase competition for land driving up its price.

Chapter 2 builds on the recent literature of urban economics in order to measure the housing supply price elasticity and tries to bridge the macroeconomics and urban economics literature with two main contributions. First it introduces the concepts of intensive and extensive supply elasticities. It argues that macroeconomists are concerned with the intensive supply elasticity as in their framework urban growth is absent and firms are price takers. For them, housing starts are the consequence of short run variations in the price of new dwellings. On the other hand, it defends the idea that urban economists are considering the extensive margin supply elasticity where housing prices are the consequence of long run urban growth and are considered as a cost. Second, using a new dataset distinguishing old and new housing prices and two original identification strategies to deal with the simultaneity bias and the endogeneity of regulation it presents some estimates and decomposition of both elasticities for the main French urban areas. It is shown that both elasticities are not equivalent and do not have the same drivers. French urban areas appear much more price inelastic than their US counterparts because of regulation.

Chapter 3 uses a natural experiment, the implementation of the Scellier Tax Credit in order to investigate the behavior of local housing markets when new constructions are subsidized. The results confirms the conclusion of chapter 2 : an exogenous subsidy appears to have a very limited impact on the production of housing units the subsidies being capitalized in housing prices probably through a rise in land prices. Such results are thus in line with the low elasticity of the french housing market.

Chapter 4, tries to deepen our understanding of this market focusing on one of its salient feature : the existence of an important non profit and subsidized rental sector. Theory suggests that when access to land is limited, subsidized housing unit might crowd out private construction through competition for land. Using an instrumental strategy and a natural experiment, our results confirm these predictions and find a significant and important crowding out effect. One subsidized housing unit displaces more than one private housing unit because there is a strong competition for land and some competition for tenants. A social housing unit displaces more than one unit because social landlords tend to build bigger units.

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Chapter 2

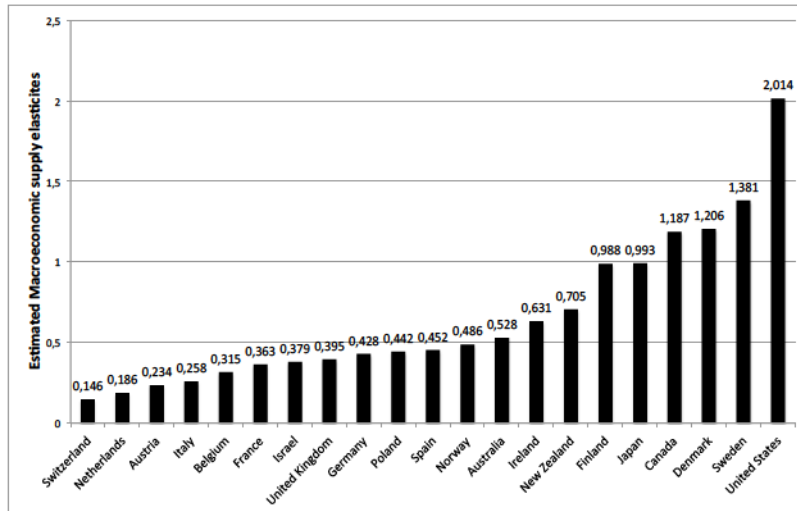
The extensive and intensive margin housing supply elasticities

This paper is jointly written with Jean Benoit Eymeoud

2.1 Introduction

The Housing Supply elasticity has long been a parameter of interest for economists as it seems an important constraint for housing policies and might play a role in real estate cycles. DiPasquale (1999) called our attention about the fact that housing supply was much less documented than housing demand. She explained this gap by the difficulty to document the production decisions (in particular conversions) and the lack of data on the production sector. After, the literature review provided by DiPasquale (1999), the number of contributions trying to estimate the housing supply elasticity increased refining the estimation techniques and highlighting the heterogeneity in supply elasticity across different areas.

Macroeconomics and urban economics both tried to measure this quantity. However both literatures remains poorly connected. For us, macroeconomics estimates two quantities. A very short run elasticity which corresponds to the price adjustment after a demand shock and a medium run elasticity which corresponds to developers reaction. Because housing takes time to built, the very short run is less elastic. In their framework we can say that firms are price takers and adjust their production level (housing starts) such that their marginal cost equates the price. Starts are the consequence of housing price variation. This literature can easily run cross country comparison as in Meen (2002) or in Andrews, Sánchez, and Johansson (2011) and documents a transatlantic gap showing that European Countries are much more price inelastic than the US (see Figure 2.1). One limit of these contributions is the fact that space and urban growth are absent from their framework.



Source : Caldera and Johansson (2013)

Figure 2.1: Price Elasticity in OECD countries

On the other hand, urban economists take space consumption as the starting point of their analysis. For them, urban growth is the result of positive spatial externalities driving firms and households to concentrate. However, cities do not grow infinitely because their expansion is curbed by agglomeration costs. The most notable one is illustrated in the monocentric model (see Combes, Duranton, and Gobillon (2016) or Saiz (2010) for an illustration) which shows that urban growth drives land and thus housing prices up. Urban economists take a long run perspective where prices are the result of urban growth. So far this literature is mostly focused on the US and showed an important heterogeneity of the elasticity across metropolitan statistical areas. Some scarce papers have also been trying to provide additional information on some European cities. For example Hilber and Vermeulen (2016) estimated the income-price elasticity for the UK while Combes, Duranton, and Gobillon (2016) estimated the land price elasticity with respect to city size for France. However these studies use different specifications and variables providing estimates hard to compare with their US counterparts. The transatlantic gap appears indirectly in the urban economics literature when assessing the impact of vouchers or allowances on prices. Indeed the magnitude of the impact of such policies appear to be systematically higher in Europe than in the US (Grislain-Letrémy and Trevien (2014))

In this work we try to bridge these two streams of literature. For us, given the absence of space and urban growth, macro-economists are interested in the **intensive margin** where the city size remains fixed. They are looking at the elasticity related to the developers marginal production costs and are interested in housing starts. As a consequence, they should use short run demand shocks in order to estimate the **short run supply equation** using new housing

prices in order to recover the intensive margin supply elasticity.

On the other hand, considering that urban growth is a decennial phenomenon, we think that urban economists are interested in the **extensive margin** where the city size is changing. Since housing prices are the consequence of the city growth, they should estimate the inverse supply equation using long run shocks as in Combes, Duranton, and Gobillon (2016) and Saiz (2010). As they are interested by an agglomeration costs faced by households and firms, it is easily understandable that one should pay attention to rents, or the price of existing unit in order to estimate the extensive supply elasticity.

Collecting an important amount of data on new and existing housing price, housing starts, geographical and regulatory constraint for the main French Urban areas, we are able to measure and decompose the intensive and extensive margin supply elasticities. To deal with the simultaneity bias, we use the standard Bartik shocks, climate amenities and an instrument derived from macroeconomics (see Monnet and Wolf (2016)) : the number of births 20 years before. We also develop a new identification strategy to disentangle the impact of regulation using national rules to instrument a local regulation index. We show that different price series (old Vs new) yield different elasticities having different drivers. The elasticity with respect to new housing price (for us the intensive margin) is mostly driven by regulation in the short run while geography appears more important on the medium run. The elasticity with respect to existing price (for us the extensive margin) is determined by geography and regulation on the short run or the share of land already developed and the level of regulation on the long run. As far as France is concerned our results also confirm the transatlantic gap, showing a long run elasticity with respect to existing unit price close to 0.333 (Vs 1.5 for the US in Saiz (2010)). Given the low level of geographical constraint, regulation might be an important explanatory factor for this gap as in the UK (see Hilber and Vermeulen (2016)).

In section 2.2, we discuss the definition of the supply elasticity, its implication for housing policies and real estate cycles. Section 2.3 introduces our distinction between the intensive and extensive margin supply elasticities and present our empirical specification and identification strategies developed to measure and decompose both concepts. Section 3.4 presents the new dataset gathered to estimate the different types of supply elasticities in France. Section 2.5 provides estimates of the intensive and extensive margin supply elasticities in the short and long run. Section 2.6 presents their respective drivers. Section 2.7 concludes.

2.2 The supply elasticity : A key ingredient to understand the housing market behaviour

2.2.1 Definition

The price elasticity of housing supply describes the way the housing market reacts to an exogenous demand shock. This quantity describes by how much percentage points will the housing stock increase when housing prices increase by 1 percentage point. Formally, we can define the behavior and magnitude of the housing supply elasticity as:

$$\beta^S = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q} \quad (2.1)$$

or when changes are small :

$$\beta^S = \frac{\partial Q}{\partial P} \times \frac{P}{Q} = \frac{\partial \ln(Q)}{\partial \ln(P)} \quad (2.2)$$

This quantity has long attracted the attention of scholars given that the very particular properties of housing¹ can have several implications on the way the market reacts to change in prices.

It is worth noting that urban economists prefer to estimate to inverse supply elasticity :

$$\frac{1}{\beta^S} = \frac{\Delta P}{\Delta Q} \times \frac{Q}{P} = \frac{\partial \ln(P)}{\partial \ln(Q)} \quad (2.3)$$

2.2.2 The impact of the supply elasticity

It appears important to measure correctly the supply elasticity in order to understand the potential constraints for public interventions and real estates cycles.

Housing is often considered as a merit good (Whitehead and Scanlon (2007)) driving public authorities to intervene on the housing market through subsidies. However, many studies emphasize that policy makers should take into account the supply elasticity when designing their policies. For example, an important amount of funds have been distributed through subsidies or tax benefit in order to enhance the development of deprived areas². Impact studies have progressively shown that such "Place Based Policies" tend to be capitalized in land prices offsetting part of the benefit of the programs (Neumark and Simpson (2015)). The standard explanation for such a phenomena invokes urban economics models where subsidies increase the demand for land resulting in a rise in its price particularly strong in inelastic areas. Such

1. Housing is often said to be a durable good, a composite good (Rosen (1974)), a local good , an Investment good , a consumption good and a merit good at the same time.

2. the Special Enterprise Zones in the US, the UK LEGII or the Zones Franches Urbaines in France are well documented examples of such policies

interpretation tends to be supported by the results of Poulhès (2015) in France documenting a dramatic increase in commercial real estates driven by inelastic areas where few land is available for additional developments. Some policies as the Low Income Housing Tax Credit in the US are designed to increase the supply of housing for low income tenants but similar mechanisms seem to decrease the efficiency of such programs (see Chapelle, Vignolles and Wolf (2016)). Moreover, while housing policies represent a major share of transfers toward low income households in Europe, a growing literature tends to demonstrate that housing benefits increase the rent of low income households (Laferrère and Le Blanc (2004), Gibbons and Manning (2006), Fack (2006) or Grislain-Letrémy and Trevien (2014)). Such a rise of their rents is thus limiting their capacity to increase their housing consumption. It is worth noting that the inflationary impact of these kind of benefits appear to be much stronger in inelastic areas (Eriksen and Ross (2015)). An important difference in the supply elasticities between French and US cities, could thus explain why French studies tend to find a larger inflationary impact than equivalent studies for the United States.

In addition, the supply elasticity might also be important to understand real estates cycles. Indeed, several papers document the connection between the degree of supply elasticity and the probability of bubble formation or the volatility of housing price. For example, Glaeser, Gyourko, and Saiz (2008) found that inelastic areas had higher price increase and lower construction level during boom. Nonetheless, the difference between elastic and inelastic areas didn't show clear patterns during bust periods. Similar conclusions were found in Grimes and Aitken (2010), Ihlanfeldt and Mayoock (2014) or Huang and Tang (2012). Davidoff (2013) mitigates the importance of supply elasticity on real estates cycles putting forward that the sand states³ had an elastic supply but experimented the most important real estate cycles. Nevertheless, some papers developed models where the supply elasticity remains key and that can reproduce the stylized facts observed by Davidoff (2013). For example, Nathanson and Zwick (2012) argues that more elastic areas are more likely to be subject to speculative movements that could provoke important real estate cycles. Gao, Sockin, and Xiong (2015) proposed a model where households use housing prices to learn about the economic strength of their neighborhood. In their framework, different elasticities generate different informational noise likely to explain the difference in the cyclical behavior of real estate markets observed in the US.

3. California, Florida, Arizona and Nevada

2.3 The intensive and extensive margins

2.3.1 Definitions

Both macroeconomics and urban economics have been trying to estimate the housing supply elasticity. However, both streams of literature are rather hard to connect. The spirit of their estimation methods appears different. In this section, we argue that macroeconomists are actually looking at the intensive margin where housing starts are the consequence of short run price variations whereas urban economics are looking at the extensive margin where land and housing prices are the consequence of urban growth.

The macroeconomics literature has long been trying to estimate the supply elasticity. Among the most important contributions, one should emphasize the work of Wheaton (1999) who developed a theoretical framework using DiPasquale and Wheaton (1994) empirical work. In his model, the author starts from the idea that housing is a durable good which depreciated very slowly once developed. He thus emphasized the distinction between the stock (housing units available) and flows (investments as construction, restoration and conversion). The main contribution of such model is the distinction between the very short run and the medium run supply elasticities. Indeed on the very short run, the supply is totally inelastic while it becomes more elastic on the medium run once the construction sector begins to increase its production. Prices move first and are followed by an adaptation of the production. Close to this idea, Macroeconomists estimates showed that the very short run elasticity (materialized by the coefficient of the quasi difference over quarters) was smaller than the long run elasticity (coefficient of the price). From this perspective firms are price takers and adapt their production level (housing starts). As land is absent and there is no urban growth, we consider that they are looking at the intensive margin.

For urban economists, space consumption is at the center of their analysis. In this literature, cities are the result of agglomeration forces driving households and firms to concentrate. However, as illustrated in the monocentric model (see Saiz (2010) or Combes, Duranton, and Gobillon (2016)), the urban development goes along with urban costs as the increase in land and thus housing prices. Housing prices are thus the consequence of urban growth, this is what we call the extensive margin as the city shape is changing. As far as the housing supply is concerned, this should be considered as a long run parameter since urban growth is a decennial process. It takes time to develop new parcels as zoning changes slowly.

One way to illustrate the difference of philosophy between urban economics and the macroeconomics literatures is to look at the consequences of the durability of housing. While for macroeconomics, the durability generates a very short run supply elasticity lower than its medium run value, in urban economics, its main consequence is to generate an asymmetry in the sup-

ply elasticity. For Glaeser and Gyourko (2005) , negative demand shocks generate stronger price adjustments than positive ones. When a city is declining, the housing price will collapse durably and strongly : there is a kink in the housing supply. The urban decline is the cause of the drop in housing prices while macroeconomics emphasized that strong price adjustment in case of demand shocks might generate overshoot of the construction at the origins of real estate cycles (see Wheaton (1999)) : research questions are also very different.

In this paper we start from this interpretation of both literatures in order to bridge them at the urban level. To do so we introduce the concepts of extensive and intensive margin supply elasticities . We distinguish both concepts using two criteria : the type of housing price used (old Vs new) and the time horizon (short run Vs long run). We illustrate the definition in Table 2.1:

	Short run	Long run
New price index	Intensive margin	Int. Int. margin
Existing price index	Int. Ext. margin	Extensive margin

Table 2.1: Definition of the intensive and extensive margin supply elasticities

As we can see there are two well defined polar cases (the intensive and extensive margins) and two intermediate cases (The Intermediate extensive and intensive margins). The extensive margin is connected with the urban economics literature and the recent estimates of Saiz (2010) or Combes, Duranton, and Gobillon (2016). In such a framework, prices are the consequence of city growth and the supply elasticity is associated to an agglomeration cost. It is a long term concept as cities take time to grow. As, the stock represent the major share of housing consumption, we use the price of existing units as we are interested in the impact of this agglomeration cost on firms and households expenditures. It is usually estimated thanks to the inverse supply equation using cross section or long differences estimates. The intermediate extensive margin, is a close concept but estimated on a shorter time span , it can also be viewed as a biased intensive margin as discussed in Section 2.B in Appendix.

The intensive margin, is connected to the macroeconomics literature. It depends on firms production costs which adapt their supply to maximize their profit when the price is varying. In this framework, starts are the consequence of price variations. And we look at short term adjustments of the production which does not require an extension of the city. It is thus a short term concept estimated using panel estimators. We should focus on the price of new units as we are interested in the production decision i.e the price received by the developer. The intermediate intensive supply elasticity is the same concept on a longer time span.

2.3.2 Estimating the short run elasticity : the intensive margin

We first follow the macroeconomics or time series literature where authors take an investment perspective : housing starts are a consequence of housing price dynamics. Demand shocks have an impact on prices which deviations from long run equilibrium generate new investments. They have been trying to estimate the investment equation regressing quantities (housing starts or stock) on price level or price variation. One can estimate the supply equation in panel in order to exploit short run variation .The estimated equation is thus :

$$\ln(Construction_{k,t}) = \beta^S \ln(Price_{k,t}) + \beta X_{k,t} + \lambda_t + \lambda_k + \varepsilon_{k,t} \quad (2.4)$$

Where $\ln(Construction_{k,t})$ is the log number of housing starts , $\ln(Price_{k,t})$ is the log of new housing price (resp. existing units price) when estimating the intensive supply elasticity (resp. the intermediate extensive supply elasticity) and $X_{k,t}$ are time varying controls⁴. λ_t and λ_k are respectively time and urban area fixed effects. Hilber and Vermeulen (2016) use a similar specification to investigate the short run elasticity between income and price

It is worth noting that the best way to estimate this equation would be to simultaneously estimate the supply and demand equation as in Brühlhart (2016). However, we don't identified short run exogenous supply shocks to instrument the demand. Urban economists tend to estimate the inverse supply elasticity.⁵ However, estimating the supply equation and the price elasticity appears closer to the spirit of the intensive margin supply elasticity (IMSE).

The main challenge when estimating equation 2.4 is to be able to deal with simultaneity bias. Indeed, supply and demand might vary simultaneously and such a regression will just describe the succession of possible equilibria. The macroeconomics literature developed 3 main ways to deal with this bias :

The first one relies on the properties of time series : potential investors first observe price movements and then make investment decision. They used investment as dependent variable and lagged value of prices sometimes instrumented in order to deal with the simultaneity

4. We mostly have income available
5. The estimated equation is then :

$$\ln(Price_{k,t}) = \frac{1}{\beta^S} \ln(Construction_{k,t}) + \beta X_{k,t} + \lambda_t + \lambda_k + \varepsilon_{k,t} \quad (2.5)$$

To us, equation 2.5 is closer to the idea of the costs of agglomeration and is more suited to estimate the long run elasticity : prices are the consequence of city growth as in the monocentric model. Both strategies yield the exact same estimates when taking the simultaneity bias into account. However, the first stage is stronger when prices are instrumented which suggests that shocks affect first price and the production sector follows price movements : we can consider this as adjustment on the intensive margins.

bias. For example, Follain (1979) regresses quarterly US housing prices on quarterly housing starts in order to estimate the supply equation with an error correction model combined with instrumental strategies. He corrects for autocorrelation and the simultaneity bias including lags and using the population as an instrumental variable for prices. Poterba (1984) estimates the supply equation regressing the quarterly price of housing on the quarterly value of residential investment on expected price one period ahead instrumented with current price. However, this approach does not seem to account for the simultaneity problem. Topel and Rosen (1988) regress quarterly housing prices on investment in a $AR(2)$ error correction model. Prices are instrumented using weather shocks. One can also quote Mayer and Somerville (2000) who used current and lagged values of changes in non-construction employment, real energy prices, mortgage rates, and the number of married couples as price shifters. Vermeulen and Rouwendal (2007) instrument prices with households' average income suggesting that its impact on new starts will exclusively happen through prices.

As emphasized in Wheaton, Chervachidze, and Nechayev (2014), these early papers based on ECM face some difficulty to deal with the simultaneity problem. As a consequence, these approaches were progressively replaced by VECM which are considered to be able to take into account simultaneity and endogeneity bias estimating jointly the supply and the demand equation. For example, Caldera and Johansson (2013) adapt a stock flow model to a VECM framework in order to estimate the supply and demand equation for a large sample of OECD countries. At the city level, Wheaton, Chervachidze, and Nechayev (2014) also used this approach in order to estimate the long run supply elasticity for 60 MSAs in the US.

Finally, some papers follow an alternate framework developed in DiPasquale and Wheaton (1994) and argue that the simultaneity bias is not an issue or is likely to be of limited size. For example, Ihlanfeldt and Mayock (2014) regress the number of housing starts on the price controlling for the stock in the previous period. They argue that since price is clearing the housing market (old + new homes), investment and prices are not obviously simultaneously determined and thus no instrumental strategy is required since investment is a small fraction of the stock.

As far as we are concerned, provided that we don't have enough yearly data points per Urban Area, we cannot adapt the two first methods based on time series analysis. In addition, the third approach relies on the strong assumption that new and existing units are on the same market with one unique price. As discussed in Section 2.B in the appendix, we don't agree with such an approach since if both types of units are not perfect substitutes we can observe a strong bias in the estimates. In our panel framework illustrated in equation 2.4, we have to instrument $\ln(Price_{k,t})$ with exogenous demand shocks. We use yearly labor market shocks with a Bartik instrument describing how the employment in the city would have evolved if

following national trends from its composition in 1990 (see Section 2.H.4 for more details). This is very close to Hilber and Vermeulen (2016) who directly regress a bartik instrument on housing price as a robustness check. However, the use of bartik instrument combined with fixed effects appears harder to interpret. Indeed, the initial share is absorbed by the city fixed effect. We thus propose a relatively new instrument to the Urban Economics literature, following Monnet and Wolf (2016). We use short run demographic shocks and more particularly the number of births twenty years before in order to instrument for current Prices because it is usually acknowledged that young households aged between 25 and 40 years old tend to be the main responsible for the demand of new housing units. This instrument is relatively strong when migration flows remains limited which appears to be the case in our sample for the 56 most important urban areas. To us, the exclusion restriction appears convincing since, it states that past births should be correlated with current construction in another way than through their impact on the demand for new housing unit translated into higher prices. The nice feature arising from both instruments is that they exploit very different sources of exogeneity and can allow us to perform meaningful endogeneity tests.

2.3.3 Estimating the long run elasticity : the extensive margin

The second parameter of interest to us is the long run elasticity. In the urban literature, house price dynamics are perceived as a consequence of city growth : housing price appreciation is a consequence of an exogenous growth of the city. Scholars estimate the inverse supply elasticity estimating the supply equation (ie regressing quantity on prices). For the sake of comparability, we propose to follow Saiz (2010) in order to estimate the impact of long run shocks on house price variations using long difference.

$$\Delta \ln(\text{Price})_{1999-2012,j} = \frac{1}{\beta^S} \Delta \ln(\text{Units})_{99-12,j} + \varepsilon_j \quad (2.6)$$

Using, the inverse supply equation can be interpreted as adjustments on the extensive margin of the city. However, one can also estimate the supply equation⁶ results remain qualitatively unchanged but the first stage is weaker : this is because on the long run prices are the consequence of the growth of the city. This is why we talk about extensive margin adjustments.

In order to identify Demand shocks we follow Saiz (2010) and Combes, Duranton, and Gobillon (2016) using temperature in January, the number of hotel rooms and a Bartik variable as instrument. We can use the Bartik instrument in the short run and in the long run because

6.

$$\Delta \ln(\text{Units})_{1999-2012,j} = \beta^S \Delta \ln(\text{Price})_{99-12,j} + \varepsilon_j \quad (2.7)$$

this instrument do not capture the same things with the different time span. In the short run, it captures small conjectural shocks more likely to affect prices for example through households' income while on the long run it captures long run trends in the national economy implying a redistribution of the population within the territory. $\Delta \ln(P_{1999-2012,j})$ is the existing House price variation (resp. New house price variation) between 1999 and 2013 when estimating the extensive margin (resp. the intermediate intensive margin) and $\Delta \ln(Units)_{99-12,j}$ is the variation of the number of housing units. It is worth noting that we use the variation of housing units contrary to Saiz (2010) who uses the population. We will perform alternate robustness checks using population to insure comparability between both studies. We are aware that constructions costs are not accounted for. We regrettably weren't able to access to the PRLN dataset or to the local wages in the construction so far. However, to our understanding, this is a limited problem given that most of construction costs comes from labor (Duranton, Henderson, and Strange (2015)) paid at a national minimum wage. Adding regional dummies to account for difference in the regional labor costs do not change our results.

2.3.4 Decomposing the Price elasticity

Since a house is immobile transactions on the housing market are the result of arbitrages for location within a city (see Muth (1969)) and between cities (see Rosen (1979) and Roback (1982)). As a consequence, an important and increasing part of the value of housing capital is linked with its location and is thus capitalized into land price (see Davis and Heathcote (2007) or Bonnet et al. (2016) for a complete review). The importance of the land component arises from the fact that land scarcity for geographical or regulatory reasons can reduce price elasticity (Saiz (2010)) making it dependent on local conditions (city size , geography or levels of regulation). Urban economics and the macroeconomics literatures have been trying to understand what are the main drivers of the supply elasticity.

In time series analysis, (Green, Malpezzi, and Mayo (2005) emphasized the importance of regulation while Andrews (2010) also suggests that competition in the construction sector might be important. In urban economics, Saiz (2010) emphasized the role physical constraints and regulation. Finally, the share of land already developed (Hilber and Vermeulen (2016)), the city size interpreted as the bindness of the geographical constraint (Saiz (2010)) were described as important drivers of the elasticity. The relative importance of each factor remains unclear, while Saiz (2010) interprets his results as the fact that geography remains the main driver of price elasticity in the US, Hilber and Vermeulen (2016) emphasizes the importance of regulation and city size and shows that the relative importance of each factor might change between Local Authorities in the UK.

To wrap up, the estimates of the supply elasticity vary across countries and MSAs. Four main

parameters are likely to influence its size, namely geography (Saiz (2010)), city size (Hilber and Vermeulen (2016)) regulation (Green, Malpezzi, and Mayo (2005)) and competition in the construction sector (Andrews (2010)). So far, we didn't find any study trying to connect the supply elasticity at the city level and the macroeconomics estimates. As a consequence we don't know if the observed transatlantic gap between the US and Europe is due to a composition effect (there are more elastic areas in the US or people live in more elastic place) or to the way the construction sector is working.

Short Run

We can try to investigate the determinants of the housing supply elasticity. To do, we can reestimate the equation introducing interaction terms with our measures of regulation and geographical constraint :

$$\begin{aligned}
 \ln(Construction_{k,t}) = & \beta^S \ln(Price_{k,t}) + \beta^R Regulation_k \times \ln(Price_{k,t}) \\
 & + \beta^{LAND} \times (1 - Available_k) \times \ln(Price_{k,t}) \\
 & + \beta^{dev} \times (Developed_k) \times \ln(Price_{k,t}) \times \\
 & + \beta X_{k,t} + \lambda_t + \lambda_k + \varepsilon_{k,t}
 \end{aligned} \tag{2.8}$$

Where $Available_k$ is the share of land available for developments (with a slope below 15% and not under water) around the city's barycenter as computed in Saiz (2010). We also control for the share of land developed $Developed_k$ which is potentially endogenous. We then use the population of the city in 1911 to control for this potential bias. Finally we also assess the impact of several regulations with $Regulation_k$. When trying to identify the impact of regulation on the supply elasticity, one has to deal with a potentially important endogeneity bias. Areas with higher price are likely to be subject to a stricter degree of regulation. Indeed, since housing is an investment good, Fischel (2001) argues that homeowners will preserve the value of their property exerting pressure on local administrations. This intuition is supported by several additional contributions as Hilber and Robert-Nicoud (2013), Solé-Ollé and Viladecans-Marsal (2013), Ferreira, Gyourko, et al. (2009), and Ortalo-Magné and Prat (2014). Saiz (2010) instrument regulation using the characteristics of homeowners⁷ and share in protective inspection in local public expenditures. Hilber and Vermeulen (2016) exploit a national change in the regulatory framework impacting differently local authorities' refusal rate.

Our identification strategies to disentangle the impact of regulation relies on the idea that the national rules decided following very general conditions are independent on local unobserved determinants of housing prices :

7. the nontraditional Christian share in 1970

The first national rule is the law of February the 5th 1943 on historical building which states that in a perimeter of 500m around a registered or classified building, any modification of a surrounding building should get an additional advice from the Association of French Architects. This should turn the housing supply more rigid because new projects should fulfill particular characteristics and should fulfill some conditions. Figure 2.H.6 illustrates this type of constraint for a French Department. Such a zoning, is likely to be exogenous since the buildings used were classified a long time before our period of study (we focus on these classified before 1960). We compute the share of each area covered by this rule. Another nationwide law, the SRU act studied in Bono and Trannoy (2012) and Gobillon and Vignolles (2016), increased dramatically the intervention of Local Authorities on the housing market. This act increased the bindness of the zoning driving the resusal rate up. Indeed, the SRU Act voted in 2000 forces mayor the increase the number of social housing units which consumes more land per unit of land. The private sector will thus tends to extend more rapidly on the extensive margins driving up the number of refusals at the urban area level. We can thus instrument the level of regulation using the share of the urban area concerned by the SRU act on the long run or directly use it as a measure of regulation on the short run.

Long Run

In order to investigate whether the decomposition differs between the extensive and intensive margin, we also decompose the long run inverse supply elasticity. We first use the following specification close to our short run approach ⁸ :

8. For the sake of comparability, we also follow Saiz (2010) and estimate:

$$\begin{aligned} \Delta \ln(P_{1999-2012,k}) = & \\ \frac{1}{\beta_{Land}} \times \ln(pop)_{1990,k} \times (1 - Available_k) \times \Delta \ln(H)_{99-12,k} & \\ + \frac{1}{\beta_{reg}} \times Regulation_k \times \Delta \ln(H)_{99-12,k} + \varepsilon_k & \end{aligned} \quad (2.9)$$

We control for non linearity in the effect of land constraint when the city size increases and for regulation. Here $\ln(pop)_{1990,k}$ is the log of the city size in 1990 and $Regulation_k$ is instrumented and measured as discussed in the previous section.

$$\begin{aligned}
\Delta \ln(P_{1999-2012,k}) &= \frac{1}{\beta^S} \times \Delta \ln(H)_{99-12,k} \\
&+ \frac{1}{\beta^{Land}} \times (1 - Available_k) \times \Delta \ln(H)_{99-12,k} \\
&+ \frac{1}{\beta^{Reg}} \times Regulation_k \times \Delta \ln(H)_{99-12,k} \\
&+ \frac{1}{\beta^{Dev}} \times \%Developed_k \times \Delta \ln(H)_{99-12,k} + \varepsilon_k
\end{aligned} \tag{2.10}$$

where $Regulation_k$ are different measure of regulation, when taking the refusals of building permits, it is instrumented thanks to the national rules as the law for historical monuments and the SRU act $\%Developed_k$ is the share of land developed in 1990, it is instrumented thanks to the population of the urban area in 1911.

2.4 Data

2.4.1 Units of observation

The question of the unit of observation is important in Urban Economics. Here we want to capture the relevant housing market. We follow Saiz (2010) and Combes, Duranton, and Gobillon (2016) and choose the Metropolitan Statistical Areas. However, some other papers as Hilber and Vermeulen (2016) take administrative areas as the UK local Authorities. We will thus perform some robustness checks reproducing our analysis at the department level (larger administrative areas).

2.4.2 Measuring Housing Prices

The measurement of housing price dynamics raises two important question. The first one is the consequence of the heterogeneity of housing unit raising the importance of quality and of the distinction between the price of new units and the stock. While the second is connected with the fact that housing is an investment good whose cost can be measured thanks to several concepts : the price, the rent and the user cost.

The importance of quality

In his seminal contribution, Rosen (1974) pointed that housing could be perceived as a **composite good**. This property has several implications when it comes to measure changes in price across time. Indeed if the features play an important role to determine the housing prices it might be important to control for changes in housing quality across time for example

using repeated sales or hedonic price indexes.

Land price, existing price or new constructions ?

While most studies use generally repeated or hedonic price index based on the transaction on the second hand market. Combes, Duranton, and Gobillon (2016) proposed to deal with the problem of quality using prices on the land market for new housing units controlling for the location within the urban area. Monnet and Wolf (2016) also criticize the use of second hand market transaction emphasizing the fact that new investments (in particular constructions) are more likely to be governed by the price of new units which sometimes diverge from standard price index as pointed in Balcone and Lafferrère (2015).

When studying housing investment dynamics, one can easily think, as argued in Monnet and Wolf (2016), that the main parameter of interest is the elasticity with respect to new unit price. As the housing supply elasticity with respect to the price of existing unit might be affected by the fact that both types of units might not be perfect substitutes as discussed in Section 2.B. In this study we use two complementary series on existing and new prices described in Section 2.H.3 s.

We do this for two reasons, for us the short run estimates of the extensive margin should look at new housing prices as we think the estimates can be different following the type of prices used. We thus use both index in the short run to assess the difference, for us a difference would suggest that both types of units are not perfect substitutes as discussed in Section 2.B. On the long run, however, if one is interested in agglomeration costs (households and firms expenditures) so land prices or existing unit prices might be the right concept as suggested in Combes, Duranton, and Gobillon (2016) since it represents the majority of what is consumed. However it can be interesting to assess the intermediate intensive margin using new prices.

Price, rent or user cost ?

Since Housing is an investment good, such a good can be bought by a household for its own use or by an investor in order to be rented. One can thus distinguish the transaction price and the rental price. While most of the studies observe the market dynamics through the lens of transaction prices, it remains unclear whether one should look at transaction price or rental price. If on the long run financial theory suggests both should be equivalent, several studies highlighted important divergences between both measures through time resulting in fluctuations in the user cost (Himmelberg, Mayer, and Sinai (2005)) or through space (see Oswald (2016)).

It is worth noting that some macroeconomics paper also chose to study housing investment

dynamics distinguishing investments in the rental sector from homeowners' computing a user cost for each sector (see Hendershott and Shilling (1980) for an example). However, since user costs rely on expectation these measures often rely on strong assumptions.

In this paper, as in most studies with the exception of Brülhart (2016) we only look at housing prices so far⁹. We justify this choice by the fact that producers in France are much more likely to observe selling prices rather than rents as most of them sell directly their products to homeowners or households willing to invest in the rental sector. Besides social housing where rents are controlled, there are few institutions involved on the rental market and most of the constructors are mostly focused on the production of new units.

2.4.3 Measuring Quantities

In the literature, there are many ways to measure the quantity. In urban economics many papers use the population and mostly care about the city size (Saiz (2010), Combes, Duranton, and Gobillon (2016)). However, the number of new units built measured through building permits or the variation of the stock is also measured. The advantage of the stock variation is to account for conversion of existing units and destruction. Related to this latter measure, Brülhart (2016) use the total floor surface dedicated to housing. Such a measure does not account for the division of existing unit but measure more precisely the volume of space dedicated to housing. Macroeconomics papers often look at housing starts or Growth Capital Formation in the housing sector.

In this paper, we measure quantity thanks to the concept of housing unit. We use the National census from 1990 1999 and the continuous census data published from 2002, this give us the net stock variation which is the most important in the long run. In addition we also use the construction data from sit@del2 database provided by the CGEDD, this gives us the gross variation which is more interesting when looking at production decisions. In order to identify demand shocks and to deal with the simultaneity bias, we have to instrument construction thanks to Bartik type instruments as described in Section 2.H.4. We also instrument demand shocks thanks to the climatic features of the area at the barycenter as reported in Section 2.H.1.

2.4.4 The determinants of supply elasticity

As we already emphasized, the literature has highlighted four main factors likely to influence the degree of elasticity : competition in the construction sector (Caldera and Johansson (2013)), regulation (Green, Malpezzi, and Mayo (2005)), the geographical constraint and its bindness

9. However we are currently trying to build a rental price index for several urban areas using the CNAF dataset on housing allowances.

(Saiz (2010) , Hilber and Vermeulen (2016)). The literature usually consider the construction sector as competitive () , in addition we can think that this parameter wouldn't strongly vary across France. We thus turn to the geographical and regulatory constraints and will present how to measure it. While the geographical constraint is considered as exogenous, the regulatory constraint and the share of developed land are considered as endogenous to housing prices. We will thus discuss how measure and identify exogenous variation in the regulatory constraint.

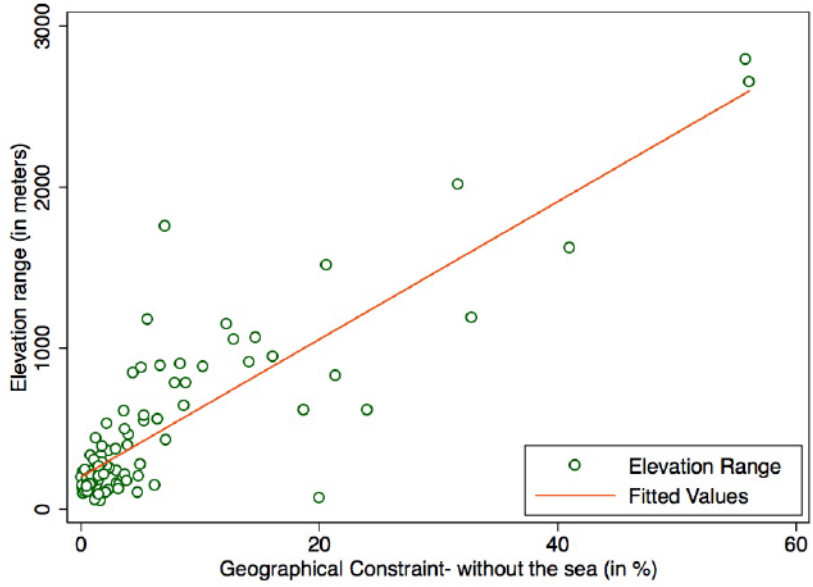
How to measure the geographical constraint?

We follow Saiz (2010) to compute the geographical constraint as exposed in Appendix . However, it is worth Hilber and Vermeulen (2016) proposed an alternate measure for this which is the difference between the highest and the lowest altitude on the territory. We are able to recover this measure and compare it with land availability. It is worth noting that they are highly correlated (85%) the main difference being that Hilber and Vermeulen (2016) does not take into account the role of oceans for coastal areas (in Saiz (2010) coastal cities are considered as highly constrained). We illustrate this difference in Figure 2.2. This feature might have important implications for the results of Hilber and Vermeulen (2016), indeed if the marginal impact of the geographical is probably unaffected the prediction and the standard deviation to assess the relative importance of each variable will. Forgetting the role of water-bodies and coastal areas can strongly explain why the authors conclude to a low impact of geographical constraints. One particular limits of such a measure, also arises from the fact that rivers can be an important sources of regulation designed in order to avoid floods. Not controlling for such areas might lead to overestimate the role of regulation, we thus prefer to use Saiz (2010) measure but our main conclusions remain unchanged using the range.

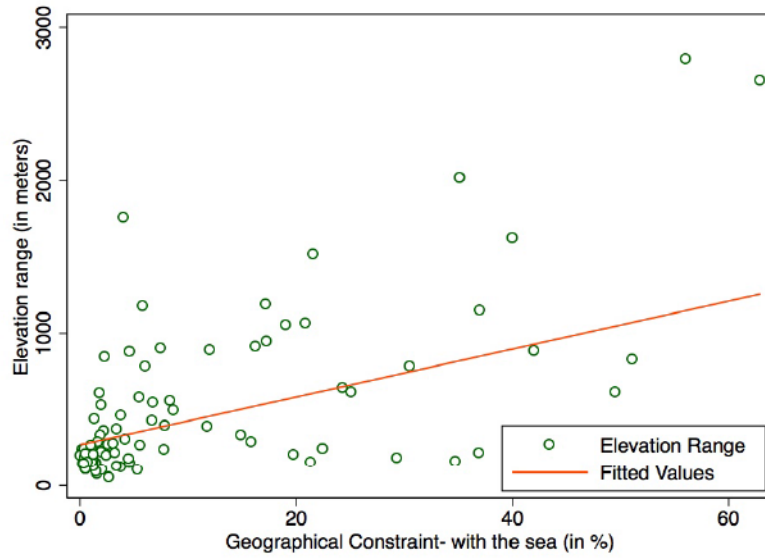
The Main geographical features of our sample of interest are reported in Table 2.H.1. One first striking fact arises when comparing their characteristics with Saiz (2010) : French Urban Areas appear to be poorly constrained. When accounting for internal water and mountainous areas, the average constraint for all Urban Areas is around 8.6% ¹⁰. This figure rises around 16.6% ¹¹ when accounting for the ocean within a 50km radius. These figures are much smaller than their US counterpart, Saiz (2010) reports an average of 26% for the North American Urban Areas.

10. 6% for the first 100 UA

11. 16% for the first 100 UA



(a) Area lost when the ocean is not accounted



(b) Area lost when the ocean is accounted

Author's computation

Figure 2.2: Correlation between elevation range and the geographical constraint

Developed land

The literature suggests that denser areas are usually more inelastic. We can recover this idea with the bindness of the geographical constraint¹² measured with the level of population at the beginning of the period (Saiz (2010)) or with share of developed land (Hilber and Vermeulen (2016)). We use the data provided by the Copernic Project at the European Level : Corine Landcover after removing the areas unavailable because of the geographical constraint we compute the share of developed land among the remaining land.

The extension of the city is likely to be endogenous with respect to prices, one possibility is to instrument it thanks to past density as in Hilber and Vermeulen (2016), to this end we use the historical data on population kindly provided by the Cassini Project ¹³. Saiz (2010) does not instrument the bindness of the geographical constraint.

How to measure the regulatory constraint ?

Regulation appears to play an important role on the Housing Supply Elasticity (Hilber and Vermeulen (2016)). However, it is worth noting that each country has its particular sets of rules that may differ quite importantly in its spirit and which should be accounted for when measuring it. So far two important papers propose different approaches to catch the regulatory pressure.

On the one hand, in the US Gyourko, Saiz, and Summers (2008) developed the Wharton Land Use Regulation Index (WLURI), a composite index able to reflect the limits on new developments (local political pressures, delays, refusals, limits of rezoning, use of Minimum Lot Size etc...). From a questionnaire addressed to Local Authorities, the authors are able to measure the strength of the regulatory environment. This index has been widely used in the literature investigating the impact of the regulatory environment. For example, Saiz (2010) averages these indexes at the Municipal level to compute an index at the Urban Area Level. On the other hand, Hilber and Vermeulen (2016) proxy for the regulatory constraint the refusal rate of major projects and use change in national rules as exogenous shocks and identify the causal impact of regulation.

France doesn't have any comparable index as the Wharton Land Use Regulation Index. However, the rich amount of data available allows us to construct a set of indices designed to proxy the stringency of different types of regulations. Indeed, while Saiz (2010) uses a multidimensional index, Hilber and Vermeulen (2016) only focus on refusal rates and are silent about zoning or other regulatory constraint as minimum lot Size or maximum floor area ratio. We

12. Saiz (2010) shows that the elasticity depends negatively from the level of the population (ie the bindness of the geographical constraint)

13. <http://cassini.ehess.fr/>

thus propose to provide different measure of regulations able to account for the specificity of the French regulatory environment. Our contribution on this aspect is twofolds we provide original sets of measures of the French Regulatory environment and we exploit an original identification strategy using exogenous National rules in order to identify the causal impact of regulation. In this section we provide a brief description of the French regulatory framework introducing our variables and identification strategy.

First of all, France is characterized by an important set of local regulation. The core element of the French urban planning system is zoning¹⁴. As in many countries the most common system of zoning used is the euclidean system of zoning where different districts are assigned to specific activities (Natural space, Industrial use, commercial use, residential use, mixed use). One strong specificity of France when compared with the US is the fact that the existence of zoning shouldn't be perceived as a constraint per se. Indeed, if some French Municipalities don't have adopted a zoning decree, the resulting regulatory environment would end stricter than with the existence of zoning since the National Planning Framework¹⁵ with its rule of limited ability¹⁶ to construct would be applied. We collected data describing the ex-post maximum Floor Area Ratio and the municipality under the RNU. However all these rules of urbanism as the minimum lot size, the maximum Floor Area Ratio are hard to compare between urban areas and municipality and are very likely to be endogenous. We thus turn to the common outcome of these rules, the refusals. In a spirit close to Hilber and Vermeulen (2016), we had access to an extraction of the sit@del dataset which is an exhaustive database on building permits containing yearly number of refusals. However, we didn't know the reasons for these refusals. We complete this variable with additional information on the number of permit cancellations resulting from an administrative decision (either from a judge, from the representant of the French state or from the mayor). We are able to distinguish whether the cancellations concerned collective buildings or single units. So far, we focus on the impact of refusals and cancellations that we instrument thanks to national rules, we also investigate the impact of national rules separately. Aggregating these information at the urban area level can mitigate the declaration bias at the municipality level: indeed one can think that small municipalities tend to inform the database less precisely, going at such an aggregate level might thus mitigate this problem.

As refusals are very likely to be endogenous, we collected data on the constraints resulting from National Laws that are less likely to be influenced by national politics. First we use the law on historical monuments already described. To create our measurement of the degree of the law, we scraped the exhaustive list of the historical monuments with their characteristics

14. PLU, POS or carte communale (Municipality map)

15. Règlement National d'Urbanisme (RNU)

16. with this rule almost no new development can be made outside the core area of the city

and date of classification on the Ministry of Culture website and then their geographical location using their wikipedia page. We then built circle of 500 meters around these monuments to compute the share of the urban area under this restriction as illustrated in Figure 2.H.6 in appendix. We also collected the zoning of the European Environment protection areas (Natura 2000) and computed the share of developable land concerned by this zoning. We also collected the exhaustive database on public forests¹⁷, and computed also the share of developable land classified as such of each urban area. Finally, we got access to the exhaustive lists of municipality under the SRU act from which we compute the surface of the urban unit at the center of each urban area concerned by this act. As illustrated in Table 2.2, the main exogenous drivers of our endogenous measure of regulation appears to be the share of territory concerned by the historical monuments rule and the share of the urban unit concerned by the SRU act. We thus use both measures as instruments or as direct measures in our empirical analysis. We can note that as in Hilber and Robert-Nicoud (2013) the share of developed land appears to be important (however it is not instrumented here)

	(1)	(2)
	Refusals	Refusals
% undevelopable	-0.309 (0.844)	-0.563 (0.872)
% developed	2.005 (1.351)	2.759* (1.640)
% SRU	1.351*** (0.348)	1.582*** (0.476)
% share Hist. Mon.	7.075*** (2.681)	7.754** (3.153)
% Natura 2000	1.662 (2.323)	-0.125 (2.678)
% Public Forests	-0.660 (1.283)	-0.668 (1.733)
R2	0.304	0.303
Obs	87	56

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.2: Drivers of regulation

17. http://carmen.carmencarto.fr/105/ONF_Forets.map

2.5 Short and long run elasticities with respect to new and existing prices

In the following section, we answer two empirical questions. First, we estimate the four elasticities described in Section 2.3 and test whether they are different. Second, we compare the supply elasticity of France with previous studies on the US using similar data and specifications in order to identify the existence of the Transatlantic gap suggested in the literature.

2.5.1 The Short run supply elasticity using a panel estimator

We first turn to the short run supply elasticity which should allow us to estimate the intensive margin supply elasticity using the new price index and test whether it diverges from the intermediate extensive supply elasticity estimated using existing unit prices . We restrict our analysis to 56 Urban Area for which we have enough observations each year in order to compute the yearly new price index and have a balanced panel.

Table 2.3 presents our baseline estimate of the intensive margin supply elasticity (IMSE). Given the reduced sample size, we estimate this equation thanks to the LIML . As we can see, the simultaneity bias generates a strong difference between the 2sls and the OLS estimates as we compare columns (1) with columns (2-4). The instrument used in column (2) is the Bartik type instrument usually used in the literature. As we can see, appears strong¹⁸. The first stages are reported in Table 2.C.1. The second instrument used in column (3) is the number of young people born between 30 and 20 years before the year under scrutiny. This instrument is even stronger¹⁹ and is more specific to each urban area which remove the concern about the collinearity with the time fixed effects. When jointly testing both instruments as in column (4), we cannot reject their joint exogeneity as indicated by the p-value. This is particularly interesting as both instruments exploit very different sources of variation. The main conclusion of this table is that the intensive margin supply elasticity for housing is around 0.9. As we already discussed, such a result is not directly comparable with the previous studies that in in urban economics which tend to estimate the extensive margin supply elasticity. We then compare this result with the supply elasticity with respect to second hand transaction prices that we defined as the intermediate extensive margin supply elasticity (IEMSE).

18. The F-stat is above the adjusted Stock Yogo critical values of 5% in column (2)

19. the F-stat is above the adjusted Stock Yogo critical values of 5%.

	(1)	(2)	(3)	(4)
	ln(construction)	ln(construction)	ln(construction)	ln(construction)
ln(price_new)	0.284*** (0.0892)	0.816** (0.332)	0.995*** (0.284)	0.937*** (0.262)
Year & UA FE	Y	Y	Y	Y
R2	0.278	.	.	.
Obs	1006	1006	1006	1006
N. of UA	56	56	56	56
Bartik	N	Y	N	Y
BirthsT-20	N	N	Y	Y
F-stat		75.33	109.6	65.02
p-value				0.571

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standards error are clustered at the Urban area level. $\ln(price_{new})$ is the price of new units which is instrumented with Bartik instruments (growth of employment predicted from the national sectorial trends) and the number of births twenty years before (BirthsT-20). F-stat indicates the strength of the first stage which can be find in Table 2.C.1, they pass the standards threshold of Stock Yogo test. The p-value indicates that the instruments pass the standard exogeneity test.

Table 2.3: Short run estimates of the supply elasticity

Table 2.4 investigates whether the IEMSE computed using the existing unit price index is significantly different from the IMSE estimated in Table 2.3 . We can remark that the estimation of the IEMSE using existing unit suggests a much less elastic supply. The Chi-2 test for the equality of both coefficient has a value of 98.45,we can thus reject the equality. Similar conclusion is reached when estimating the inverse supply elasticity in Table 2.C.9 in Section 2.C.4. It is worth noting than the first stage shows coefficient much higher for the existing unit price : exogenous shocks have a stronger impact on the price of existing units. The coefficients in the second hand price transaction are always significantly higher. We consider that such result suggests that new housing units and existing units are not perfect substitutes as discussed in Section 2.B. The IEMSE has a value of 0.56 and given the data and the specification used is more directly comparable with the macroeconomic estimates found in Caldera and Johansson (2013) for France. It is of comparable order of magnitude. In order to get estimates comparable with the macroeconomics literature we need to turn to long run inverse supply elasticities using long differences.

	(1)	(2)	(3)	(4)
	ln(construction)	ln(construction)	ln(construction)	ln(construction)
ln(price_new)	0.191*		0.898**	
	(0.101)		(0.354)	
ln(price_old)		0.545***		0.443**
		(0.109)		(0.181)
Year & UA FE	Y	Y	Y	Y
R2	0.272	0.291	.	.
Obs	839	839	839	839
N. of UA	56	56	56	56
Bartik	N	N	Y	Y
BirthsT-20	N	N	Y	Y
F-stat			36.30	220.6
p-value			0.911	0.321

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standards error are clustered at the Urban area level. $ln(price_{new})$ and $ln(price_{old})$ are the prices of new and existing units which are instrumented with Bartik instruments (growth of employment predicted from the national sectorial trends) and the number of births twenty years before (BirthsT-20). F-stat indicates the strength of the first stage which can be found in Tables 2.C.6 and 2.C.8, they pass the standards threshold at 5%. The p-value indicates both instruments pass the exogeneity test. A chi-2 test was run to compare the two elasticities of column (3) and (4) and yields a value of 98.45 rejecting the equality of both coefficients.

Table 2.4: Short run estimates of the supply elasticity with the two index (1998-2013)

2.5.2 The long run inverse supply elasticity using long differences

We now reproduce Saiz (2010) baseline estimates using a long difference over 12 years. The number of unit in our baseline specification is higher because we are less demanding on housing price as we only need to have enough observation for 1999 and 2012. This allows us to increase our sample size.

Table 2.5 presents our estimate of the intermediate intensive margin supply elasticity using the new price index. As in the short run, the simultaneity bias appears to be relatively strong as illustrated the difference between column (1) and (2-4) . Our instruments appear to be strong and pass the standard stock yogo critical value of 5%. The first stage are reported in Table 2.D.1 in Section 2.D.1. We can't reject the exogeneity of the instrument when used together. As we can see, the elasticity with respect to new housing prices is very close to the one estimated in the Section 2.5.1 but still appear slightly higher. In Section 2.D.2 Table 2.D.2 we perform additional robustness checks on this point restricting our sample to the sample of the panel used in Table 2.4 in the previous section . This seems to confirm that the short run elasticity is indeed higher bu first stage are weaker and the elasticity less precisely estimated. We can see that the supply is less elastic when facing long run shocks driving the city to grow on its extensive margin. However the order of magnitude tends to be in line with our interpretation of this elasticity as an intermediate intensive margin supply elasticity.

	(1)	(2)	(3)	(4)
	$\Delta \ln(\text{price_new})$	$\Delta \ln(\text{price_new})$	$\Delta \ln(\text{price_new})$	$\Delta \ln(\text{price_new})$
$\Delta \ln(\text{Units})$	0.636** (0.274)	1.116* (0.573)	1.429** (0.714)	1.230** (0.523)
R2	0.0598	.	.	.
Obs	87	87	87	87
Bartik	N	N	Y	Y
Temperature	N	Y	N	Y
F-stat		25.43	15.89	16.53
p-value				0.660

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

$\Delta \ln(\text{price}_{new})$ is the long difference of new prices. $\Delta \ln(\text{Units})$ is the long difference of the number of units which is instrumented with the Temperature in January and labor market shocks (Bartik). F-stat indicates the strength of the first stage reported in Table 2.D.1, they pass the standards threshold of the cue with limited information at 5%. The p-value indicates that we can't reject the joint exogeneity of the instruments.

Table 2.5: Long Difference estimates of the inverse supply elasticity

We then turn to the intensive margin supply elasticity in Table 2.6. The simultaneity bias appears to be relatively strong as illustrated the difference between column (1) and (2-4) and the instruments are still strong as the first stage is the same as in the previous table. We can't reject the exogeneity of the instrument when used together. This Table suggests that the extensive margin supply elasticity is much lower. We can say that the supply is less elastic when facing long run shocks driving the city to grow on its extensive margin. The order of magnitude is relatively closer to the estimates with respect to existing prices in the short run, this tends to confirm that the short run elasticities with respect to existing unit prices are an intermediate supply elasticity. As already discussed in Combes, Duranton, and Gobillon (2016), the long run elasticity might be considered as an agglomeration cost.

	(1)	(2)	(3)	(4)
	$\Delta \ln(\text{price_old})$	$\Delta \ln(\text{price_old})$	$\Delta \ln(\text{price_old})$	$\Delta \ln(\text{price_old})$
$\Delta \ln(\text{Units})$	0.962*** (0.283)	2.778*** (0.710)	3.339*** (0.932)	3.064*** (0.675)
R2	0.120	.	.	.
Obs	87	87	87	87
Bartik	N	N	Y	Y
Temperature	N	Y	N	Y
F-stat		25.43	15.47	16.53
p-value				0.457

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

$\Delta \ln(\text{price_old})$ is the long difference of existing unit prices. $\Delta \ln(\text{Units})$ is the long difference of the number of units which is instrumented with the Temperature in January and labor market shocks (Bartik). F-stat indicates the strength of the first stage reported in Table 2.D.1., they pass the standards threshold of the cue with limited information at 5%. The p-value indicates that we can't reject the exogeneity of the instruments.

Table 2.6: Long Difference estimates of the inverse supply elasticity with existing prices

Table 2.7 summarizes the difference between the intermediate intensive margin supply elasticity (IIMS) and the extensive margin supply elasticity (EMSE). We can observe that they diverge considerably and are significantly different from one another. This tends to confirm our intuition according to which we are looking at two clearly different concepts and that the IIMS is more related with the developer production costs.

Finally, we can compare the extensive margin supply elasticity (EMSE) with Saiz (2010). In his contribution the inverse supply elasticity estimated for the US metropolitan Area is around 0.6 whereas we find an inverse supply elasticity with respect to existing prices around 3 for the existing unit. We can then confidently conclude that these estimates are line with the idea of the transatlantic gap emphasized in the Macroeconomics literature.

	(1)	(2)	(3)	(4)
	$\Delta \ln(\text{price_old})$	$\Delta \ln(\text{price_new})$	$\Delta \ln(\text{price_old})$	$\Delta \ln(\text{price_new})$
$\Delta \ln(\text{Units})$	0.962*** (0.283)	0.636** (0.274)	3.064*** (0.675)	1.230** (0.523)
R2	0.120	0.0598	.	.
Obs	87	87	87	87
Bartik	N	N	Y	Y
Temperature	N	N	Y	Y
F-stat			16.53	16.53
p-value			0.457	0.660

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

$\Delta \ln(\text{price}_{\text{new}})$ and $\Delta \ln(\text{price}_{\text{old}})$ are respectively the long difference of new and existing unit prices. $\Delta \ln(\text{Units})$ is the long difference of the number of units which is instrumented with the Temperature in January and labor market shocks (Bartik). F-stat indicates the strength of the first stage reported in Table 2.D.1, they pass the standards threshold of the cue with limited information at 5%. The p-value indicates that we can't reject the exogeneity of the instruments.

Table 2.7: Long Difference estimates of the inverse supply elasticity with existing and new prices

2.6 Decomposing the two elasticities

We now try to determine what are the main driver of the supply elasticity on the extensive and intensive margin. The idea of this section is to decompose the elasticities between the parts due to geography and the part due to regulation. This might help us to understand the difference between the supply elasticity with respect two the two indexes, between the extensive and intensive margins and between the US and France.

2.6.1 The intensive margin supply elasticity

We first turn to the short run specification in order to decompose the intensive margin for new housing unit in Table 2.8. Column (1) introduces our measure for the geographical constraint which appears strongly significant. According to the estimate, an Urban Area with a constraint of 100% would then have its elasticity divided by 2, going from 1.6 to 0.8. However, it is worth noting that as we already emphasized, French urban area are actually poorly constrained when compared with the similar measure for the US. In column (2), we introduce an indicator for the % of the Urban Unit concerned by the SRU Act. This Act, forces Mayors to intervene on the housing market in order to increase the share of social housing unit. As already mentioned, we consider this act as exogenous as it comes from a national rules designed according to an arbitrary threshold. All the urban units in our sample are concerned, their degree of concern depends on a legacy of the past : past social housing units built in their area which are mainly a legacy from the 70s. This appears also to decrease significantly the supply elasticity. We add another exogenous measure of regulation in column (3) : the share of area concerned by the historical monuments law. This also enters significantly into the regression

and a small variation of such a zoning appears to have a major impact. Finally, we include the share of developed land instrumented thanks to the population in the urban area in 1911. This never turns significant contrary to the findings of Hilber and Vermeulen (2016). In a last specification, we includes an endogenous indicator of the degree of regulation : the refusal index computed at the urban area level. When instrumented with the share of historical monuments it appears to play an important and significant role. We don't instrument with the SRU act, as on the short run this instrument is weak and not significant on regulation is on the long run when turning it binding because of the social housing sector expansion as illustrated in Chapelle (2015). Such rebates could be compensated on the other sales to the private households. To sum up, both regulation and geography appears to be important drivers of the short run supply elasticity but given the features of the French urban areas , regulation is strongly responsible for the relative inelasticity of the French housing supply.

	(1)	(2)	(3)	(4)	(5)
	ln(construction)	ln(construction)	ln(construction)	ln(construction)	ln(construction)
ln(price_new)	1.609*** (0.455)	2.666*** (0.827)	2.904*** (0.858)	2.912*** (0.873)	5.391*** (2.051)
ln(price_new) x % undevelopable	-0.829** (0.374)	-1.051** (0.463)	-1.208** (0.482)	-1.657** (0.712)	-1.728** (0.703)
ln(price_new) x % SRU		-0.334** (0.156)	-0.319** (0.160)	-0.341** (0.168)	
ln(price_new) x % hist mon			-3.786* (2.056)	-6.065* (3.100)	
ln(price_new) x % developed				1.662 (1.615)	
ln(price_new) x refusals					-0.220* (0.113)
Year & UA FE	Y	Y	Y	Y	Y
R2	.	.	.	.	.
Obs	1006	1006	1006	1006	1006
N. of UA	56	56	56	56	56
Bartik	Y	Y	Y	Y	Y
BirthsT-20	Y	Y	Y	Y	Y
Pop 1911	N	N	N	Y	Y
Hist Mon	N	N	N	N	Y
F-stat	18.08	5.812	4.553	3.437	2.506
p-value	0.299	0.918	0.636	0.948	0.231

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standards error are clustered at the Urban area level. F-stat indicates the strength of the first stage, which pass the Stock Yogo critical value at 5% in the baseline and is then weaker when increasing the number of interaction terms. The p-value indicates that we can't reject the exogeneity of the instruments in any of the specifications. SRU designed the % of the urban unit covered by the SRU Act, % hist mon designed the % of the Urban area concerned by restrictions due to a proximity to an historical monument. % undevelopable is the % of land not developable because under water or with a slope above % percent. % developed designes the share of the urban area already built, it is instrumented with the population in 1911 and is never significant Finally refusal is the average number of refusal in the municipality of the urban area, we instrument this index with the % of area covered by the historical monuments .

Table 2.8: Decomposition of the short run supply elasticity with new unit price

2.6.2 The intermediate extensive margin supply elasticity

We can turn to the decomposition of the elasticity with respect to existing unit price. Geography enters also seems to play an important role as illustrated in column (1) of Table 2.9. So does the % of the urban area covered by the SRU act and the historical monuments regulation. The percentage of land developed still does not seem to play any significant role suggesting that the land constraint is not binding for French urban area. Finally our refusal index still enters significantly and has a strong and negative impact on the supply elasticity. The coefficient on the regulation index appears to be stronger than when looking for the new price index. Part of the bias could come from that regulation is capitalized into the land price of existing unit which benefit from the positive externalities of regulation. Regulation might then accentuate the low elasticity of substitution between both goods increasing the differences between both types of units.

	(1)	(2)	(3)	(4)	(5)
	ln(construction)	ln(construction)	ln(construction)	ln(construction)	ln(construction)
ln(price_old)	0.732*** (0.221)	0.967*** (0.242)	1.255*** (0.281)	1.280*** (0.297)	5.305*** (1.686)
ln(price_old) x % undevelopable	-0.602** (0.290)	-0.550* (0.293)	-0.711** (0.306)	-0.638 (0.428)	-1.268*** (0.408)
ln(price_old) x % SRU		-0.0300** (0.0134)	-0.0284** (0.0135)	-0.0286** (0.0135)	
ln(price_old) x % hist mon			-4.305** (1.704)	-3.825 (2.599)	
ln(price_old) x % developed				-0.323 (1.322)	
ln(price_old) x refusals					-0.352*** (0.127)
Year & UA FE	Y	Y	Y	Y	Y
R2	.	.	.	.	.
Obs	840	840	840	840	840
N. of UA	56	56	56	56	56
Bartik	Y	Y	Y	Y	Y
BirthsT-20	Y	Y	Y	Y	Y
Pop 1911	N	N	N	Y	N
SRU	N	N	N	N	Y
Hist. Mon	N	N	N	N	Y
F-stat	85.89	58.62	42.77	19.57	6.669
p-value	0.116	0.238	0.457	0.482	0.462

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standard errors are clustered at the Urban area level. F-stat indicates the strength of the first stage, which pass the Stock Yogo critical value at 5% in the baseline and is then weaker when increasing the number of interaction terms. The p-value indicates that we can't reject the exogeneity of the instruments in any of the specifications. SRU designed the % of the urban unit covered by the SRU Act, % hist mon designed the % of the Urban area concerned by restrictions due to a proximity to an historical monument. % undevelopable is the % of land not developable because under water or with a slope above % percent. % developed designs the share of the urban area already built, it is instrumented with the population in 1911 and is never significant. Finally refusal is the average number of refusal in the municipality of the urban area, we instrument this index with the % of area covered by the historical monuments and the % covered by the SRU act.

Table 2.9: Decomposition of the short run supply elasticity with existing unit price

2.6.3 The intermediate intensive margin supply elasticity

We now turn to the extensive margin decomposition. Table 2.10 shows the decomposition of the inverse supply elasticity with respect to new housing prices. As we can see in column (1) the % geographical constraint appears important, however when controlling for the percentage of land already developed (instrumented with the population in 1911) as in column (2) it turns not significant anymore. However, when controlling for the level of regulation (we control for endogeneity using the national rules : the percentage of area covered by the SRU act and the historical monuments) as in column (3) it remains significant. When controlling for the geographical constraint, the level of regulation and the percentage of land developed, results are puzzling because the first stage is too weak as illustrated by the F-stat in column (4) we thus run a "horse race" removing the variation of housing units. In such a specification only the share of developable land remains significant. We can interpret such a result as the fact that using new housing prices is still close to an estimate of the production function. On the long run, the main driver of the elasticity might be the technical challenge faced by developers when the city is growing on its extensive margin and has to develop on less productive land parcels with more technical challenges.

	(1)	(2)	(3)	(4)	(5)
	$\Delta \ln(\text{price_new})$	$\Delta \ln(\text{price_new})$	$\Delta \ln(\text{price_new})$	$\Delta \ln(\text{price_new})$	$\ln(\text{price_new})$
$\Delta \ln(\text{Units})$	0.389 (0.475)	-0.186 (0.549)	-2.029* (1.052)	-3.248** (1.378)	
$\Delta \ln(\text{Units}) \times \% \text{ undevelopable}$	1.556*** (0.535)	-0.255 (1.183)	1.527*** (0.533)	2.517*** (0.831)	1.538** (0.661)
$\Delta \ln(\text{Units}) \times \% \text{ Developed}$		12.99* (7.150)		-6.691* (4.044)	-1.466 (3.072)
$\Delta \ln(\text{Units}) \times \text{refusals}$			0.254** (0.113)	0.389*** (0.149)	0.0592 (0.0453)
R2	.	.	.	.	.
Obs	87	87	87	87	87
Bartik	Y	Y	Y	Y	Y
Temperature	Y	Y	Y	Y	Y
N Hotels rooms	N	Y	Y	Y	Y
Pop in 1911	N	Y	Y	Y	Y
SRU	N	N	Y	Y	Y
Hist Mon	N	N	Y	Y	Y
F-stat	12.45	1.419	5.159	1.891	3.508
p-value	0.588	0.931	0.708	0.951	0.344

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standards error are robust. F-stat indicates the strength of the first stage, which pass the Stock Yogo critical value at 5% in the baseline and is then weaker when increasing the number of interaction terms. The p-value indicates that we can't reject the exogeneity of the instruments in any of the specifications. % undevelopable is the % of land not developable because under water or with a slope above 15% percent. % developed designates the share of the urban area already built, it is instrumented with the population in 1911 and is never significant. Finally refusal is the average number of refusal in the municipality of the urban area, we instrument this index with the % of area covered by the historical monuments and the % covered by the SRU act.

Table 2.10: Decomposition of the inverse supply elasticity with new prices

2.6.4 The extensive margin supply elasticity

Table 2.11 shows the decomposition of the inverse supply elasticity with respect to existing housing prices. As in the previous table in column (1) the percentage geographical constraint appears important, however when controlling for the percentage of land already developed (instrumented with the population in 1911) as in column (2) it turns not significant anymore. When only controlling for regulation and the share of undevelopable land, as for the short run, regulation appears more important than when looking at new prices. This is in line with the idea that regulation is distorting the substitutability between new homes and the existing stock. This idea is confirmed by the horse race in column (5) which suggests that the degree of regulation and the share of land developed are much more important than the geographical constraint which turns not significant while it was the only significant variable in the previous table.

	(1)	(2)	(3)	(4)	(5)
	$\Delta \ln(\text{price_old})$	$\Delta \ln(\text{price_old})$	$\Delta \ln(\text{price_old})$	$\Delta \ln(\text{price_old})$	$\ln(\text{price_old})$
$\Delta \ln(\text{Units})$	2.410*** (0.609)	1.228 (0.820)	-2.937*** (1.036)	-0.717 (1.475)	
$\Delta \ln(\text{Units}) \times \% \text{ undevelopable}$	1.205* (0.687)	-2.807 (1.768)	1.247** (0.525)	-0.263 (0.889)	-0.546 (0.827)
$\Delta \ln(\text{Units}) \times \% \text{ Developed}$		28.56*** (10.69)		10.17** (4.327)	11.88*** (3.844)
$\Delta \ln(\text{Units}) \times \text{refusals}$			0.522*** (0.111)	0.289* (0.160)	0.219*** (0.0566)
R2	.	.	.	.	.
Obs	87	87	87	87	87
Bartik	Y	Y	Y	Y	Y
Temperature	Y	Y	Y	Y	Y
N Hotels rooms	Y	Y	Y	Y	Y
Pop in 1911	N	Y	Y	Y	Y
SRU	N	N	Y	Y	Y
Hist Mon	N	N	Y	Y	Y
F-stat	12.45	1.419	5.159	1.891	3.508
p-value	0.392	0.950	0.0585	0.126	0.184

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standards error are robust. F-stat indicates the strength of the first stage, which pass the Stock Yogo critical value at 5% in the baseline and is then weaker when increasing the number of interaction terms. The p-value indicates that we can't reject the exogeneity of the instruments in any of the specifications. % undevelopable is the % of land not developable because under water or with a slope above 15% percent. % developed is the share of the urban area already built, it is instrumented with the population in 1911 and is never significant. Finally refusal is the average number of refusal in the municipality of the urban area, we instrument this index with the % of area covered by the historical monuments and the % covered by the SRU act.

Table 2.11: Decomposition of the inverse supply elasticity with existing prices

In a last exercise we reproduce Saiz (2010)'s specification for France as illustrated in Section 2.F.3. If we take the existing price and compare the estimates with Saiz's results, we can disentangle where does the transatlantic gap comes from. As we already stated when analyzing our results on existing housing prices, most of the difference comes from the role of regulation as the geographical constraint is much lower in France. As in Saiz, the chart in Section 2.F.4 shows a positive correlation between the supply elasticity and housing price variation. When

comparing the US and France, one might say that if the supply elasticity appears important in both countries to understand price dynamics, regulation appears more important in particular when considering the elasticity with respect to the existing unit price which is closer to the concept of agglomeration cost for us.

2.7 Conclusion

In this paper we identified a gap between the macroeconomics and the urban economics literature when considering the housing supply elasticity. Using the distinction between the extensive and intensive margin, we showed that there exists two supply elasticities.

The first one is related with the production cost of developers and should be estimated using short run variation with the price for new units. The fact the same specification using existing unit price yields a different estimates suggest that new and existing units are not perfect substitutes as illustrated in Section 2.B. For France, we found that the supply elasticity is about 0.9 (vs 0.56 when estimated with existing prices) and is strongly influenced by regulation in the short run. Using the new price index in long difference, one can identify also the production function of producers when dealing with the extensive margin. This value is slightly lower than its short run value and seems to be mostly driven by the technical challenges implied by developing land parcels less suited for developments as the geographical constraint appears to be its main significant driver.

The second type of housing supply elasticity is the extensive margin elasticity related to urban growth and should be considered as a cost of agglomeration as in Combes, Duranton, and Gobillon (2016) and estimated using existing unit prices as the existing stock represents most of the households housing expenditures . Our results suggest that the extensive margin elasticity is lower than the intensive one. It is about 0.3 and is mostly driven by the share of land already developed and the degree of regulation while the geographical constraint appears to play a minor role.

Our results can be summarized in Table 2.12:

		Short run	Long run
New price index	Name	Intensive margin	Int. Int. margin
	Value	0.9	0.8
	1st Driver	Regulation	Geography
	2nd Driver	Geography	
Existing price index	Name	Int. Ext. margin	Extensive margin
	Value	0.5	0.3
	1st Driver	Regulation	Regulation
	2nd Driver		% of land developed

Table 2.12: Summary of the estimates of the housing supply elasticities for France

While bridging two streams of the literature this paper opens also new questions. Indeed, suggesting that existing and new homes are actually imperfect substitutes might have implication of the housing price dynamics within a city. For example, one can think that growing city with an important of regulation increasing the difference new and existing unit (for example limiting the development within the CBD) could distort the rent gradient when the city is growing.

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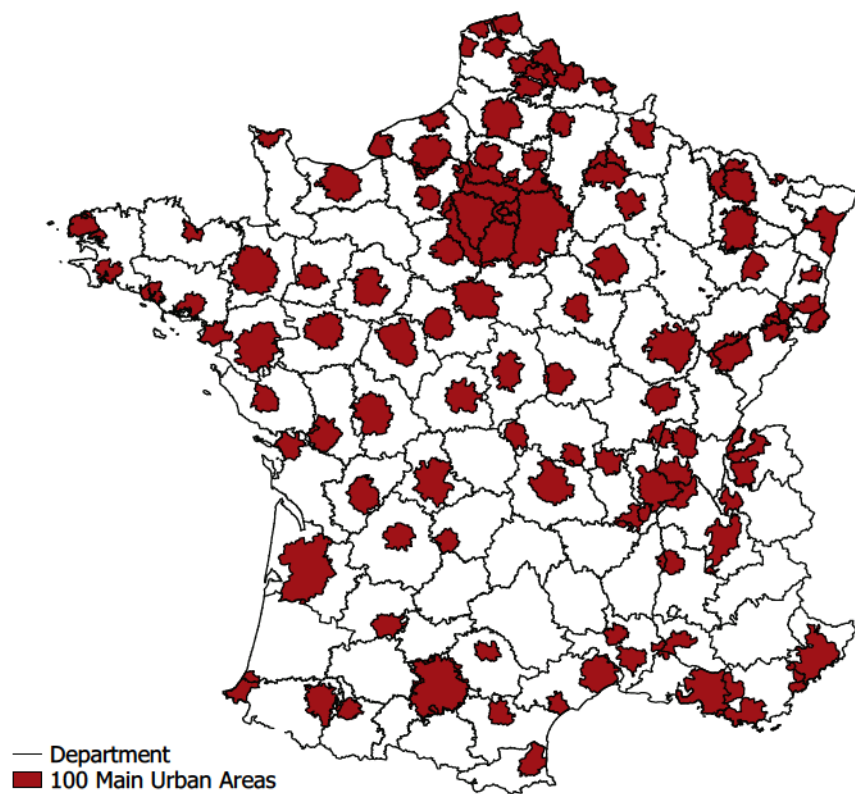
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Appendix

2.A Map of French Departments and Urban Areas



Source : IGN Geofla (c)

Figure 2.A.1: French Departments and the main Urban Areas

2.B Theoretical framework for the intensive margins

As the extensive margin is already well grounded theoretically (see Combes, Duranton, and Gobillon (2016) or Saiz (2010)) we propose to develop a simple framework in order to understand the intensive margin. In this model, competitive producers react to an exogenous short run demand shock. As we consider the demand addressed to the producer, one should account that the housing stock is not uniform, there is the existing stock (O) and there are new housing units (N) usually flats or single units in the suburbs more distant from the CBD and the amenities. As a consequence, the representative household does not consider them as perfect substitutes. We then, represent housing consumption with the following CES utility function where s is the elasticity of substitution between old and new housing units:

$$H = (\alpha N^{\frac{s-1}{s}} + (1 - \alpha)O^{\frac{s-1}{s}})^{\frac{1}{s-1}} \quad (2.11)$$

The representative household budget constraint is :

$$Income = p_O \times O + p_N \times N \quad (2.12)$$

We consider that the existing stock is fixed:

$$O = \bar{O} \quad (2.13)$$

The demand for new housing unit, that is faced by the production sector is then :

$$N = \frac{Income}{p_N + p_O \left(\frac{(1-\alpha)p_N}{\alpha p_O} \right)^s} \quad (2.14)$$

The price for existing units should clear the demand of existing unit :

$$\bar{O} = \frac{Income}{p_O + p_N \left(\frac{\alpha p_O}{(1-\alpha)p_N} \right)^s} \quad (2.15)$$

Here p_N represents the annualized cost of housing paid by the household to the producer whereas p_O represents the annualized cost of housing paid by the household to an absentee landlord. To close the model, we add a competitive production sector for new housing units as in Hilber and Vermeulen (2016). We then just state that the price of new housing units should equate its marginal production cost :

$$p_N = C'(N) \quad (2.16)$$

To illustrate the implications of the imperfect substitutability between new housing unit and the existing stock, we solve numerically and simulate this model. We have three endogenous variables p_O , p_N and N and three equilibrium conditions represented in equation 2.14, 2.15 and 2.16. We set α to 0.5²⁰ and choose O such that $p_N = p_O$ before the shock. We take a simple convex production function with increasing marginal cost for $C(N)$ as in Hilber and Vermeulen (2016). The idea of the simulation exercise is to look how the relative price of existing units with respect to new units varies when there is an exogenous income shock. The model allows to account for the fact that the housing stock can only adjust through the extensive margin : the production of new housing unit. Results are displayed in Figure 2.B.1.

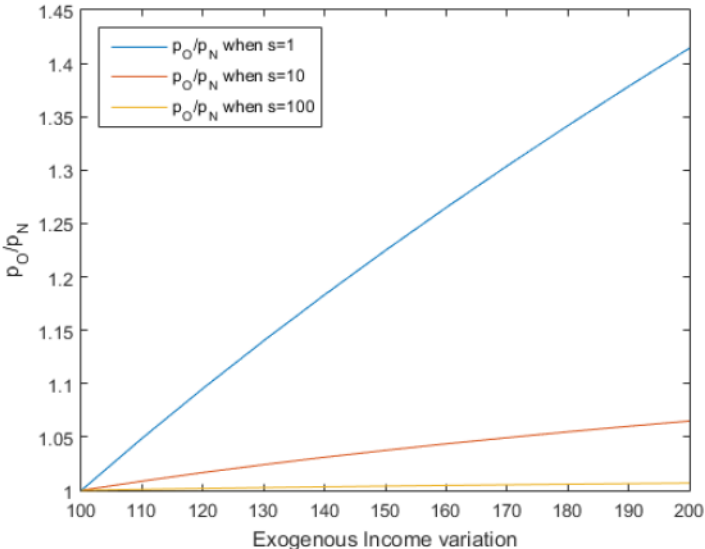


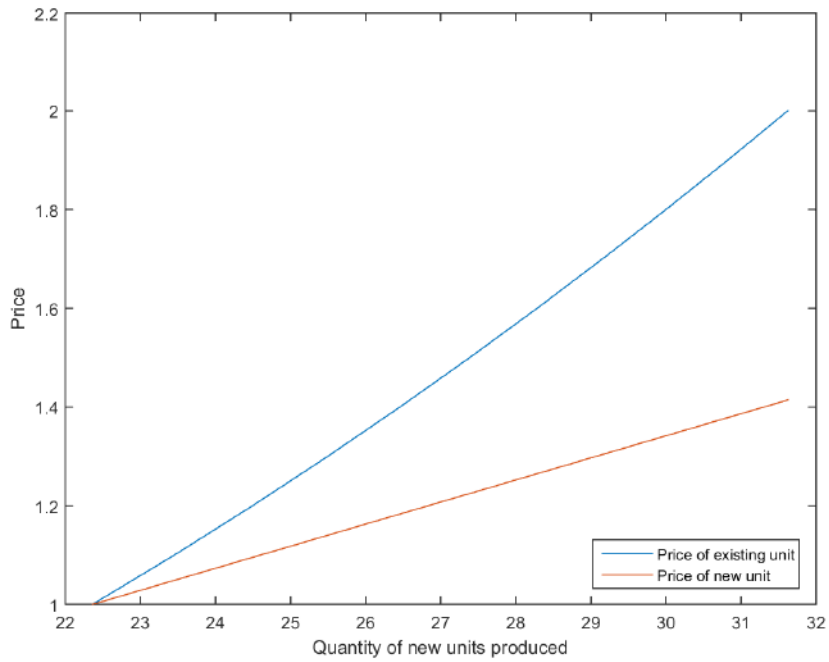
Figure 2.B.1: Impact of an exogenous Income shock on the relative price of existing and new housing units with different elasticities of substitution

The Model is solved numerically with $\alpha = 0.5$, O is determined such that $p_N=p_O$ in an initial step. $Cm = N$. Prices are normalized to one in the first period when income is at its lower level. We depict the evolution of the ratio between the price of existing price with respect to the price of new units when the income of households increases exogenously. The blue line depicts the case where the elasticity of substitution (s) is set to 1 (very inelastic), in the red one s is set to 10 (more substitutable) while the yellow illustrates the case where existing and new units are almost perfectly substitutable ($s=100$)

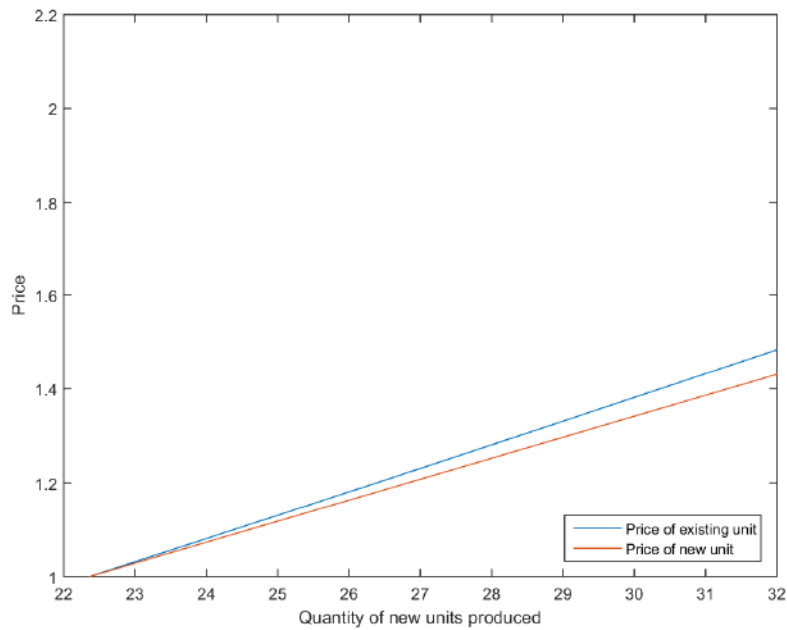
Figure 2.B.2 illustrates our point, in our model, unless existing units and new housing units are perfect substitutes, when representing the relationship between prices and quantities the slope of the relation between old price and the production and new price and the production is not the same. Using existing units price variation is thus likely to bias the estimate of the housing supply elasticity. The fixity of the existing stock combined with the imperfect substitutability between both types of units could suggest a more inelastic housing supply than its true value which is driven by the production function. The resulting bias between estimates

20. results are not sensitive to α

using new price index and old price index can be viewed as the difference between the intensive margin supply elasticity (IMSE) and the intermediate extensive margin supply elasticity (IEMSE).



(a) Bias in the supply equation when $s=1$



(b) Bias in the supply equation when $s=10$

Figure 2.B.2: Displacement along the supply curve resulting from demand shocks and existing unit price variations

The Model is solved numerically with $\alpha = 0.5$, O is determined such that $p_N = p_O$ in an initial step. $Cm = N$. Prices are normalized to one in the first period when income is at its lower level. The blue line shows the supply curve estimated thanks to existing unit price while the red one shows the true relationship between the supply and the demand such that $(p_N = Cm)$. In the top panel the elasticity of substitution (s) is set to 1 (very inelastic) whereas s is set to 10 (more elastic). While the "true" Supply elasticity in which is the relationship between the quantity supplied by the production sector and the price for new units remains the same, the less substitutable both types of unit, the more biased the supply elasticity estimated thanks to existing units prices.

2.C Short Run : robustness checks and first stage

2.C.1 First Stages of the Baselines Estimates

	(1)	(2)	(3)
	ln(price_new)	ln(price_new)	ln(price_new)
Bartik	2.085*** (0.238)		1.152*** (0.266)
BirthsT-20		0.707*** (0.0669)	0.546*** (0.0759)
Year & UA FE	Y	Y	Y
R2	0.950	0.952	0.953
Obs	1006	1006	1006
N. of UA		56	56

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standards error are clustered at the Urban area level.

Table 2.C.1: First stage of the supply equation (new) (1994-2013)

	(1)	(2)	(3)
	ln(price_new)	ln(price_new)	ln(price_new)
Bartik	1.828*** (0.316)		0.768** (0.352)
BirthsT-20		0.704*** (0.0847)	0.602*** (0.0964)
Year & UA FE	Y	Y	Y
R2	0.941	0.943	0.944
Obs	839	839	839
N. of UA		56	56

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standards error are clustered at the Urban area level.

Table 2.C.2: First stage of the supply equation (new)(1998-2013)

2.C.2 Robustness check adding yearly income as control

	(1)	(2)	(3)	(4)
	ln(construction)	ln(construction)	ln(construction)	ln(construction)
ln(price_new)	0.261*** (0.0938)	0.746** (0.373)	1.010*** (0.303)	0.281 (0.180)
ln(income)	0.795** (0.345)	0.415 (0.450)	0.209 (0.422)	0.446 (2.669)
Year & UA FE	Y	Y	Y	Y
R2	0.286	.	.	.
Obs	950	950	950	950
N. of UA	56	56	56	56
Bartik	N	Y	N	Y
BirthsT-20	N	N	Y	Y
F-stat		60.94	99.95	7.434
p-value				0.00690

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

standards error are clustered at the Urban area level.

Table 2.C.3: Short run estimates of the supply elasticity

	(1)	(2)	(3)
	ln(price_new)	ln(price_new)	ln(price_new)
lnrevenue	0.631*** (0.118)	0.716*** (0.114)	0.652*** (0.115)
Bartik	1.899*** (0.241)		0.964*** (0.269)
BirthsT-20		0.674*** (0.0667)	0.540*** (0.0759)
Year & UA FE	Y	Y	Y
R2	0.953	0.955	0.955
Obs	950	950	950
N. of UA	56	56	56

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

standards error are clustered at the Urban area level.

Table 2.C.4: First stage of the supply equation (new) controlling for income (1994-2013)

2.C.3 Robustness Checks using the transaction price index for existing units

	(1)	(2)	(3)	(4)
	ln(construction)	ln(construction)	ln(construction)	ln(construction)
ln(price_old)	0.545*** (0.109)	0.352* (0.203)	0.565*** (0.218)	0.443** (0.181)
Year & UA FE	Y	Y	Y	Y
R2	0.291	.	.	.
Obs	839	839	839	839
N. of UA	56	56	56	56
Bartik	N	Y	N	Y
BirthsT-20	N	N	Y	Y
F-stat		313.5	256.2	220.6
p-value				0.321

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standards error are clustered at the Urban area level. The first stage is the same as the one for new units, it is reported in Table 2.C.8

Table 2.C.5: Short run estimates of the supply elasticity with existing unit price (1998-2013)

	(1)	(2)	(3)
	ln(price_old)	ln(price_old)	ln(price_old)
Bartik	1.828*** (0.316)		0.768** (0.352)
BirthsT-20		0.704*** (0.0847)	0.602*** (0.0964)
Year & UA FE	Y	Y	Y
R2	0.941	0.943	0.944
Obs	839	839	839
N. of UA		56	56

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standards error are clustered at the Urban area level.

Table 2.C.6: First stage of the supply equation (old)(1998-2013)

	(1)	(2)	(3)	(4)
	ln(construction)	ln(construction)	ln(construction)	ln(construction)
ln(price_new)	0.191*	0.856*	0.908**	0.898**
	(0.101)	(0.512)	(0.367)	(0.354)
Year & UA FE	Y	Y	Y	Y
R2	0.272	.	.	.
Obs	839	839	839	839
N. of UA	56	56	56	56
Bartik	N	Y	N	Y
BirthsT-20	N	N	Y	Y
F-stat		32.87	67.62	36.30
p-value				0.911

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standards error are clustered at the Urban area level.

Table 2.C.7: Short run estimates of the supply elasticity with price of new units (1998-2013)

	(1)	(2)	(3)
	ln(price_new)	ln(price_new)	ln(price_new)
Bartik	1.828***		0.768**
	(0.316)		(0.352)
BirthsT-20		0.704***	0.602***
		(0.0847)	(0.0964)
Year & UA FE	Y	Y	Y
R2	0.941	0.943	0.944
Obs	839	839	839
N. of UA		56	56

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standards error are clustered at the Urban area level.

Table 2.C.8: First stage of the supply equation (new)(1998-2013)

2.C.4 Robustness checks estimating the short run inverse supply

	(1)	(2)	(3)	(4)
	ln(price_new)	ln(price_new)	ln(price_new)	ln(price_new)
ln(construction)	0.0371*** (0.0117)	1.225** (0.499)	1.005*** (0.287)	1.068*** (0.295)
Year & UA FE	Y	Y	Y	Y
R2	0.947	.	.	.
Obs	1006	1006	1006	1006
N. of UA	56	56	56	56
Bartik	N	Y	N	Y
BirthsT-20	N	N	Y	Y
F-stat		6.115	12.88	6.786
p-value				0.571

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standards error are clustered at the Urban area level. F-stat indicates the strength of the first stage, they pass the standards threshold of Stock Yogo test at 5% (Births) and 10%(Bartik) . The p-value indicates that we can't reject the exogeneity of the instruments.

Table 2.C.9: Short run estimates of the inverse supply elasticity

	(1)	(2)	(3)
	ln(construction)	ln(construction)	ln(construction)
Bartik	1.702** (0.682)		0.656 (0.778)
BirthsT-20		0.703*** (0.194)	0.612*** (0.222)
Year & UA FE	Y	Y	Y
R2	0.275	0.280	0.281
Obs	1006	1006	1006
N. of UA		56	56

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standards error are clustered at the Urban area level.

Table 2.C.10: First stage (1994-2013)

2.D Long Run : First Stages and Robustness Checks

2.D.1 First Stage of the long difference

	(1)	(2)	(3)
	$\Delta \ln(\text{Units})$	$\Delta \ln(\text{Units})$	$\Delta \ln(\text{Units})$
Temperature	0.0126*** (0.00247)		0.0101*** (0.00259)
Bartik		0.959*** (0.238)	0.598** (0.238)
R2	0.230	0.158	0.282
Obs	87	87	87

Standard errors in parentheses
 * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.D.1: First Stage for the Long Difference estimates of the inverse supply elasticity

2.D.2 Long run estimates on the same sample as the panel

	(1)	(2)	(3)	(4)
	$\Delta \ln(\text{price_new})$	$\Delta \ln(\text{price_new})$	$\Delta \ln(\text{price_new})$	$\Delta \ln(\text{price_new})$
$\Delta \ln(\text{Units})$	0.661** (0.313)	1.156 (0.819)	3.163*** (1.122)	2.726*** (0.853)
R2	0.0752	.	.	.
Obs	57	56	56	56
Bartik	N	N	Y	Y
Temperature	N	Y	N	Y
F-stat		9.094	10.44	7.981
p-value				0.0825

Standard errors in parentheses
 * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.D.2: Long Difference estimates of the inverse supply elasticity (same sample as the panel)

	(1)	(2)	(3)
	$\Delta \ln(\text{Units})$	$\Delta \ln(\text{Units})$	$\Delta \ln(\text{Units})$
Temperature	0.00873*** (0.00284)		0.00640** (0.00285)
Bartik		0.918*** (0.279)	0.713** (0.282)
R2	0.144	0.162	0.231
Obs	56	56	56

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.D.3: First Stage for the Long Difference estimates of the inverse supply elasticity (same sample as the panel)

2.E Estimates of the long run supply elasticity

	(1)	(2)	(3)	(4)
	$\Delta \ln(\text{Units})$	$\Delta \ln(\text{Units})$	$\Delta \ln(\text{Units})$	$\Delta \ln(\text{Units})$
$\Delta \ln(\text{price_old})$	0.125*** (0.0366)	0.360*** (0.0919)	0.299*** (0.0836)	0.326*** (0.0721)
R2	0.120	.	.	.
Obs	87	87	88	87
Bartik	N	N	Y	Y
Temperature	N	Y	N	Y
F-stat		25.46	28.19	21.85
p-value				0.457

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.E.1: Long Difference estimates of the supply elasticity with existing prices

	(1)	(2)	(3)
	$\Delta \ln(\text{price_old})$	$\Delta \ln(\text{price_old})$	$\Delta \ln(\text{price_old})$
Temperature	0.0350*** (0.00687)		0.0247*** (0.00689)
Bartik		3.318*** (0.625)	2.434*** (0.633)
R2	0.230	0.245	0.342
Obs	87	87	87

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.E.2: First Stage for the Long Difference estimates of the supply elasticity (existing units)

	(1)	(2)	(3)	(4)
	$\Delta \ln(\text{Units})$	$\Delta \ln(\text{Units})$	$\Delta \ln(\text{Units})$	$\Delta \ln(\text{Units})$
$\Delta \ln(\text{price_new})$	0.0940** (0.0404)	0.896* (0.461)	0.700** (0.350)	0.813** (0.341)
R2	0.0598	.	.	.
Obs	87	87	87	87
Bartik	N	N	Y	Y
Temperature	N	Y	N	Y
F-stat		3.763	4.247	2.913
p-value				0.660

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.E.3: Long Difference estimates of the supply elasticity

	(1)	(2)	(3)
	$\Delta \ln(\text{price_new})$	$\Delta \ln(\text{price_new})$	$\Delta \ln(\text{price_new})$
Temperature	0.0141** (0.00717)		0.00975 (0.00769)
Bartik		1.370** (0.657)	1.022 (0.707)
R2	0.0424	0.0476	0.0649
Obs	87	87	87

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.E.4: First Stage for the Long Difference estimates of the supply elasticity

2.F Additional information for the decomposition

2.F.1 Short Run : Descriptive statistics

	Mean	Std.Dev.	Obs	min	max
Population	572961.1	1480139.4	56	83374	11173886
N. of Housing units	266793.3	685360.0	56	36782	5173317
% of Land Unavailable (25km)	15.1	18.2	56	0	63
% of Land Unavailable (50km)	19.4	21.1	56	0	72
% of Land developed	12.6	6.1	56	5	33
ln(Refusal Index)	8.2	0.9	56	7	11
% of the UU covered by SRU	43.7	27.5	56	0	100
% covered by the his. Mon. restr.	4.0	1.6	56	1	8

Table 2.F.1: Descriptive statistics (Short run sample)

	Mean	Std.Dev.	Obs	min	max
Population	135110.3	633340.5	355	1724	11173886
N. of Housing units	63232.0	293072.7	355	752	5173317
% of Land Unavailable (25km)	14.0	17.9	355	0	83
% of Land Unavailable (50km)	16.5	18.7	355	0	74
% of Land developed	11.3	7.9	354	2	46
ln(Refusal Index)	6.3	1.2	355	3	11
% of the UU covered by SRU	11.5	23.6	354	0	100
% covered by the his. Mon. restr.	4.4	2.9	354	0	18

Table 2.F.2: Descriptive statistics (All Urban Areas)

2.F.2 Long Run : Descriptive Statistics

	Mean	Std.Dev.	Obs	min	max
Population	411571.6	1197002.0	88	79279	11173886
N. of Housing units	190442.4	554571.2	88	33047	5173317
$\Delta \ln(\text{Units})$	0.1	0.1	88	0	0
$\Delta \ln(\text{price_new})$	0.6	0.1	88	0	1
$\Delta \ln(\text{price_old})$	0.7	0.1	88	0	1
% of Land Unavailable (25km)	13.0	16.5	88	0	63
% of Land Unavailable (50km)	16.8	20.0	88	0	72
% of Land developed	12.1	6.5	88	4	33
ln(Refusal Index)	7.9	0.9	88	6	11
% of the UU covered by SRU	35.6	28.1	88	0	100
% covered by the his. Mon. restr.	4.1	1.7	88	1	11

Table 2.F.3: Descriptive statistics (Long run sample)

2.F.3 Long Run : Reproducing Saiz's (2010) specification for France

	(1)	(2)	(3)	(4)	(5)
	$\Delta \ln(\text{price_old})$	$\Delta \ln(\text{price_old})$	$\Delta \ln(\text{price_old})$	$\Delta \ln(\text{price_old})$	$\Delta \ln(\text{price_old})$
$\Delta \ln(\text{Units})$	3.064*** (0.675)	2.627*** (0.632)	1.982*** (0.500)		
$\Delta \ln(\text{Units}) \times \% \text{ undevelopable}$		1.123 (0.712)	-47.04*** (11.63)	-54.80*** (12.55)	-25.77*** (9.788)
$\ln(\text{Pop}) \times \Delta \ln(\text{Units}) \times \% \text{ undevelopable}$			3.911*** (0.943)	4.596*** (1.021)	2.160*** (0.802)
$\Delta \ln(\text{Units}) \times \text{refusals}$					0.234*** (0.0512)
R2	.	.	.	.	.
Obs	87	87	87	87	87
Bartik	Y	Y	Y	Y	Y
Temperature	Y	Y	Y	Y	Y
N Hotels rooms	N	N	Y	Y	Y
Pop in 1911	Y	Y	Y	Y	Y
SRU	N	N	N	N	Y
Hist Mon	N	N	N	N	Y
F-stat	16.53	9.246	7.721	9.509	4.195
p-value	0.457	0.124	0.430	0.00280	0.377

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standards error are robust. F-stat indicates the strength of the first stage, which pass the Stock Yogo critical value at 5% in the baseline and is then weaker when increasing the number of interaction terms. The p-value indicates that we can't reject the exogeneity of the instruments in any of the specifications. % undevelopable is the % of land not developable because under water or with a slope above 15% percent. % developed designates the share of the urban area already built, it is instrumented with the population in 1911 and is never significant. Finally refusal is the average number of refusal in the municipality of the urban area, we instrument this index with the % of area covered by the historical monuments and the % covered by the SRU act.

Table 2.F.4: Decomposition of the supply elasticity with existing prices (Saiz (2010))

	(1)	(2)	(3)	(4)	(5)
	$\Delta \ln(\text{price_new})$	$\Delta \ln(\text{price_new})$	$\Delta \ln(\text{price_new})$	$\Delta \ln(\text{price_new})$	$\Delta \ln(\text{price_new})$
$\Delta \ln(\text{Units})$	1.230** (0.523)	0.380 (0.475)	0.112 (0.444)		
$\Delta \ln(\text{Units}) \times \% \text{ undevelopable}$		1.538*** (0.535)	-19.34* (10.32)	-18.91* (10.24)	-18.25* (9.776)
$\ln(\text{Pop}) \times \Delta \ln(\text{Units}) \times \% \text{ undevelopable}$			1.695** (0.838)	1.664** (0.833)	1.600** (0.800)
$\Delta \ln(\text{Units}) \times \text{refusals}$					0.0372 (0.0530)
R2	.	.	.	.	.
Obs	87	87	87	87	87
Bartik	Y	Y	Y	Y	Y
Temperature	Y	Y	Y	Y	Y
N Hotels rooms	N	N	Y	Y	Y
Pop in 1911	Y	Y	Y	Y	Y
SRU	N	N	N	N	Y
Hist Mon	N	N	N	N	Y
F-stat	16.53	9.246	7.721	9.509	4.108
p-value	0.660	0.676	0.746	0.863	0.748

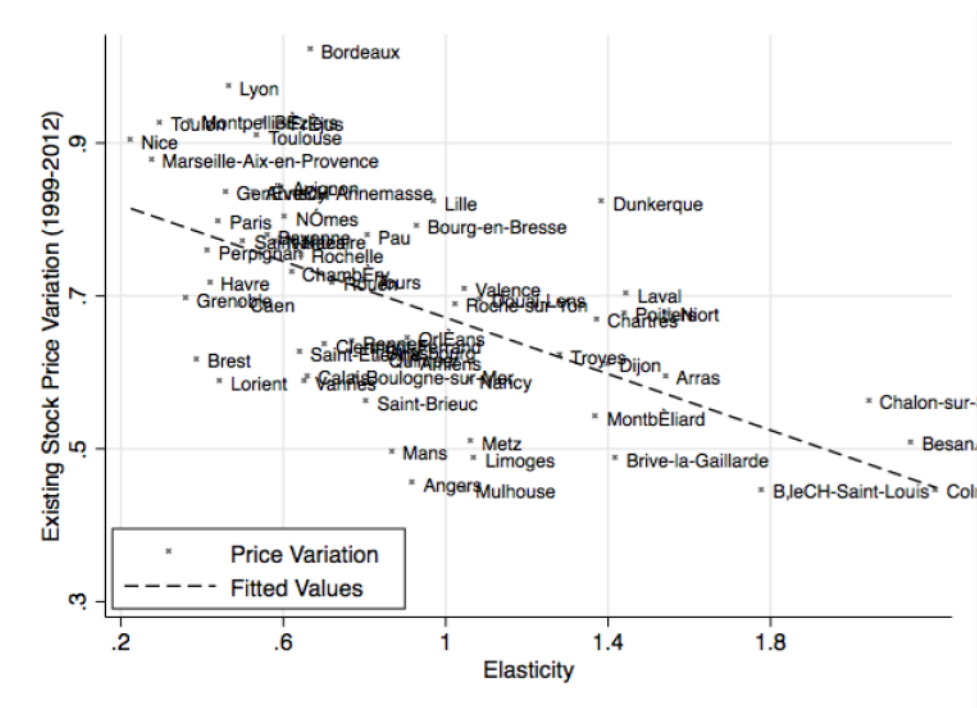
Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

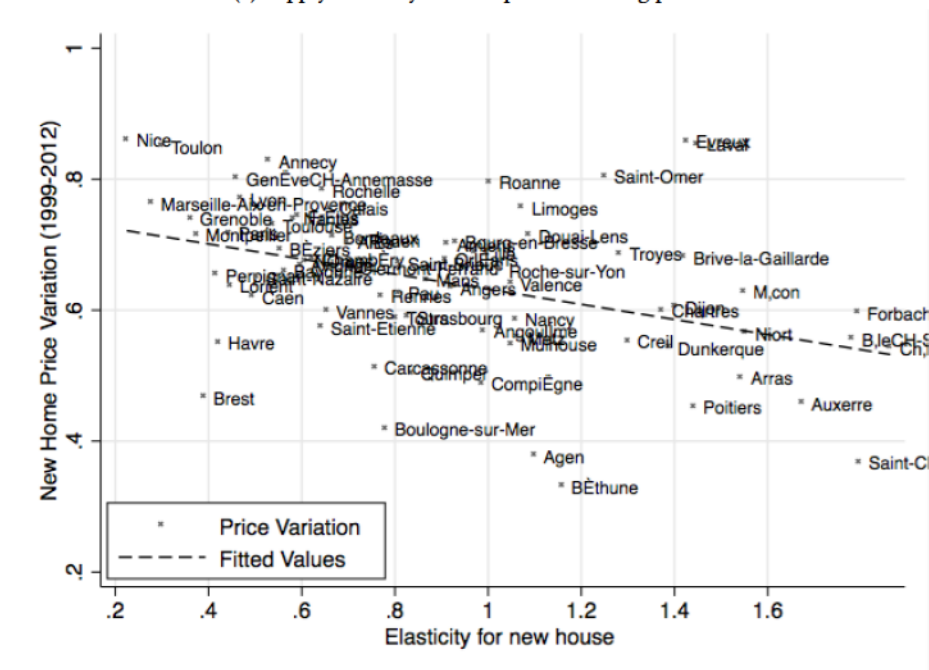
Standards error are robust. F-stat indicates the strength of the first stage, which pass the Stock Yogo critical value at 5% in the baseline and is then weaker when increasing the number of interaction terms. The p-value indicates that we can't reject the exogeneity of the instruments in any of the specifications. % undevelopable is the % of land not developable because under water or with a slope above 15% percent. % developed designates the share of the urban area already built, it is instrumented with the population in 1911 and is never significant. Finally refusal is the average number of refusal in the municipality of the urban area, we instrument this index with the % of area covered by the historical monuments and the % covered by the SRU act.

Table 2.F.5: Decomposition of the supply elasticity with new prices (Saiz (2010))

2.F.4 Correlation between the supply elasticity and housing price variation



(a) Supply elasticity with respect to existing prices



(b) Supply elasticity with respect to new housing prices

Figure 2.F.1: Correlation between the supply elasticity and housing price variation

2.G Robustness check at the department level

	(1)	(2)	(3)
	ln(construction)	ln(construction)	ln(construction)
ln(price_old)	0.901*** (0.202)	0.765*** (0.236)	
ln(price_new)			1.016*** (0.341)
Year & DEP FE	Y	Y	Y
R2	.	.	.
Obs	1439	930	930
N. of DEP	96	62	62
BirthsT-20	Y	Y	Y
F-stat	268.8	180.9	63.14

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Column (1) presents our estimate for all the departments as we have a old price index for all of them, column (2) restricts the sample to the departments for which we have also a price index for new housing units. Column (3) reproduces column (2) but with the new price index. The coefficient for new and old are still statistically different from one another. The difference between column (1) and (2) is easily understandable as the department for which we don't have observations for the new price index are the rural departments more elastic. First stages are reported in Table ??

Table 2.G.1: Short run estimates of the supply elasticity in the French Departments

	(1)	(2)	(3)
	ln(price_old)	ln(price_old)	ln(price_new)
BirthsT-20	0.694*** (0.0421)	0.778*** (0.0574)	0.586*** (0.0731)
Year & DEP FE	Y	Y	Y
R2	0.973	0.973	0.948
Obs	1439	930	930
N. of DEP	96	62	62

Standard errors in parentheses

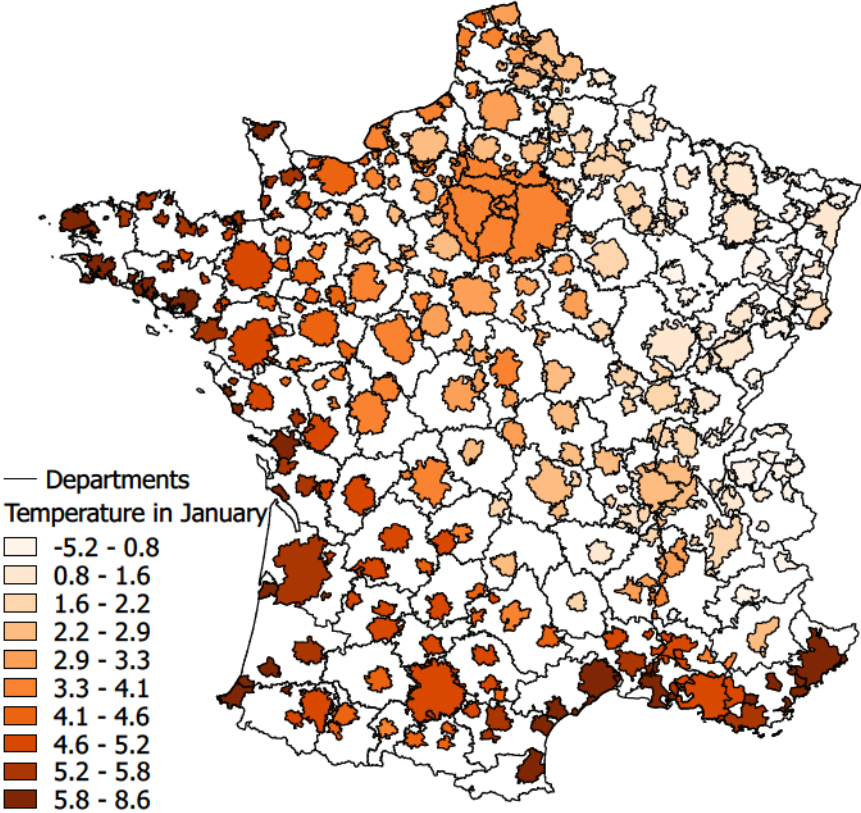
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.G.2: First Stage of the short run estimates of the supply elasticity in the French Departments

2.H Construction of the variables

2.H.1 The temperature in France

We recover the temperature in January at the barycenter of each urban area using the highly precise data compiled in Hijmans et al. (2005) and available online.

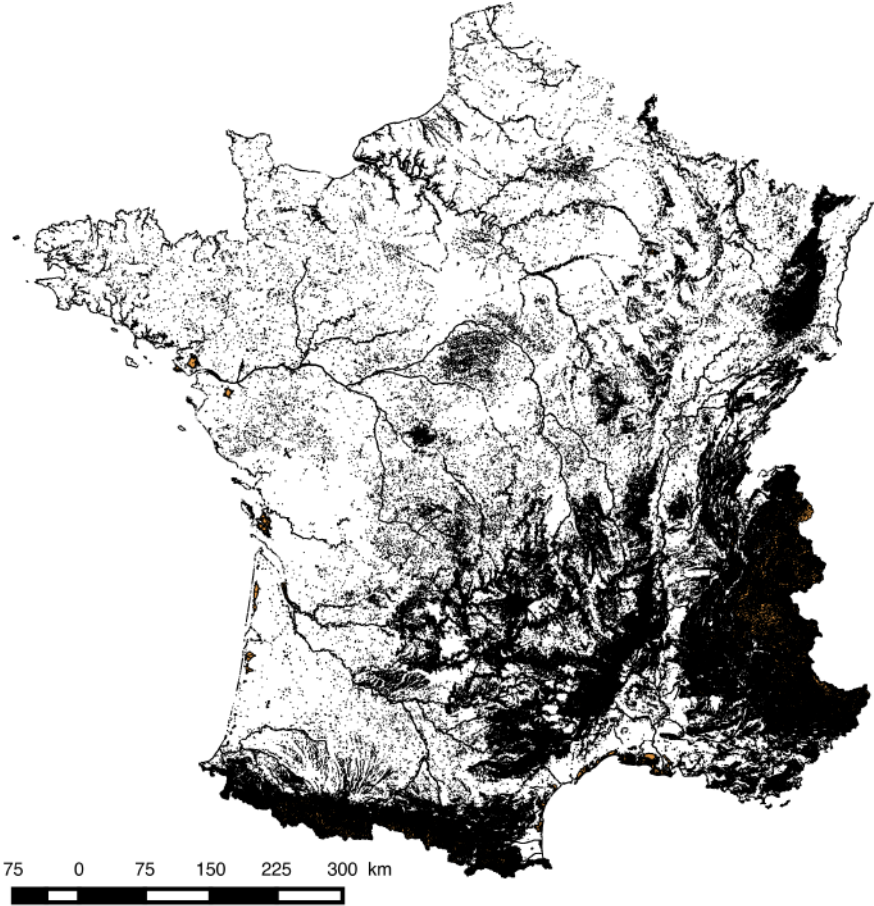


Source : Hijmans et al. (2005)

Figure 2.H.1: The temperature in January

2.H.2 Share of undevelopable land in the Main Urban Areas

As in Saiz (2010) we exploit elevation models computed from the IGN database BD ALTI with a 75m precision (more precise than the previous papers) in order to identify the place where the slope is above 15%. In addition, we use the BD CARTHAGE in order to identify wetlands and water surface. This allows us to build a shapefile describing all the places where constructions can only hardly take place as illustrated in Figure 2.H.2.



Authors' computation from the IGN databases (GEOFLA, BD ALTI and BD CARTHAGE)

Figure 2.H.2: Geographical Constraint in France

Finally we build a shape file corresponding to the oceans surrounding France that we merge with the continental constraint. This allows us to compute the share of unavailable land. We try different ways to compute this constraint using the unavailable continental area on the territory of the urban area or the global constraint (ocean + continental constraint) within a 25km and 50km radius around the barycenter of the Area. We report in Table 2.H.1 the share of undevelopable land for the main French Urban Area.

Urban Area	Alt. Max. (Meters)	Alt. Min. (Meters)	Range	Continental constraint (in %)	Constraint (25km ring) (in %)	Constraint (50km ring) (in %)
Paris	236	9	227	1	1.9	1.1
Lyon	929	145	784	7.9	6	10.5
Marseille- Aix-en- Provence	1148	0	1148	12.2	37	44.8
Lille	107	9	98	.2	1.5	1
Toulouse	523	85	438	1.3	1.3	1.1
Nice	2649	0	2649	56.1	62.9	72.4
Bordeaux	118	0	118	2.3	3.8	4.7
Nantes	101	0	101	4.7	5.3	5.1
Strasbourg	964	120	844	4.4	2.3	8.9
Toulon	827	0	827	21.4	51.1	59.1
Douai-Lens	188	16	172	1.1	.7	.8
Rennes	191	5	186	.7	.6	.4
Rouen	236	0	236	3	.2	.8
Grenoble	2969	176	2793	55.8	56	49.6
Montpellier	641	0	641	8.6	24.3	36.3
Metz	403	150	253	2.4	2.9	2.4
Nancy	541	179	362	2.3	2.2	1.8
Clermont- Ferrand	1465	288	1177	5.6	5.8	8.5
Valenciennes	135	10	125	1	3.4	1.2
Tours	182	37	145	1.4	1.5	1
Caen	334	0	334	.8	14.9	27.7
Orléans	152	78	74	1.5	1.6	1.5
Angers	104	0	104	2.1	2	1
Dijon	636	176	460	4	3.8	2.8
Saint-Etienne	1308	360	948	16.1	17.3	15.2
Brest	179	0	179	1.5	29.3	53.8
Havre	147	0	147	6.2	42.8	44.5
Mans	182	31	151	.5	.5	.3
Reims	276	45	231	.2	.3	.7
Avignon	891	10	881	5	4.6	8.8
Mulhouse	456	221	235	1	7.8	13.7
Amiens	194	6	188	.7	.6	.4

Urban Area	Alt. Max. (Meters)	Alt. Min. (Meters)	Range	Continental constraint (in %)	Constraint (25km ring) (in %)	Constraint (50km ring) (in %)
Béthune	193	14	179	.7	.4	.8
Dunkerque	54	0	54	1.6	2.7	1.6
Perpignan	784	0	784	8.8	30.5	49.7
Limoges	701	172	529	2.2	2	1.8
Besançon	734	189	545	5.3	6.7	5.1
Nîmes	274	1	273	1.4	2.6	14.9
Pau	1848	90	1758	7	4.1	19.8
Bayonne	883	0	883	10.2	42	42.2
GenèveCH- Annemasse	1840	326	1514	20.6	21.6	34.8
Poitiers	187	55	132	.2	.4	.4
Annecy	2338	320	2018	31.6	35.1	41.9
Lorient	158	-1	159	3	34.7	41.4
Montbéliard	836	277	559	6.4	8.4	11.4
Troyes	303	84	219	1.7	1.9	1.2
Saint-Nazaire	70	0	70	20	43.3	44
Rochelle	56	0	56	1.2	42.6	38.2
Valence	1148	93	1055	12.8	19	30.4
Thionville	423	147	276	5	3.1	2
Angoulême	225	20	205	.3	.3	.3
Boulogne- sur-Mer	202	0	202	.9	46	55.5
Chambéry	1845	222	1623	41	40.1	44.5
Chalon-sur- Saône	502	167	335	1.7	1.9	2.4
Chartres	248	106	142	.3	.3	.2
Niort	200	0	200	0	.1	.2
Calais	181	0	181	.8	45.4	54.9
Béziers	204	0	204	4.9	19.8	42.2
Arras	178	42	136	.1	.4	.5
Bourges	348	107	241	.4	.4	.7
Saint-Brieuc	246	0	246	1.6	22.5	26.7
Quimper	286	-5	291	1.6	15.8	42.4
Vannes	154	-1	155	3.3	21.4	31.1
Cherbourg- Octeville	179	0	179	1	42.5	71.8

Urban Area	Alt. Max. (Meters)	Alt. Min. (Meters)	Range	Continental constraint (in %)	Constraint (25km ring) (in %)	Constraint (50km ring) (in %)
Maubeuge	229	83	146	.2	4.6	1.6
Blois	147	56	91	1.5	1.5	1.4
Colmar	1240	175	1065	14.6	20.8	19.3
Tarbes	579	189	390	1.8	11.8	25.1
Compiègne	188	30	158	.9	1.2	.9
Charleville- Mézières	396	132	264	2.2	5.6	2.7
Belfort	1244	331	913	14.1	16.2	16
Roanne	1155	253	902	8.3	7.5	10
Forbach	388	190	198	3.6	2.5	2.6
Saint- Quentin	156	49	107	.4	.5	.5
Laval	199	32	167	.7	.6	.4
Bourg-en- Bresse	681	182	499	3.7	8.7	12.3
Beauvais	236	50	186	.5	.4	.5
Nevers	441	155	286	1.8	1.6	1
Creil	150	23	127	3.1	1.3	1
Roche-sur- Yon	112	5	107	.6	.6	16.6
Evreux	182	26	156	.6	1.1	1.7
Agen	246	30	216	3.7	3.2	1.9
Saint-Omer	211	0	211	.8	.5	13
Périgueux	271	65	206	1.5	1.2	2
Châteauroux	259	107	152	.8	.7	1.4
Epinal	586	280	306	1.1	4.2	10.7
Alés	692	79	613	18.7	25.1	26
Brive-la- Gaillarde	509	82	427	7.2	6.6	7.6
Mâcon	747	167	580	5.3	5.5	6.7
Elbeuf	179	2	177	3.9	4.5	2.2
Albi	526	130	396	4	7.8	11.8
Auxerre	346	81	265	1.5	1	.9
Saint- Chamond	1396	208	1188	32.8	17.2	13.2
Fréjus	616	0	616	24	49.5	58.4

Urban Area	Alt. Max. (Meters)	Alt. Min. (Meters)	Range	Continental constraint (in %)	Constraint (25km ring) (in %)	Constraint (50km ring) (in %)
Bélech-Saint- Louis	831	222	609	3.6	1.8	4.1
Carcassonne	945	52	893	6.7	12	16.9
Dieppe	216	0	216	1.9	36.9	39.8
Vichy	608	234	374	2.9	3.4	4.7
Châlons-en- Champagne	214	72	142	.5	.4	.9

Table 2.H.1: Geographical features of the Main French Urban Areas

2.H.3 Construction of the new price index and scraping of the old price index

We take advantage of the dataset Enquête sur la Construction des Logements Neufs realized by the Statistical Division of the French Ministry for Housing and sustainable development in order to design price index at the urban area. There are two methods used in France to compute price index. Both are based on hedonic regression but go through different steps. We test both in order to insure that the method does not bias our results :

The first method is based on Gouriéroux and Laferrère (2009) and is composed in several steps :

First, the method estimate correction coefficient using an hedonic regression on an estimation stock of transaction. We thus estimate at the beginning of the period the coefficient of this equation for each urban area:

$$\ln(p_i) = \log(p_{0,s}) + \sum_{k=1}^K \beta_{k,s} X_{k,i} + \sum_{a=1}^2 \alpha_{a,s} Y_{a,i} + \epsilon_i \quad (2.17)$$

where $\ln(p_i)$ is the price per square meter of the proeject and the intercept $\log(p_{0,s})$ is interpreted as the price per square meter of the reference good at the beginning of the period. $Y_{a,i}$ is a year dummy, $X_{k,i}$ are the unit characteristics (here the number of rooms, the type of units (flats or single units²¹), the surface of the project, the number of dwellings in the project and the distance from the barycenter). Second, the parameters $\beta_{k,s}$ are recovered and are used in order to correct the value of the transaction in terms of the reference good. We then follow the average price of the reference good for every year in order to build the new price index.

The second method is based on Balcone and Lafferrère (2015). And is simpler, we pool all the observation and estimate a rather similar equation :

$$\ln(p_i) = \log(p_{0,s}) + \sum_{k=1}^K \beta_{k,s} X_{k,i} + \sum_{a=1996}^{2014} \alpha_{a,s} Y_{a,i} + \epsilon_i \quad (2.18)$$

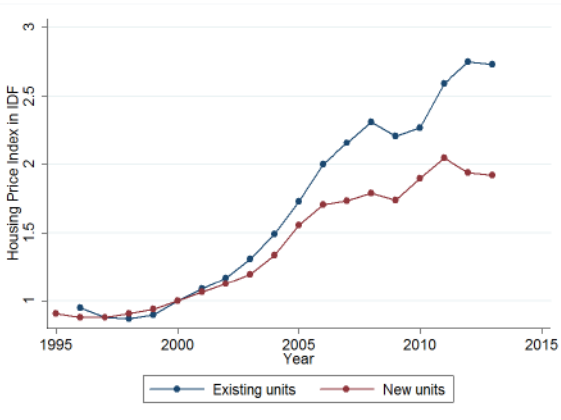
where the $e^{\alpha_{a,s}}$ is the index for each year a with respect to the reference year which is here 1995 (the year dropped). As in Balcone and Lafferrère (2015), we find very close results using both methods.

These models are estimated for each Urban Area where we have enough observations for each year. We thus have 56 Urban Areas for which we have enough observations to compute a yearly index for flats. We conducted some robustness checks including single units the re-

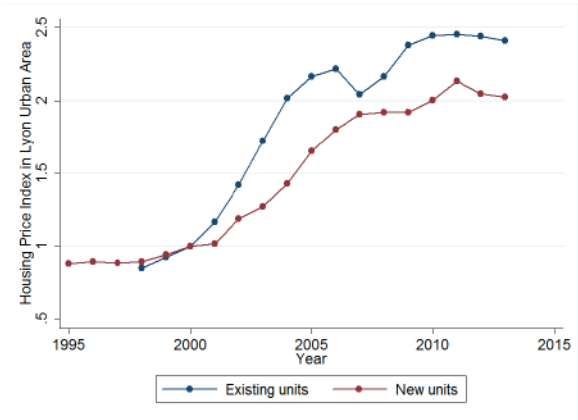
21. In the main table the index is the one for flat only as we have the existing unit price index for flats, including new units does not affect our results

sulting index does not change our results.

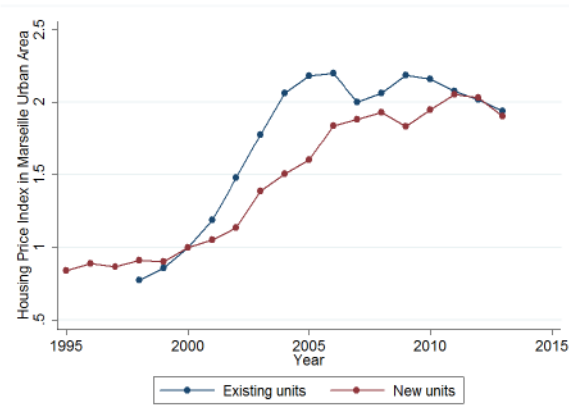
We were also able to recover online the strata-level components of the INSEE-Notaires price index for existing unit transactions for flats. We are thus able to get index covering approximately the urban area and the index for French departments. We can compare the dynamics of new dwellings and of existing dwelling. We thus represent both index for the urban area as illustrated in Figure 2.H.3.



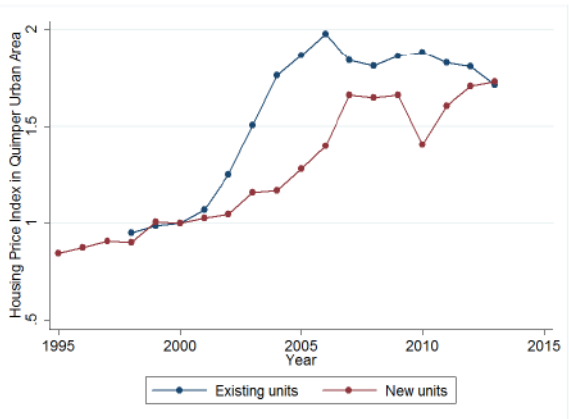
(a) Paris



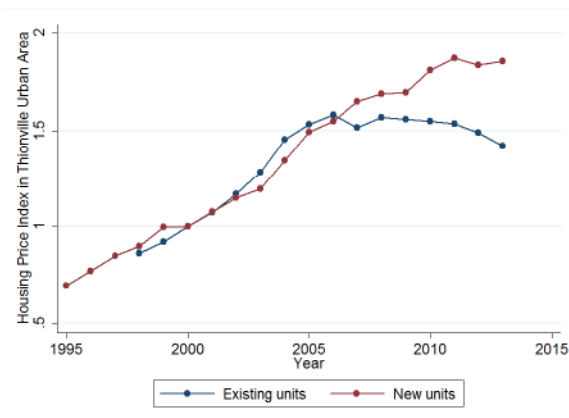
(b) Lyon



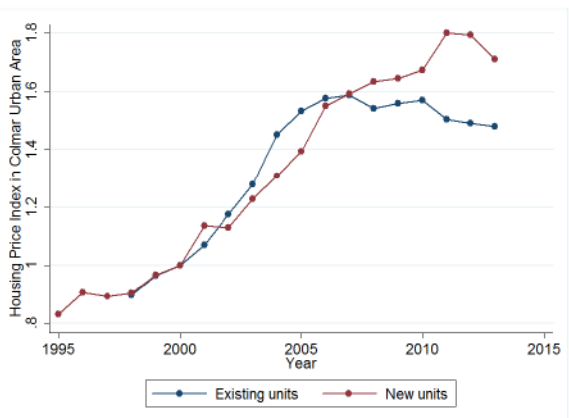
(c) Marseille



(d) Quimper



(e) Thionville



(f) Colmar

Figure 2.H.3: Price series for several Urban Areas

2.H.4 Construction of the Bartik Instrument

We build the bartik instruments thanks to the INSEE dataset on employment categories, which are available for four categories of employment in the census at the municipal level²² and from 5 to 38 categories at Employment Area²³ or Department level ²⁴. We thus build bartik predicting the evolution of the employment in the department or the employment area of the Urban Area under study starting from their initial composition in 1990. Alternate reference years can be taken however, one might think that exogeneity will be strengthened taking the . We illustrate the different shocks in Figures 2.H.4 and 2.H.5. We can clearly see that there has been a major decline of the industrial employments and of agricultural activities while tertiary activities have been constantly increasing. We build two bartiks based on the 5 and 17 sectors illustrated in both aforementioned figures , both are closely correlated and does not change our results.

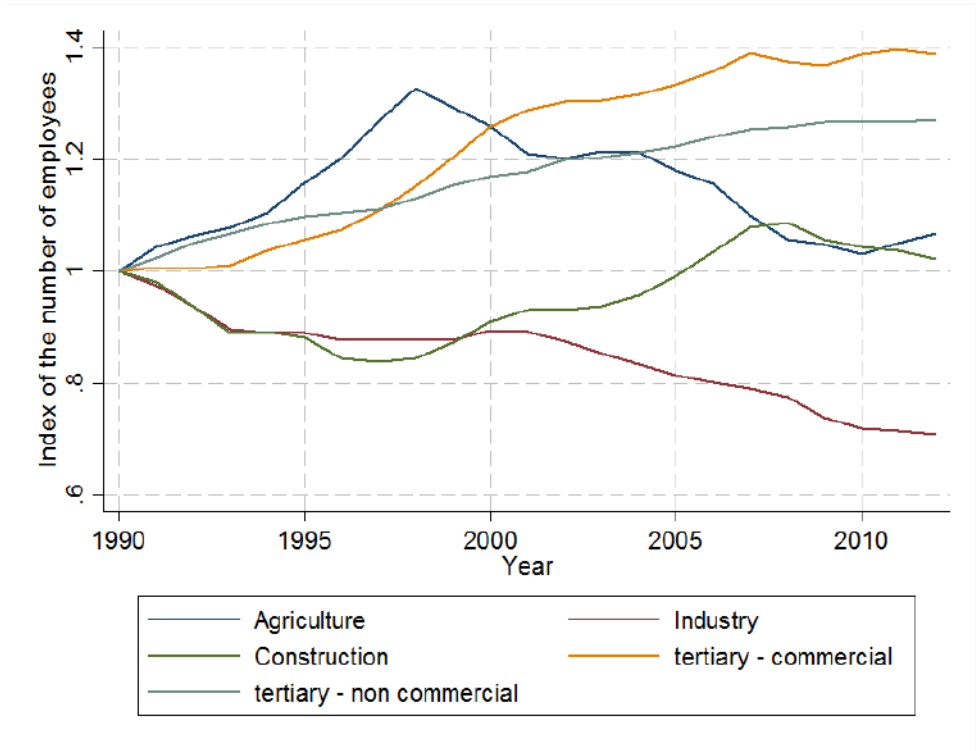


Figure 2.H.4: National Employment shocks : 5 sectors

22. <https://www.insee.fr/fr/statistiques/1893185>
 23. <https://www.insee.fr/fr/statistiques/1893177>
 24. <https://www.insee.fr/fr/statistiques/1409895?sommaire=1409948>

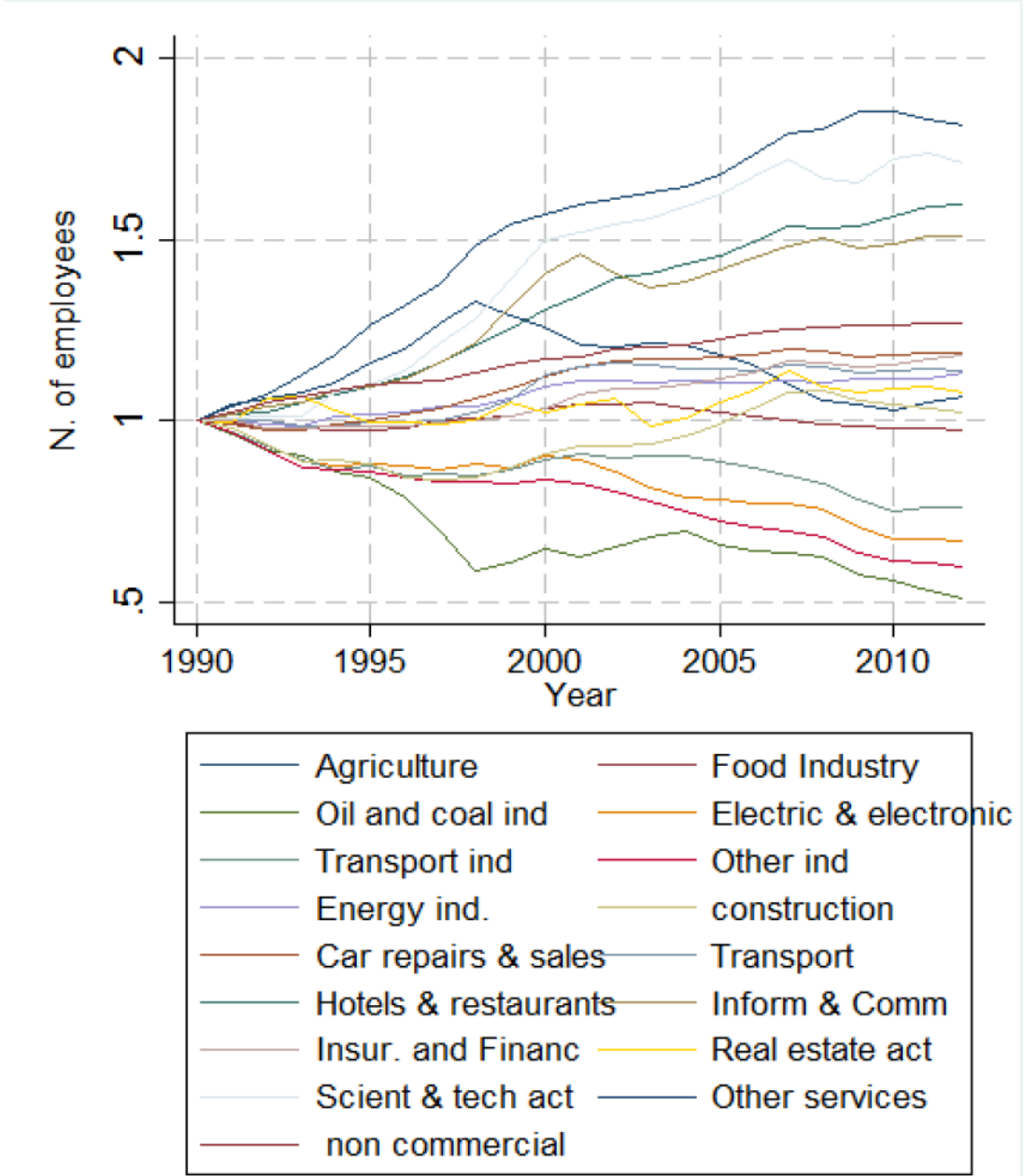
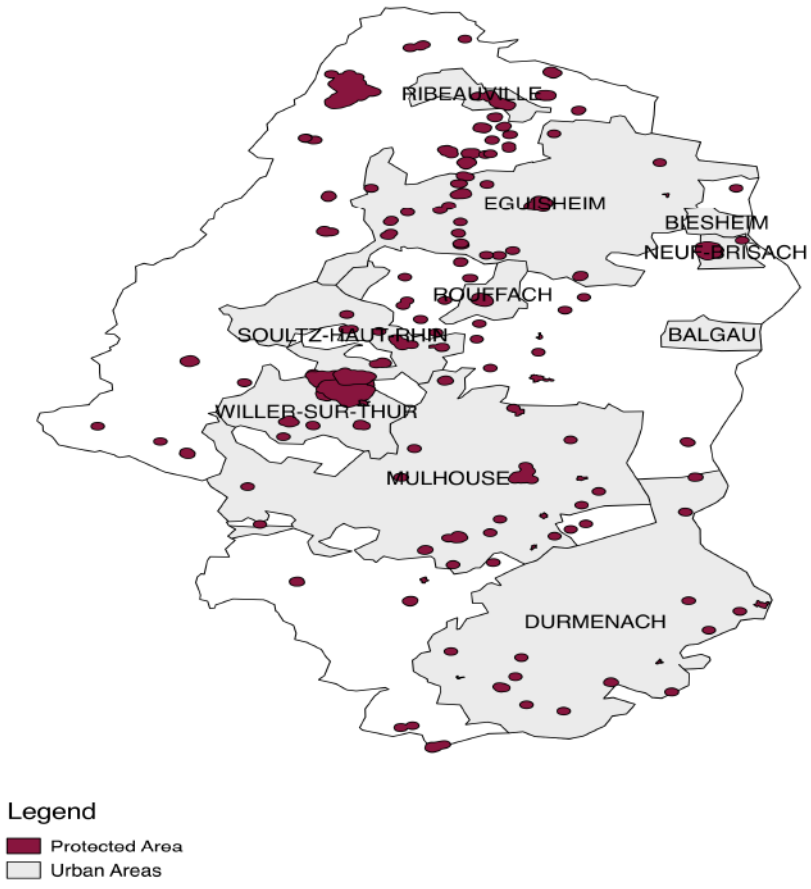


Figure 2.H.5: National Employment shocks : 17 sectors

2.H.5 The historical monuments areas



Authors' computation from wikipedia compared with Bas Rhin Dataset

Figure 2.H.6: Protected Areas around Historical Monuments : the example of Bas Rhin

Chapter 3

The Impact of a housing tax credit : evidence from France

This chapter is jointly written with Benjamin Vignolles and Clara Wolf

3.1 Introduction

In France, total subsidies to the housing sector represents about 40 billions euros (around 2% of GDP), of which support to the rental sector accounts for 71%. Policies that promote rental property investments through an income tax rebate, such as the Scellier Tax Credit (STC), are a continuous and non-negligible part of it. Indeed, the overall fiscal cost of the STC amounted to 2.1 billions euros between 2009 and 2013, and 8 policies of this kind succeeded to one another since 1984.

To benefit from an income tax rebate, the household has to buy a new dwelling between 2009 and 2013 in a municipality eligible to the STC, and commit to rent it under a mandatory rent ceiling for at least 9 years. Moreover, households benefit from a higher tax rebate, if the dwelling is rented to low-income tenants. The STC only applies to part of the territory, the eligible area being divided in 3 areas (A, B1 and B2) according to the degree of tension on the housing market. The rent ceiling is set accordingly with the highest one in A areas, and the lowest in B2 areas.

The STC law was promulgated right after the financial crisis of 2007-2008, in the context of an exceptional housing crisis. The aim was to fight against the increase of unsold dwellings, by boosting demand for new dwellings and reviving housing supply, with the end goal of restoring the equilibrium between housing demand and supply.¹ By imposing rent ceilings and income resource constraints, the STC also has the implicit objective of increasing housing affordability for low-income tenants. Did the Scellier Tax Credit fulfill its objectives? Or was

1. According to the report 3805 of the National Assembly, for the project of the finance law 2012, which makes an assessment of the STC.

the STC a windfall effect for housing developers to build dwellings that they would have built anyway?

To answer these questions, we exploit the geographical variation of the STC in a difference-in-difference framework, to evaluate its impact on the housing stock, the vacancy rate of new dwellings, house prices, and the number and income of new dwellings' tenants, using fiscal data at the housing block level. Indeed, contrary to preceding policies, the STC only applies to part of the territory. In other words, before the STC, the whole territory benefited from policies similar to the STC, whereas after its implementation, non-eligible areas stop benefiting from this kind of policy. Therefore, the areas non-eligible to the STC are our treated groups whereas the eligible B areas constitute our control groups. **To sum up, the STC is the continuation of previous tax credit with some minor changes when looking at the amount and conditions of the subsidy for the areas still concerned (A, B1,B2) but a major change for the areas C which cannot benefit from such subsidies anymore.**

Our paper is related to the literature evaluating place-based policies using fine-resolution data on narrow areas, like Gobillon, Magnac, and Selod (2012) or Neumark and Kolko (2010). This literature puts forward an important trade-off: while treated areas can be more convincingly compared to neighboring areas because of similar unobservable characteristics, such areas are more likely experiencing spillovers or externalities from the policy. The evaluation of the STC is subject to similar challenges, we thus combine Einio and Overman (2016) and Kline and Moretti (2014) approaches, to identify comparable treated and control groups while limiting the influence of the treatment on the control groups. Thus, our second identification strategy is to divide our treated and control areas into 1 km-wide rings from the treatment boundary, to assess the presence of spillover effects, and to be able to estimate the net effect of the policy for comparable areas.

Like the small strand of literature evaluating the impact of the Low Income Housing Tax Credit (LIHTC), a policy similar to the STC in the US (see Malpezzi and Vandell (2002) and Sinai and Waldfoegel (2005)), or the only other paper on the STC (Bono and Trannoy (2012)), our results cast some doubts on the efficiency of the STC.

Indeed, we find that the STC has no impact on the housing stock for similar areas, while it has an inflationary impact on housing prices. The STC increases house prices by 1.75% more in eligible areas compared to non-eligible areas, and by 1% for similar nearby areas. Moreover, the STC increased the vacancy rate of new dwellings by 2 percentage points more in eligible areas compared to non-eligible areas, for areas within 1 and 5km from the treatment border. The number of tenants in new dwellings increases by 16% more in eligible areas but these new tenants do not have a lower income than tenants in non-eligible areas.

We evaluate a local impact, since B and C areas close to the treatment frontier, are mostly located at the periphery of urban areas. However, our results might be seen as an upper bound for the effect on quantities (and a lower bound for the effect on prices), because these areas are believed, according to the Scellier zoning, to have a higher housing supply elasticity than

tenser areas (like A areas). In a nutshell, our estimations suggest that for similar areas on the city fringe, the STC was a pure windfall effect, dwellings built would have been built without the policy. Moreover, its inflationary effect on prices, and positive effect on the new dwellings' vacancy rate, point towards a failure to restore the equilibrium between housing demand and supply in local housing markets. Concerning the low-income housing, the absence of impact of the policy on the income of new tenants, leads us to the conclusion that, such as the LIHTC, the STC failed to provide accommodation to low-income households.

The paper is organized as follows. After presenting briefly the policy in Section 3.2, we review the literature on place-based policy evaluation in Section 3.3. Section 3.4 describes the datasets used in this study, while Section 3.5 provides the details of our identification strategy. Results are provided in Section 3.6 and Section 3.7 concludes.

3.2 Policy overview

In this paper, we propose an econometric analysis of a French tax credit: the Scellier Tax Credit (STC) for rental housing. Such a device, falls under the category of place-based privately owned subsidized projects. Indeed, its aim is to promote rental property investments through an income tax rebate, for taxpayers who own new dwellings from the first of January 2009 until the 31st of December 2012. The law's recipients have to commit to rent their dwellings at least 9 years under a mandatory rent ceiling to tenants satisfying some resources constraints to get the highest rebate.² The STC only applied for one dwelling per owner. The STC can be summarized by the following formula:

$$\text{Annual Tax Rebate} = \frac{1}{9} (0.25 \times \max(P, 300000) + 0.3 \times R \times 1_{\text{intermediate}})$$

where *Annual Tax Rebate* is the amount the taxpayer can deduced from its yearly income tax, P is the price of the new dwellings in euros, R is the total gross rental income received by the dwelling owner, and $1_{\text{intermediate}}$ is a dummy that is equal to one when the dwelling is under intermediate STC. For example, in the most advantageous case, the intermediate Scellier, a 300 000 euros investment translates into a tax rebate of, at least, 111 000 euros.³

It is worth noting that the STC is not the first fiscal device of this kind. Since 1984, 8 tax incentives for rental housing have been succeeding to one another.⁴ The salient fact of the STC, is that contrary to preceding policies, only part of the territory is eligible to the program. This fact is essential to our identification strategy, since the disappearance of the subsidies in some areas will be our main source of identification.

This fiscal device can be seen as the french counterpart of the Low Income Housing Tax Credit (LIHTC) in the US, which has been under the scrutiny of several papers. The main difference between the LIHTC and the STC is that, for the STC, the income limit of the tenant is only mandatory for one type of investment, the intermediate STC, and is not very binding given that more than 70% of the households are eligible.

Such investment schemes are related to low-income rental housing policies which repre-

2. For details on the law, see Section 3.A. See Tables 3.B.1 and 3.B.2 in the Section 3.B, for details on the rent ceilings and the resource constraints.

3. The tax rebate is of 8333 euros per year during 9 years, and 6000 euros per year until the 15th year. If the household keeps renting the dwelling under intermediate Scellier after 9 years, a 2% rate applies until the 15th year. This accounting of the tax rebate doesn't take into account the rebate linked to the gross rent perceived. If the dwelling is rented for 9000 euros per year, there is a supplementary tax rebate of 2700 euros.

4. The Méhaignerie law (1984-1997), the Périssol (1996-1999), the Besson (1999-2002), the Robien (2003-2006), the re-centered Robien and the Borloo (2006-2009), the Scellier (2009-2012), the Duflot (2013-2014), the Pinel (2014 until now). For details on the preceding policies, see Scellier (2008).

sent an important amount of public subsidies.⁵ Rental housing policies are usually divided in two broad categories: project-based assistance where the subsidy is attached to the dwelling unit, and tenant-based assistance where it is attached to the assisted household. Project-based rental assistance is itself divided in two categories: public or social housing,⁶ and privately owned subsidized projects.

The country is divided in 4 areas: A, B1, B2 and C. Only the areas A, B1 and B2 are eligible to the STC. The rent cap varies in the different eligible areas, it is higher in the tense local housing markets, the A areas, and lower for the areas with moderately tense housing markets, the B areas (B1 and B2). The policy zoning was based on municipalities, a municipality is either eligible or not. The spatial distribution of the different areas can be seen on Figure 3.1. According to the 2007 INSEE Census, 38% of the total population live in a non eligible area (C areas), 43% in B areas (21% in B1 areas and 22% in B2 areas) and 19% in A areas. The exact methodology to determine the zoning is unknown, in some administrative notes it is mentioned that the share of household receiving housing allowances and the average rent were taken into account. But the methodology has apparently been lost.

From the first of January to the third of May 2009, the areas were those of the preceding law, the Robien law. However the differences between the Scellier and Robien areas are small, only 1068 municipalities changed zones and none went from being eligible to being non eligible.⁷ Given the short length of the initial zoning, we focus on the extended one. To our knowledge, this zoning is only used for the Scellier Zoning. Alternate policies as subsidized loan or housing allowances adopted a very different zoning and a different time span.

3.3 Literature review

3.3.1 Housing policies

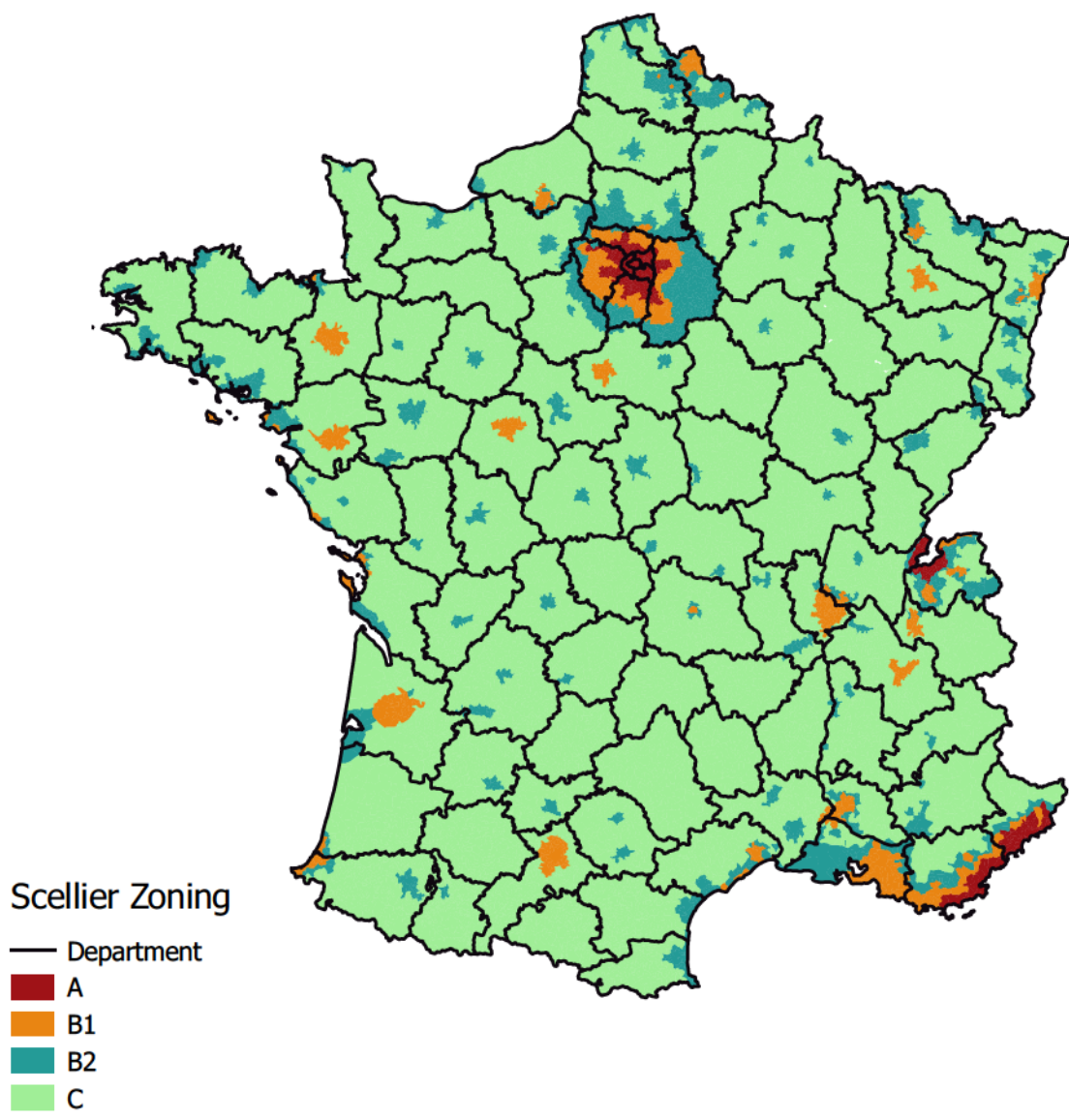
An important stream of the literature on housing policies analyzed the effectiveness of housing policies in the US. Indeed, since the 1970s scholars have been trying to disentangle which housing policy is the best (see Apgar Jr (1990) or Olsen (2003) for an historical review).

The most important debate tried to find whether project-based or tenant-based subsidies

5. The sum of total subsidies to the housing sector represents about 40 billions of euros (about 2 % of the GDP) in France, of which support to the rental sector represents 71% (Compte du Logement 2013). Low-income housing assistance in the US amount to 50 billions of dollars (0.3% of the GDP). Project-based policies account for 70% of low-income rental assistance policies in the US.

6. This category usually refers to a non profit housing sector which is very common in Europe. For example, it represents about 18% of the French housing market or 20% of the UK housing market. See Whitehead and Scanlon (2007) for further details.

7. 720 municipalities went from C to B2, 255 from B1 to B2, 36 from C to B1, 23 from B2 to B1, 18 from A to B1, and 16 from B1 to A.



Source: Authors computations from IGN GEOFLA(R) and French Ministry of Housing. Areas A, B1 and B2 are eligible to the Scellier Tax Credit whereas areas C are not eligible.

Figure 3.1: Scellier Zoning for Subsidies

were more efficient (see Chapelle (2015) for a review). The particular case of privately owned project-based subsidies, such as the LIHTC in the US or the STC in France, has long been set aside, as emphasized by Baum-Snow and Marion (2009), Cummings and DiPasquale (1999), Malpezzi and Vandell (2002) or Bono and Trannoy (2012), while they represent an important amount of public spending.⁸

The main goal of such policies is to boost the residential investment in order to increase the number of rental dwellings proposed to low-income tenants. A simple incidence analysis in an economic framework, as performed in Eriksen and Rosenthal (2010), suffices to highlight a potential caveat of such approach: the capacity of such schemes to increase the number of units available depends on the elasticity of the supply and the demand on the rental market. In other words, such subsidy is likely to generate a potential crowding out effect when the demand is not perfectly elastic areas and the supply not perfectly inelastic. Moreover, it depends also on the elasticity of the land supply on the land market as emphasized in Bono and Trannoy (2012)⁹. The crowding out effect could be considered as a windfall profit when historical investors just adopt the scheme for a project they would have built otherwise, or could be perceived as a substitution effect when some investors (for example, private investors) are replaced by others (such as non profit institutions). In such situations, Bono and Trannoy (2012) suggest that one important channel for such crowding out effect would be the competition for land. The subsidies that are capitalized into land prices, cancel out the impact of the subsidies on additional investments: the additional profit being captured by landowners. Such effects could be reinforced through the competition to attract tenants, in particular when the income ceilings remains fairly high, as it is the case in France where more than 70% of the households can access such units.

In the US, many studies have been documenting such a crowding out effect for the LIHTC. For example, Sinai and Waldfoegel (2005) and Eriksen and Rosenthal (2010) found a very substantial crowding out, usually well above 50% and even close to 100%. Burge (2011) found that tax credit developers capture most of the subsidy that the government provides, by making excess profits and rent-seeking expenditures. In the case of the STC, some observers fear that developers might have an interest to build a dwelling for households attracted by the tax incentive regardless of the demand for rental units.¹⁰ We will address this issue by looking at the vacancy rate of the newly built dwellings in eligible areas.

However, as Malpezzi and Vandell (2002) underline, the crowding out effect does not justify the abandonment of the LIHTC if the policy increases housing affordability for low-income households. Nonetheless, the LIHTC seems to struggle to achieve this objective. For example,

8. According to a DGFIP (Direction générale des finances publiques) report, the fiscal expenditures linked to the STC amount to 2.1 billions of euros between 2009 and 2013.

9. For example, when access to new land parcels is limited, the tax rebate increases the demand for land resulting in a pure price effect if the amount of developable land is perfectly inelastic

10. <http://www.leparisien.fr/oise-60/les-premiers-rates-de-la-loi-scellier-07-02-2012-1849893.php>

McClure (2000) observed that the LIHTC program does not deliver mixed income housing, and Eriksen and Rosenthal (2010) observed that LIHTC serve families with much higher incomes than other housing policies like vouchers.

As far as France is concerned, it is worth noting that the US studies just reviewed, cast some doubts on the potential effectiveness of such policies. Indeed, the housing supply elasticity in France is usually considered much lower than in the US (see Caldera and Johansson (2013) or Chapelle and Eyméoud (2016)). In addition, most of the papers analyzing the impact of tenant-based subsidies documented a strong inflationary impact, tending to confirm such a low elasticity. For example, Grislain-Letrémy and Trevien (2014), Fack (2006) or Laferrère and Le Blanc (2004) demonstrate that housing benefits, which represent the most important public spending in the rental sector,¹¹ have a strong and positive impact on rents. In addition, Labonne and Welter-Nicol (2015) showed that subsidized loans for new homeowners, also generated house price increases. Furthermore, Chapelle (2015) has been documenting an important crowding effect of private construction by the non-profit sector which might be caused by competition for both land and tenants. Finally, on the STC per se, Bono and Trannoy (2012) showed that it has a strong impact on land prices, and thus did increase the competition for land. In this work, we want to contribute to this stream of literature, by investigating the impact of the STC on many dimensions such as the number of housing units, the vacancy rate, the housing price and the number and income of new tenants.

3.3.2 Methods

To assess whether the STC has achieved its underlying goals of providing mixed income housing and increase the supply on local housing markets, we use a quasi-experimental approach to causal inference (see Baum-Snow and Ferreira (2014) and Angrist and Pischke (2008) for a review). These methods use exogenous variations as a means to identify causal impacts of treatments on outcomes of interest. In the STC case, the fact that the policy is only applied to part of the territory is the exogenous variation that we will use.

The methodologies used in our paper build on the previous literature that evaluate the impact of place-based policy using fine-resolution spatial data. The most recent and innovative methods are used in the literature focusing on the impact of enterprise zones (see Neumark and Simpson (2015) or Gobillon, Magnac, and Selod (2012) for a review).

One popular method to assess the impact of such policies, is the Regression in Discontinuity Design (RDD), used for example in Einio and Overman (2016). Such approach is based on a treatment that is determined by the value of a variable X , being on either side of a threshold k . Units with values of X near the threshold k can be considered to be randomly assigned. However, since the Ministry of Housing never published a methodological note about how the Scellier areas were constructed, and which variables were used, a RDD approach is not

11. About 18 billions of euros (43% of the public spending in the housing sector in 2014).

feasible in our case. Alternatively, we follow Bono and Trannoy (2012) and the other strategy used in Einio and Overman (2016) by exploiting the geographical variation of the STC in a difference-in-difference framework.

A major challenge of the literature exploiting geographical variation to evaluate the impact of place-based policies, is to select appropriate control groups. The idea is to select control areas that are similar to treated areas but where the policy was not applied. The most recent research tries to construct reliable control groups by using very detailed geographic information on narrow areas. Neumark and Kolko (2010) and Billings (2009) use maps of respectively the California and Colorado's enterprise zones to pick out a 1000ft wide or a 1/4 mile control ring around the treatment border area. Bono and Trannoy (2012) use the areas B2 (eligible to the STC) contiguous to areas C (non-eligible to the STC). The rationale of choosing control groups that border treatments areas is that economic conditions and unobservable characteristics are likely to be similar, aside from the effects of the policy, between two contiguous areas.

Nevertheless, the previous literature, with the noticeable exception of Einio and Overman (2016), did not take into account the potential displacement effects between the treated areas and their nearby control areas. Inhabitants can move to the treated area because of the policy, and move out from control areas, or in our case, housing developers can build dwellings just across the treatment border to benefit from the STC. To undermine this caveat, Neumark and Kolko (2010) compared results using a 2500 foot control ring instead of a 1000 foot control ring to see if the estimates of the policy's impact are stronger using the larger ring in which spillovers should be weaker. Similarly, they also try to use the 1000 foot control ring but excluding a 100 foot buffer (in any direction) from the treatment area boundary. However, this approach is imperfect since spillovers might come from further away with employers making longer distance moves to take advantage of area benefits.

To account for displacement effects and truly examine the net effect of the STC, we use a method developed in Einio and Overman (2016) examining the distribution of change in the outcomes of interest, by splitting the treatment and control zones into one-km-wide areas based on the distance from the treatment area frontier.

3.4 Data

This paper uses two different datasets: fiscal data on the housing stock and data on housing unit transactions and prices.

3.4.1 Fiscal data

The FiLoCom dataset (for "Fichier des Logements dans les Communes" in French or file of housing units in municipalities) is produced jointly by the French fiscal administration and the French Ministry of Housing. It consists in an exhaustive fiscal census of each housing

unit in Metropolitan France, which is edited on January 1st of every two years since 1995 from households' fiscal declarations (each file contains approximately 34 millions observations). They include information about each housing unit location (at the so-called "section cadastrale" or housing block scale), characteristics (surface, number of rooms and building period), residence conditions (is the dwelling full time or part time occupied? Is it occupied by its owner, rented or vacant? Is the owner private or public?) and resident themselves (the number of residents, their marital status, their ages and income level). However, they contain no information on prices or transactions.

3.4.2 Data on dwelling transactions

The data is collected by the French solicitors (the so-called "notaires"), who, in France, enact housing unit transactions. However, they are not exhaustive because the collection of the data is not compulsory and of variable quality. A re-weighting of the observations is constructed at the so-called French department scale from a confrontation of these data with fiscal ones on dwelling transactions, which are exhaustive but exist only at this aggregated geographic level. This re-weighting is used notably by the national French statistic institute (the so-called INSEE) to produce the French residential property prices index. Indeed, the data contains information on second-hand dwelling prices, location, transaction date and characteristic more complete than those contained in the fiscal data (information on housing characteristics includes furthermore number of bathroom, cellars, balconies, parking and the land surface for houses). All these variables are used to compute hedonic prices, as if all housing units had the same characteristics, in order to make them comparable to one another. We have to signal that the exact surface is missing for about one third of the apartments and half of the houses, so they have been imputed with the fiscal data previously presented, by computation of the mean surface at the housing block level with the same characteristics (using this method to impute existing surfaces and regressing it on their imputations give respectively R^2 of 55 percents for houses and 75 percents for flats).

3.4.3 Units of observation

While most of the previous studies on housing market policies have been using municipal data (Bono and Trannoy (2012), Gobillon and Vignolles (2016) or Chapelle (2015)), or Iris Data (Baumont et al. (2004)), we take advantage of the high precision of our dataset to assess the policy using new units of observation: fiscal sections from the French cadastre. These units are small and relatively homogeneous blocks. Some minor alterations were brought to take into account for some changes in their limits, by splitting or merging sections over the period.

We use a GIS software to compute the minimum distance between the border of these units of observation and the closest frontier between a B and a C area.

3.5 Empirical Strategy

3.5.1 The difference in difference framework

The general framework of our study is the potential outcome framework developed by Rubin (1973, 1977) and Neyman, Dabrowska, Speed, et al. (1990). The Difference-in-Difference (DiD) approach is a research design for estimating causal effects, it is widely used in the literature to estimate the effects of a policy that do not affect everybody at the same time and in the same way.

Capital letters represent random variables, and small letters are realizations of those variables. We denote Y_i the outcome of interest for the housing block i . Z_i is a dummy equals to one if the unit belongs to the treated group (C areas), and is zero otherwise. T_i is a dummy equals to one for the post-treatment period (after 2009), and 0 for the pre-treatment period. Y_i^1 is the outcome of interest for the treated groups, everything else equal, reversely Y_i^0 is the outcome of interest for the control groups, everything else equal. In the post-treatment period ($t = 1$) for the treated group ($z = 1$), $Y_i^1 = Y_i$, we observe the outcome for the treated after the application of the treatment, but we do not observe the counterfactual value of the outcome for the control groups if they had been treated (i.e. we do not observe $Y_i^0|z = 1$). Reversely, if $z = 0$, we do not observe the outcome of interest of the treated if they had not been treated ($Y_i^1|z = 0$). The observable outcome is :

$$Y_i = (1 - D_i)Y_i^0 + D_iY_i^1$$

where $D_i = Z_iT_i$ is a treatment dummy equals to one for treated groups in the post-treatment period. The conditional average treatment effect is:

$$\begin{aligned} \hat{\delta} = & \{E[Y_{it}|X_i = x, Z_i = 1, T_i = 1] - E[Y_{it}|X_i = x, Z_i = 1, T_i = 0]\} \\ & - \{E[Y_{it}|X_i = x, Z_i = 0, T_i = 1] - E[Y_{it}|X_i = x, Z_i = 0, T_i = 0]\} \end{aligned}$$

or the difference in the conditional differences over time between the treated and control units.

3.5.2 The choice of a counterfactual: comparing B and C areas

The fundamental problem of causal inference is that we cannot observe both Y_i^0 and Y_i^1 simultaneously for any given unit, as highlighted by Holland (1986). To assess the impact of the STC, we consider that the fact that C areas stop benefiting from fiscal incentive for rental investment similar to the STC, is the treatment. The goal of the identification strategy is to find a convincing counterfactual for these areas. We thus exploit the fact that B areas, that continues to benefit from the tax incentive, have relatively close characteristics to C areas. On the other hand, A areas which are considered too dissimilar, are excluded from the analyses, because they include metropolitan areas such as Paris and its surroundings, which present a

high level of market tightness. We will first realize a simple difference-in-difference estimate, taking the whole areas B and C respectively, as control and treated groups. We thus estimate equation (3.2) on the sections belonging to areas B and C for the volume of construction, the number and income of tenants, and the vacancy rate of new dwellings:

$$Y_{it} = \lambda_i + \mu_t + \delta^{tr} D_{it} + \beta X_{it} + \epsilon_{it} \quad (3.1)$$

where Y_{it} and X_{it} are respectively the outcome variable and the controls for the housing block i at time t . λ_i is the housing block fixed effect and μ_t is the time fixed effect. For the controls, we take their values in 2005, i.e. before the beginning of the treatment, interacted with time dummies to be able to control for them despite fixed effects. It is particularly important to control for the features of the housing stock in the initial period since their contemporaneous changes would be collinear with the treatment. In addition, we control for the contemporaneous average household income and surface per inhabitant. δ^{tr} is the estimated treatment effect, D_{it} is taking value one when the section is treated in the post-treatment period i.e. when the STC is implemented and C areas stop benefiting from subsidies. Housing blocks belonging to the same urban areas could be affected by the same shocks, introducing a potentially time-varying urban area component in ϵ_{it} . Following Angrist and Pischke (2008) and Bertrand, Duflo, and Mullainathan (2004), we cluster the residuals by urban areas to allow for maximum flexibility in the variance-covariance matrix of residuals.

An alternate specification in long difference over 4 year periods is also adopted following Gobillon and Vignolles (2016):

$$\Delta Y_i = \delta^{tr} G_i + \beta X_i + \epsilon_i \quad (3.2)$$

Where X_i is a set of control at the beginning of the period. G_i is a dummy that is equal to one when the housing block belong to the treated groups, and 0 otherwise.

As far as housing prices are concerned, we apply this identification strategy in an hedonic regression framework, following Rosen (1974), that we adapt to the difference in difference estimator. We regress the log of the price $\ln(p_{j,t})$ of transaction j at time t on a set of hedonic characteristics (X_j), a city fixed effect ($\theta_{k(j)}$), a year fixed effect (μ_t) and a treatment indicator (D_{jt}) with value one when the transaction took place in the unsubsidised area after the first of January 2009. We thus estimate the following equation:

$$\ln(p_{j,t}) = \theta_{k(j)} + \mu_t + \delta^{tr} D_{jt} + \beta X_{jt} + \epsilon_{jt} \quad (3.3)$$

3.5.3 The common trend assumption

To be able to identify the average treatment effect, several assumptions must hold. The first one, is the fact that in the absence of treatment both treated and untreated units should have

evolved along the same temporal path. To give credit to this parallel trends assumption, we will perform placebo tests estimating equations (3.2) and (3.3) until the 1st of January 2009, and considering that the placebo treatment could have started in 2005 or 2007 for equation (3.2), or in 2008 for equation (3.3). We consider that the common trend assumption is indirectly satisfied if the treatment dummies for the pre-treatment periods are not significant.

3.5.4 Exploiting the distance to deal with the the conditional treatment unconfoundedness

For any unit, the potential outcomes must be independent of treatment assignment once we condition on observed covariates X i.e. $Y_i^0, Y_i^1 \perp\!\!\!\perp Z_i | X_i$. This assumption is sometimes called the conditional treatment ignorability or unconfoundedness. We will thus control for observed characteristics of each section as we do with X_{it} in equations (3.2) and (3.3), in which we also include temporal common shocks within urban areas or within rings.

As emphasized by Neumark and Kolko (2010) and Duranton, Gobillon, and Overman (2011), using control groups close to treatment groups could be an interesting strategy to deal with the unobserved characteristics that could vary between C and B areas.¹² The idea is that unobserved area characteristics affecting the outcomes vary smoothly across nearby locations, because they are at equal distance of amenities, share the same local labor market, experience the same shocks etc. Duranton, Gobillon, and Overman (2011) underline that the unconfoundedness assumption is more likely to hold the smaller the distance is between treated and control groups.

Following Bono and Trannoy (2012), we can re-estimate equations (3.2) and (3.3) restricting our sample to the sections or the transactions 5 km around the border. However, we should first verify that the single unit treatment value assumption (SUTVA) holds, and adopt a buffer area, in the spirit of Kline and Moretti (2014), around the frontier if not. It is worth noting that the population density tends to decrease around the frontier while the share of homeowners increases. Such patterns are accounted for when controlling for the observed characteristics.

3.5.5 The importance of the SUTVA assumption in spatial econometrics

The last assumption of particular importance is the SUTVA, according to which there should not be interference or spillover effects between treated and control groups. In other words, the treatment should not affect the outcome of the control group. This problem is of particular importance in spatial econometrics, given that spatial spillovers are really likely to arise: developers could easily displace a project to another municipality in order to benefit from the

12. In the absence of treatment, the outcome of the treated and control groups would have been different because of these unobserved characteristics which would invalidate the conditional treatment ignorability.

subsidy. We clearly see a trade-off arising when using our geographical approach: adopting areas closer to the border as control and treatment groups, increase the comparability between both groups, but also the likelihood to violate the SUTVA assumption.

If there is a substitution effect at the border, the average treatment effect estimated is biased. To avoid this issue, one solution applied in Kline and Moretti (2014) is to drop the nearest untreated locations from the control group. However, concerning the STC, the choice of which range of control groups to drop would be totally arbitrary. As a consequence, we chose to follow Einio and Overman (2016) in their non parametric approach, by interacting the treatment with ring dummies. Our treatment effect will be the effect with respect to a reference ring. To assess whether there are spillover effects between B and C areas near the Scellier area border, we augment equation (3.2) with dummy variables for 1 km wide control and treatment rings that run parallel to the Scellier boundary. The equation estimated becomes:

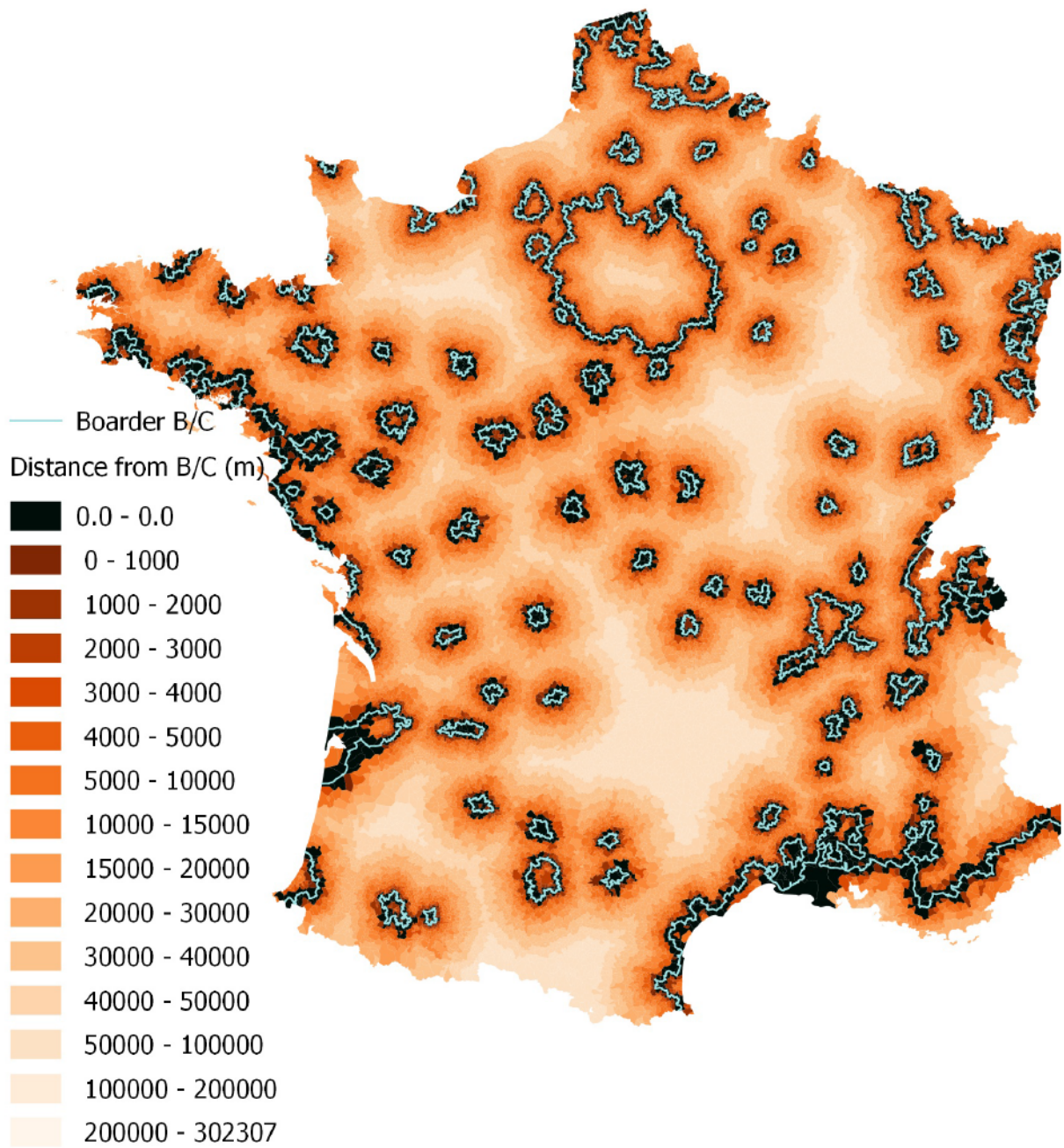
$$Y_{it} = \lambda_i + \mu_t + \sum_{k=1}^{25} \delta_k^{co} CO_{it}^k + \sum_{h=1}^{25} \delta_h^{tr} TR_{it}^h + \beta X_{it} + \epsilon_{it} \quad (3.4)$$

where Y_{it} and X_{it} are respectively the outcome variable and the controls as before. CO_{it}^k are the set of 25 one-km-wide control ring dummies, they are equal to one if the distance to the Scellier area border (i.e. the distance to the nearest treated housing block) is between $k - 1$ and k kilometers in the post-treatment period, and zero otherwise. Symmetrically, we define TR_{it}^h the 25 treatment ring dummies. We represent the rings in Figure 3.1. We restrict our sample to housing blocks 25 km far away from the STC frontier at the maximum, which represent 74% of the B and C areas (see Table 3.C.1 in Section 3.C).

Equivalently, this gives for housing prices:

$$\ln(p_{j,t}) = \theta_{k(j)} + \mu_t + \sum_{k=1}^{25} \delta_k^{co} CO_{it}^k + \sum_{h=1}^{25} \delta_h^{tr} TR_{it}^h + \beta X_{jt} + \epsilon_{jt} \quad (3.5)$$

In equations (3.4) and (3.5), $\delta_h^{tr} - \delta_k^{co}$ is the difference in the average conditional growth rate for the outcome of interest between treatment ring at distance h and control ring at distance k . However, this difference identifies the treatment effect of the STC only if the unconfoundedness and the single unit treatment value assumption (SUTVA) hold. Nevertheless, as underlined in Section 3.5.4, the unconfoundedness assumption is more likely to hold the closer from the treatment border if characteristics vary smoothly across space. Yet, displacement effects are more likely to increase the closer to the border. For example if the treatment effect is negative, evidence of displacement would be seen if $\delta_k^{co} - \delta_h^{tr}$ is higher near the border, δ_k^{co} would decrease and δ_h^{tr} would increase further away from the frontier if the displacement effect is only present around the border.



Authors computations from IGN GEOFLA(R) and French Ministry of Housing

Figure 3.1: Distance from B/C Boarder

3.6 Results

3.6.1 The impact of the STC on the housing stock

Firstly, we investigate the impact of the STC on the housing stock. Is it a windfall effect? In order to answer this question, we study the impact of the policy on the log of the private housing stock at the housing block level.

Our empirical strategy relies on the fact that C areas which were eligible to all the preceding similar policies (because they applied to the whole territory), stop being eligible to the tax incentive for rental housing policies with the implementation of the STC. C areas are the treated groups and B areas are the control groups. We expect that housing supply will decrease in C areas because housing supply is no longer subsidized.

	Placebo				STC	
	2005-2009		2007-2009		2009-2013	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	-0.003 (0.004)	-0.006 (0.004)	-0.003 (0.004)	-0.005 (0.004)	-0.008 (0.006)	-0.012** (0.006)
Controls	No	Yes	No	Yes	No	Yes
Observations	659244	656802	659244	656802	1099251	1094721
No. of sections	219935	219009	219935	219009	220176	219060
R^2 within	0.15	0.15	0.15	0.15	0.18	0.19
Estimation Period	2005-2009				2005-2013	

Note: In this panel fixed-effects regression, the dependent variable is the log of the stock of private housing. The treatment variable is the interaction between a group dummy (equals to 1 for the treated group, 0 otherwise) and a time dummy (equals to 1 for the post-treatment period, 0 otherwise). Time fixed effects are included for all the regressions. Controls include the household revenues, the share of owners, the number of dwellings, the average square meters per person, the share of apartments, the share of dwellings built between 1949 and 1970. All the controls are for 2005 except the household revenues and the average square meters per person which are contemporaneous. The standard errors are clustered by 1999 urban areas.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.

Table 3.1: Impact of the STC on the Housing Stock

Our preferred specification is in column (6) of Table 3.1, where the treatment is the implementation of the STC in 2009 and where we control for several characteristics of the local housing market.¹³ Indeed, as observed in Table 3.C.3, B and C areas have different characteristics, B areas are more densely built, with richer households, more flats occupied by private

13. We control for the share of owners, the number of dwellings, the share of apartments, the share of dwellings built between 1949 and 1970. Those controls are for 2005. In addition, we control for the contemporaneous household revenues and the average square meters per person. To have the controls in 2005 despite having fixed effects, we interact the value of the controls for 2005 with time dummies. All the controls concern the housing stock i.e. the existing dwellings.

and social tenants, before the policy. Hence, the need to control for these observable characteristics.

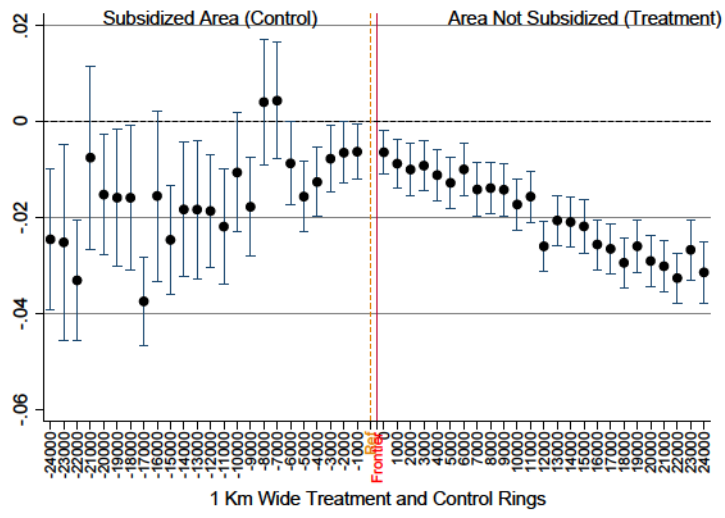
According to the specification in column (6), the housing stock in the C areas decreased by 1.2% more, after the implementation of the STC, than in the B areas. There are on average 116 dwellings per cadastral section (see Table 3.C.2), so the policy would induce a decrease on average of approximately 1.4 dwellings per section. Long differences in Table 3.D.1 confirmed this result. Compared to preceding studies on the Robien law, Brest (2008) and Rigaud, Gay, and Barthélemy (2008), which estimate that between 11 and 17% of the total new dwelling construction in their respective regions (Brest and Rhône-Alpes) is due to Robien, we find an important windfall effect, most of the dwellings built would have been built without the policy.

Moreover, we do not find any pre-trends by doing placebo regression with other treatment dates (restricting the sample to pre-treatment periods). None of the treatment coefficient are significant for 2005-2009 or 2007-2009 (see columns (1) to (4) in Table 3.1, which correspond to placebo regressions with and without controls).

We then look at potential displacement effects around the border for the housing stock, which means that if there was a dwelling which would have been built in a C area close to the treatment frontier in the absence of treatment, it has been effectively been built just on the other side of the frontier to benefit from the STC. The control area within 1 km from the frontier, is the base category. As seen on Figure 3.1, most of the coefficients of other ring dummies have a negative and significant sign, which means that the housing stock is higher, after the implementation of the STC, in the 1km ring control areas (which is eligible to the STC), than in the rest of the control and treated areas within 25 km from the treatment boundary. To put in a nutshell, we see an evidence of a construction peak for areas eligible to the Scellier which are within 1km from the treatment boundary. To further investigate this potential displacement effect, we use the control areas that are between 1 and 2km of the treatment boundary as the new base category. Figure 3.2 confirm our intuition, the housing stock increase positively and significantly more within 1km from the treatment boundary in eligible B areas than in areas B that are within 1 and 2km from the treatment frontier.

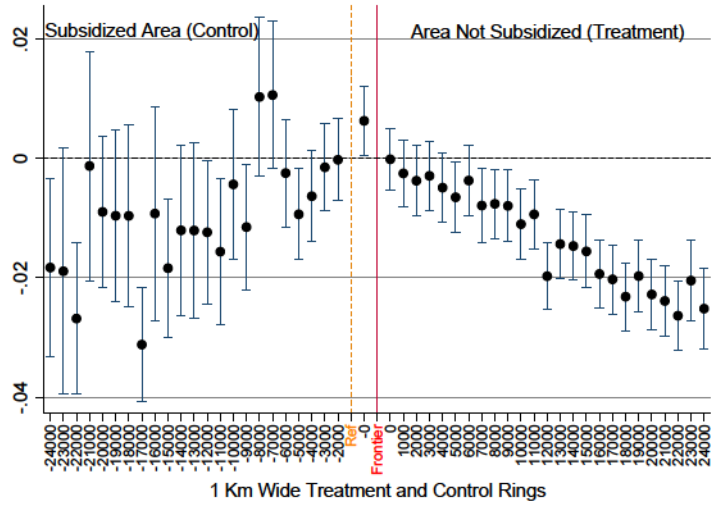
Since there is evidence of a displacement effect within 1km from the treatment border, we re-estimate our specifications for treated and control sections and dropped those that are located within 1km of the treatment frontier. To undermine concerns about the unconfoundedness assumption, we choose nearby housing blocks, that are located between 1 and 5km from the treatment boundary, because they are likely to be the least confounded by unobserved characteristics.¹⁴ Moreover, we observe a significant and more negative coefficient for treated areas that are between 10km and 25km from the treatment boundary. The removal of

14. For most of the observable characteristics, such as the income of households living in new and existing dwellings, the surface per person and number of person per household, the share of vacant dwellings in existing dwellings, and the number of new dwellings built, the difference between B control areas and C treated areas is less important when restricting the sample between 1 and 5km away from the treatment boundary than by comparing all the C areas to all the B areas (see Table 3.C.4).



Note: Difference-in-difference estimates by 1km-wide control and treatment rings. The outcome is the log of the private housing stock. The reference category is the control ring which is within 1km from the treatment boundary.

Figure 3.1: Scellier effect on the housing stock around the boundary



Note: Difference-in-difference estimates by 1km-wide control and treatment rings. The outcome is the log of the private housing stock. The reference category is the control ring which is within 1 and 2 km from the treatment boundary.

Figure 3.2: Scellier effect on the housing stock around the boundary (1-2 km reference)

subsidies in these areas had a stronger impact on the growth rate of the housing stock, possibly because of different unobserved characteristics (C areas far away from the frontier are more likely rural areas), which make the unconfoundedness assumption less credible for these areas. We further check that pre-treatment trends in treatment and control areas, within 1 and 5km of the treatment area boundary, are similar to give credibility to the unconfoundedness assumption.

	Placebo				STC	
	2005-2009		2007-2009		2009-2013	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.007*** (0.001)	0.004 (0.003)	0.007*** (0.001)	0.003 (0.003)	0.005*** (0.004)	-0.001 (0.002)
Controls	No	Yes	No	Yes	No	Yes
Observations	127839	127575	127839	127575	213198	212641
No. of sections	42656	42544	42656	42544	42737	42559
R^2 within	0.14	0.14	0.14	0.14	0.16	0.17
Estimation Period	2005-2009				2005-2013	

Note: Panel fixed-effects regression where the dependent variable is the log of housing stock. The treatment and controls are the same as before. Time fixed effects are included for all the regressions. The standard errors are clustered by cadastral sections.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.

Table 3.2: Impact of the Scellier on the housing stock (within 1 and 5km from the treatment boundary)

In Table 3.2, we find no impact of the STC on the housing stock. When controlling by observable characteristics, there is no pre-trends and no significant impact of the treatment. When comparing all the B areas to the C areas in Table 3.1, we overestimated the impact of the Scellier on housing supply because of the displacement effect around the border. Long differences in Table 3.D.1 confirmed this result. Some housing project that were supposed to be built in non-eligible areas close from the treatment boundary were built in an eligible area which was just one kilometer away.

To conclude, for areas with similar characteristics, the STC has no impact on the housing supply, the dwellings built would have been built without the subvention, it is a pure windfall effect.

3.6.2 The Impact of the STC on the Vacancy Rate

Another important concern regarding the STC, is that it increases the vacancy rate of the new dwellings built. In effect, the STC creates demand for newly built dwellings in the areas eligible to the Scellier from households attracted by the tax incentive. However, to be favorable to the investors, the newly built dwelling has to be rented. If this increased supply does not meet

a rental housing demand, the dwelling will be vacant. This could happen if for example, the government misperceived the tension of the local housing market, and put areas eligible to the Scellier where they should have not been. This concern is reinforced by the literature on the LIHTC, McClure (2006, 2012) finds that over 90% of allocations between 2000 and 2004 went to neighborhoods where there was a surplus of dwellings, i.e. areas where there were more units in the price range of a LIHTC project than tenants in the relevant income category that demand it.

	Placebo				STC	
	2005-2009		2007-2009		2009-2013	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	-0.004** (0.002)	-0.000 (0.002)	-0.007*** (0.002)	-0.003 (0.003)	-0.017*** (0.002)	-0.015*** (0.002)
Controls	No	Yes	No	Yes	No	Yes
Observations	300297	299958	300297	299958	488181	487411
No. of sections	154061	153776	154061	153776	173918	173430
R^2 within	0.001	0.002	0.001	0.002	0.001	0.002
Estimation Period	2005-2009				2005-2013	

Note: Panel fixed-effects regression where the dependent variable is the ratio of private new dwellings that are vacant on the total private new dwellings built. The treatment variable is the interaction between a group dummy (equals to 1 for the treated group, 0 otherwise) and a time dummy (equals to 1 for the post-treatment period, 0 otherwise). Time fixed effects are included for all the regressions. Controls include the household revenues, the share of owners, the number of dwellings, the average square meters per person, the share of apartments, the share of dwellings built between 1949 and 1970. All the controls are for 2005 except the household revenues and the average square meters per person which are contemporaneous. The standard errors are clustered by 1999 urban areas.

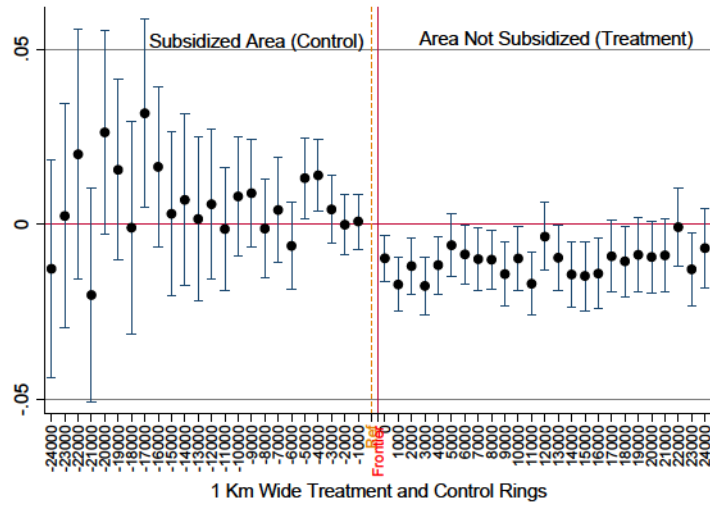
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.

Table 3.3: Impact of the Scellier on the dwelling vacancy rate

Indeed, Table 3.3 shows that vacancy rate increase less in C areas compared to the B areas eligible to the Scellier. It means that the share of the newly built private dwellings that are vacant increased by 1.5 percentage points more in the B areas eligible to the Scellier compared to C areas (see column (6)). There are no pre-trends if we control by the local housing market characteristics (see column (2) and (4)). Long differences in Table 3.D.2 confirmed this result.

There is no visible sign of displacement effects around the Scellier border. Most of the control rings have a vacancy rate not significantly different from the 1km control ring, where as vacancy rates are uniformly lower in the treated areas (the C areas not eligible to the Scellier) compared to the 1km control ring. We take the control ring from 1 to 2km from the treatment boundary as a base category, and the spatial patterns are similar (see Figure 3.D.1), confirming the absence of displacement effect close to the treatment frontier.

New dwellings are more likely to be vacant in eligible areas. As seen on Table 3.4, there



Note: Difference-in-difference estimates by 1km-wide control and treatment rings. The outcome is the rate of new vacant dwellings on total new dwellings built. The reference category is the 1km control ring.

Figure 3.3: Scellier effect on the vacancy rate around the boundary

	Placebo				STC	
	2005-2009		2007-2009		2009-2013	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	-0.002 (0.003)	0.000 (0.003)	-0.000 (0.003)	0.003 (0.004)	-0.021*** (0.002)	-0.020*** (0.002)
Controls	No	Yes	No	Yes	No	Yes
Observations	65772	65709	65772	65709	107300	107131
No. of sections	32204	32155	32204	32155	35732	35629
R^2 within	0.001	0.002	0.001	0.002	0.002	0.003
Estimation Period	2005-2009				2005-2013	

Note: Panel fixed-effects regression where the dependent variable is the vacancy rate of new dwellings built. The treatment and controls are the same as before. Time fixed effects are included for all the regressions. The standard errors are clustered by cadastral sections.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.

Table 3.4: Impact of the Scellier on the vacancy rate of new dwellings (within 1 and 5km of treatment boundary)

is a supplementary increase of 2 percentage points of the vacancy rate of new dwellings in B areas, eligible to the STC, compared to the C areas, non eligible to the policy, for similar areas (1 to 5 km from the treatment border). Long differences in Table 3.D.2 suggest an even stronger impact. This fact might be puzzling given that we didn't find any impact of the production of housing units. One can explain this with the fact that the composition of the stock is affected, a rental sector might appear at the expense of owner occupied housing while the demand for the private sector remains limited in the eligible areas. The combination of both phenomena could then explain our results.

3.6.3 The effects of STC on Housing Prices

We now turn to the impact of the STC on housing prices. Because there are much less observations on dwelling transactions than for the housing stock, a lot of housing blocks have no observations at all or just a few ones, especially in rural areas. So we carried out our estimations at the transaction level and not at the housing block level for this part, and we added fixed effects at the housing block level. Moreover, this method let us introduce control variables related to the characteristics of sold dwellings at the housing unit level, in order to take into account in a better way, structural differences between them.

Even if houses prices are, generally, more volatile and less easy to explain than flat ones, because of more unobserved differences between houses, we estimate that our results on houses prices are more robust than those on flat ones. Indeed, in France, flats are a lot more concentrated in urban areas compared to houses, so there could be a selection bias in the evaluation of the STC on flat prices, because rural areas have a greater probability to be in a C area after 2009.

We estimate a simple difference-in-difference regression, completed by our geographical identification strategy. In Table 3.5, the results on the houses show no significant pre-trends and a significant decrease in houses prices growth rates in the C areas after 2008, of 17.5%. Moreover, as seen on Figure 3.4, our results exhibit no geographical pattern which could induce spatial spillovers: the impact is statistically non significantly different from the 1km control ring, in the whole C area, and globally positive with no outliers in the B one. For similar areas, that are from 1 to 5km around the treatment boundary, there is a 10% supplementary increase of house price in B eligible areas compared to C non eligible areas.

The results on flat prices are mixed, close to the treatment frontier, the STC has no significant impact on price but there is a peak 10km away from the frontier, as seen on Figure 3.D.2 and Table 3.6. However, these results are estimated with about half the number of observations, and there is a potential upward bias due to the urban concentration of housing transactions in the B area, which could explain the peak observed.

The results on house prices confirm those of Bono and Trannoy (2012), who find that the STC is essentially capitalized in land prices higher growth, which is explain by physical and

institutional constraints on land release, and a consequently low housing supply elasticity. One might be puzzled by the fact that a program such as the STC has also an impact on the price of existing dwellings. This can be easily understood if we refer to the replacement cost framework when studying the housing market. In such a framework, the arbitrage of households between new and existing units, lead us to split the value of a unit between its structure and its land component. If such an arbitrage exists, we can think that an increase in building plot prices will tend to be capitalized into the land component of existing units.

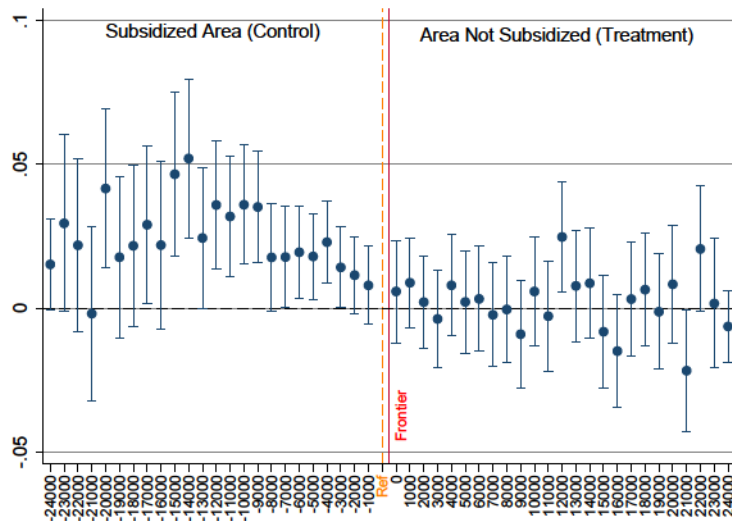
It might be puzzling to observe an effect on prices without any adjustment in quantity. We interpret this finding as an evidence in the change of type of investors. Without the law, one will observe medium income households willing to access to homeownership and limited access to credit. Their willingness to pay will be relatively low. On the other hand, given the important amount of tax credit, the same units can be sold to wealthier households with a much higher willingness to pay. There is a change in the destination of the units with a development of new rental units instead of new units sold to homeowners. Moreover, if households invest in areas on which they do not have knowledge on the local housing characteristics (for example, a Parisian household buying a Scellier good in a suburban area of another city), housing developers can set a higher price for new dwellings than those observed on the local markets before the STC, because of this asymmetry of information and the increasing demand linked to the STC. The subsequent increase in price of new units will deviate candidates for homeownership to the existing units leader their price to increase as well. There are 3 possible outcomes for the households candidate to homeownership who might have bought the previous units. First, they can become the tenants of these new dwellings, second , they can buy an existing unit driving up the price of existing units, third, given the increase in housing prices, they can renounce to their desire to increase their housing consumption and stay in their current unit. If the two last phenomena can contribute to increase the vacancy rate documented in the next section.

	Log of the price per square meters			
	Placebo		STC	
	(1)	(2)	(3)	(4)
Treatment	0.0225*** (6.22)	-0.000341 (-0.13)	-0.0299*** (-11.59)	-0.0175*** (-9.06)
N	224145	365393	414835	640463
R^2	0.5988	0.5800	0.6115	0.5610
Type of goods	Flats	Houses	Flats	Houses
Estimation Period	2006-2008		2006-2012	

Note: Hedonic regression where the dependent variable is the log of the transaction price. The treatment and controls are the same as before. Rings and Time fixed effects are included for all the regressions. We control for all hedonic characteristics available : log of the surface and is square, presence of an elevator, number of rooms, number of bathroom, presence of a basement, presence of a garden, presence of a balcony, period of construction. We also add Fixed Effects for Municipalities and control for the distance to the frontier (controlling with ring dummies or log distance does not change our results. The standard errors are robust.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.

Table 3.5: Impact of the Scellier on Housing Prices



Note: Difference-in-differences estimates by 1km-wide control and treatment rings. The outcome is the log of the price of single unit dwellings. The reference category is the 1km control ring.

Figure 3.4: Scellier effect on the Price of Houses

	Log of the price per square meters			
	Placebo		STC	
	(1)	(2)	(3)	(4)
Treatment	0.0113 (1.52)	-0.00147 (-0.36)	-0.00500 (-0.95)	-0.00985*** (-3.27)
N	101685	133101	185787	233149
R^2	0.5635	0.4841	0.5693	0.4705
Type of goods	Flats	Houses	Flats	Houses
Estimation Period	2006-2008		2006-2012	

Note: Hedonic regression where the dependent variable is the log of the transaction price. The treatment and controls are the same as before. Rings and time fixed effects are included for all the regressions. We control for all hedonic characteristics available: log of the surface and its square, presence of an elevator, number of rooms, number of bathroom, presence of a basement, presence of a garden, presence of a balcony, period of construction. We also add fixed effects for municipalities and control for the distance to the frontier (controlling with ring dummies or log distance does not change our results). The standard errors are robust.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.

Table 3.6: Impact of the Scellier on Housing Prices in the ring between 1 and 5 km around the boarder

3.6.4 Impact on the rental sector

On the composition of the local housing market

A logical consequence of the Scellier is its impact on the composition of the local housing markets between tenants and owner-occupied dwellings. Since the goal of the STC is to promote rental property investments, we expect to see an increase of the number of tenants in newly built dwellings in areas eligible to the Scellier.

In effect, as it can be seen in Table 3.7, there is a supplementary increase of 23% of the number of tenants in new dwellings in areas B, which are eligible to the Scellier, compared to the non-eligible C areas. Long differences in Table 3.D.3 suggests an even stronger impact with an increase of 31% but confidence intervals overlap.

However, there could be a potentially important displacement effect on the location decision of new tenants close to the frontier: since STC dwellings are subject to a rent capping, tenants close to the treatment boundary have an incentive to move just across the border to benefit from lower rents, provided these ones are sufficiently low compared to the non-eligible C areas on the other side of the border.

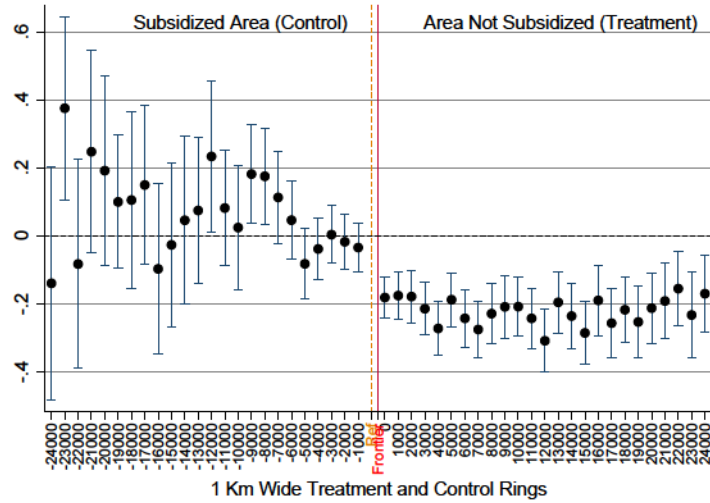
Nevertheless, according to the results seen on Figure 3.5, such a displacement effect, which would only be observable at the boundary, can not be distinguished from a significant global effect at every ring on the non-eligible side. Therefore, we conclude that the STC has a positive

	Placebo				STC	
	2005-2009		2007-2009		2009-2013	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	-0.010 (0.020)	0.002 (0.020)	-0.054*** (0.020)	-0.017 (0.021)	-0.218*** (0.019)	-0.216*** (0.020)
Controls	No	Yes	No	Yes	No	Yes
Observations	100172	100083	100172	100083	161807	161580
No. of sections	68296	68221	68296	68221	88013	87851
R^2 within	0.01	0.02	0.01	0.02	0.01	0.01
Estimation Period	2005-2009				2005-2013	

Note: Panel fixed-effects regression where the dependent variable is the log of the number of renters in new dwellings. The treatment variable is the interaction between a group dummy (equals to 1 for the treated group, 0 otherwise) and a time dummy (equals to 1 for the post-treatment period, 0 otherwise). Time fixed effects are included for all the regressions. Controls include the household revenues, the share of owners, the number of dwellings, the average square meters per person, the share of apartments, the share of dwellings built between 1949 and 1970. All the controls are for 2005 except the household revenues and the average square meters per person which are contemporaneous. The standard errors are clustered by 1999 urban areas. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.

Table 3.7: Impact of the Scellier on the number of renters in new dwellings

effect on the number of tenants in newly built dwellings. As seen on Table 3.8, there is a supplementary increase of 16% of the number of tenants in eligible areas compared to non-eligible areas within 1 and 5km from the treatment boundary. Long differences in Table 3.D.3 confirm these results. Since the STC has no effect on the housing stock, this effect would be a pure composition one, owner-occupied properties being replaced by rental ones in the eligible areas. This could be explained by the positive and inflationary impact of the STC on second-hand housing stock, which would reduce the housing purchasing power of household who move to the B area, which remains eligible to the STC.



Note: Difference-in-difference estimates by 1km-wide control and treatment rings. The outcome is the log of the number of renters in new dwellings. The reference category is the 1km control ring.

Figure 3.5: Scellier effect on the number of renters around the boundary

	Placebo				STC	
	2005-2009		2007-2009		2009-2013	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	-0.026 (0.031)	-0.032 (0.033)	-0.099*** (0.031)	-0.040 (0.031)	-0.171*** (0.023)	-0.160*** (0.029)
Controls	No	Yes	No	Yes	No	Yes
Observations	27220	27195	27220	27195	44652	44575
No. of sections	17754	17735	17754	17735	22547	22493
R^2 within	0.012	0.019	0.013	0.019	0.008	0.013
Estimation Period	2005-2009				2005-2013	

Note: Panel fixed-effects regression where the dependent variable is the log of the number of renters in new dwellings. The treatment and controls are the same as before. Time fixed effects are included for all the regressions. The standard errors are clustered by cadastral sections.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.

Table 3.8: Impact of the Scellier on the number of renters in new dwellings (within 1 to 5km of treatment boundary)

On the income profile of new tenants

So far, we found that the STC does not increase housing supply, when displacement effect are properly controlled for, but newly built dwellings are more vacant in Scellier areas. Our results also indicate that the STC has an inflationary impact on house prices. Taking all together those results point towards a substantial inefficiency of the STC. Nevertheless, as Malpezzi and Vandell (2002) underline it, despite those negative results, a policy such as LIHTC or STC would still be socially useful if it succeed in creating more mixed income housing. We now investigate, if effectively, STC allowed lower-income households to be accommodated.

However, as showed in Table 3.9, the Scellier Tax Credit policy has no impact on the level of income of the tenants arriving in new dwellings eligible to the STC. The treatment coefficient is not significant. We investigate further, to assess whether this result is drove by border displacement effects.

	Placebo				STC	
	2005-2009		2007-2009		2009-2013	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.004 (0.013)	-0.009 (0.015)	0.014 (0.015)	0.011 (0.015)	-0.002 (0.008)	-0.010 (0.010)
Controls	No	Yes	No	Yes	No	Yes
Observations	98252	98165	98252	98165	158536	158316
No. of sections	67201	67128	67201	67128	86704	86548
R^2 within	0.00	0.00	0.00	0.00	0.01	0.01
Estimation Period	2005-2009				2005-2013	

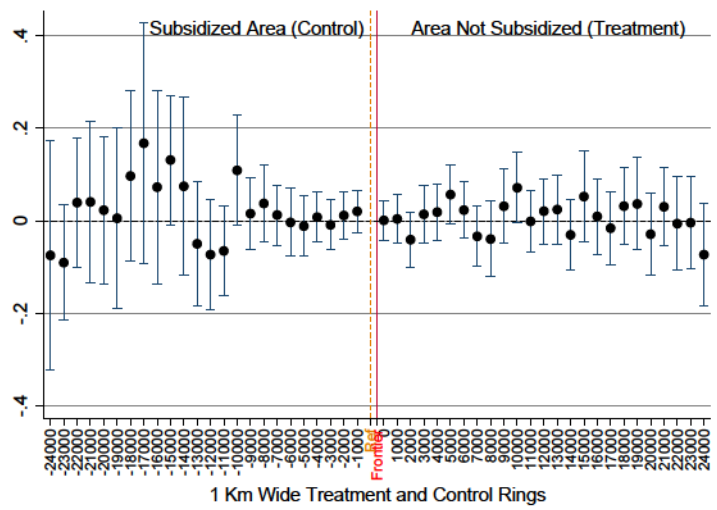
Note: Panel fixed-effects regression where the dependent variable is the log of the income of renters in new dwellings. The treatment variable is the interaction between a group dummy (equals to 1 for the treated group, 0 otherwise) and a time dummy (equals to 1 for the post-treatment period, 0 otherwise). Time fixed effects are included for all the regressions. Controls include the household revenues, the share of owners, the number of dwellings, the average square meters per person, the share of apartments, the share of dwellings built between 1949 and 1970. All the controls are for 2005 except the household revenues and the average square meters per person which are contemporaneous. The standard errors are clustered by 1999 urban areas.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.

Table 3.9: Impact of the Scellier on the income of renters in new dwellings

Figure 3.6 indicates that there are no displacement effects. The level of income of new tenants is not significantly increasing differently, after the implementation of the policy, in either Scellier eligible areas or non-eligible areas compared to the 1km control ring base category.

Table 3.10 results' confirm that the STC policy has no impact on the income profile of renters arriving in new dwellings, for housing blocks with similar characteristics. As it can be seen in Table 3.B.2, the income constraint for renters to live in an intermediary Scellier are not stringent enough since more than 70% of households are eligible to it.



Note: Difference-in-difference estimates by 1km-wide control and treatment rings. The outcome is the log of the number of renters in new dwellings. The reference category is the 1km control ring.

Figure 3.6: Scellier effect on the income of renters in new dwellings around the boundary

Pessimistically, long differences in Table 3.D.4 suggest that the average income profile of tenants in new dwellings increased 5% (or 10% within 1 to 5 km from the treatment border) faster in areas eligible to the STC. It would mean that the law had a paradoxical impact by granting access of new rental dwellings to wealthier households.

	Placebo				STC	
	2005-2009		2007-2009		2009-2013	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	-0.012 (0.022)	-0.025 (0.024)	0.015 (0.021)	0.027 (0.024)	-0.003 (0.016)	-0.009 (0.018)
Controls	No	Yes	No	Yes	No	Yes
Observations	26800	26775	26800	26775	43926	43851
No. of sections	17547	17528	17547	17528	22326	22273
R^2 within	0.002	0.004	0.002	0.004	0.009	0.011
Estimation Period	2005-2009				2005-2013	

Note: Panel fixed-effects regression where the dependent variable is the log of the income of renters in new dwellings. The treatment and controls are the same as before. Time fixed effects are included for all the regressions. The standard errors are clustered by cadastral sections.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.

Table 3.10: Impact of the Scellier on the renter's income in new dwellings (within 1 to 5km of treatment boundary)

3.7 Conclusion

Our results cast some doubts on the efficiency of the Scellier Tax Credit (STC). In our specification accounting for spillover effects, we don't find any evidence of an impact of the STC on the evolution of the housing stock for similar areas close to the treatment boundary. Even when comparing the whole B eligible areas and C non-eligible areas, the effect found is limited. Our results confirm, similarly to the results on the LIHTC, that the windfall effect is substantial in the case of the STC.

Our results that concern B and C areas, which are mostly located at the periphery of urban areas, can be seen as an upper bound effect on quantities (and lower bound effect on prices), because these areas are believed to have a more elastic housing supply, according to the Scellier zoning.

In addition, we find that the STC increases the share of vacant dwellings among the new dwellings built, and has an inflationary impact on prices of existing dwellings, confirming the findings of Bono and Trannoy (2012). Those results point towards an inadequacy of the Scellier zoning, which might have had a counterproductive impact with regard to its initial aim of correcting disequilibrium between housing supply and demand.

The STC also has an impact on the composition of local housing markets, since there is a supplementary increase in the number of tenants in new dwellings, in areas eligible to the STC. Nevertheless, the new tenants arriving in dwellings eligible to the STC, do not have a significantly lower income than tenants in non-eligible areas. The Scellier Tax Credit failed to achieve a social goal of accommodating low-income households, which is not surprising given that most households can access such units.

Our results follow closely the previous findings of Grislain-Letrémy and Trevien (2014), Fack (2006) or Labonne and Welter-Nicol (2015), which highlight that low supply elasticity tend to reduce the efficiency of housing policies.

To put in a nutshell, our study tends to confirm that nationwide policies uncoordinated with local land use regulation, will tend to generate undesirable effects, as emphasized in Wasmer (2016).

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Appendix

3.A The Scellier Law

The exact text referring to the Scellier Tax Credit is the following:

”L’article 31 de la loi de finance rectificative pour 2008 (numéro 2008-1443 du 30 décembre 2008) réforme les mécanismes d’incitation fiscale à l’investissement locatif. Cette réforme consiste à supprimer à compter du 1er janvier 2010, les dispositifs ”Robien” et ”Borloo” et à les remplacer par un avantage prenant la forme d’une réduction d’impôt sur le revenu. Cette réduction d’impôt sur le revenu s’applique, à compter du 1er janvier 2009, aux contribuables domiciliés en France qui acquièrent ou font construire des logements neufs dans certaines zones du territoire se caractérisant par un déséquilibre entre l’offre et la demande de logements, qu’ils s’engagent à donner en location nue à usage d’habitation principale pour une durée minimale de neuf ans. Au titre d’une même année d’imposition, un seul logement peut ouvrir droit à la nouvelle réduction d’impôt. L’acquisition du logement, ou le dépôt de la demande de permis de construire dans le cas d’un logement que le contribuable fait construire doit intervenir au plus tard le 31 décembre 2012. La réduction d’impôt s’applique également aux contribuables qui souscrivent, entre le 1er janvier 2009 et le 31 décembre 2012, des parts de sociétés civiles de placement immobilier (SCPI) réalisant ces mêmes investissements. La réduction d’impôt est calculée sur le prix de revient du logement ou le montant des souscriptions, dans la limite annuelle de 300 000 euros. Son taux est fixé à 25 % pour les investissements réalisés en 2009 et 2010 et à 20 % pour ceux réalisés en 2011 et 2012. Elle est répartie sur neuf années, à raison d’un neuvième de son montant chaque année. Lorsque la location est consentie dans le secteur intermédiaire, le contribuable bénéficie, en plus de la réduction d’impôt, d’une déduction spécifique fixée à 30 % des revenus bruts tirés de la location du logement. Lorsque le logement reste loué dans le secteur intermédiaire après la période d’engagement de location, le contribuable bénéficie, par période de trois ans et dans la limite de six ans, d’un complément de réduction d’impôt égal à 2 % par an du prix de revient du logement. Pour les investissements réalisés en 2009, le contribuable peut choisir entre les dispositifs dits ”Robien” et ”Borloo” et la nouvelle réduction d’impôt, sans toutefois pouvoir cumuler ces avantages au titre d’un même investissement.”

Translation:

” The article 31 of the budgetary law for 2008 [...] reforms the fiscal incentives for rental investments. This reforms suppresses from January the 1st 2010, the Robien and Borloo Tax Credits in order to substitute them with a new Income Tax Credit. This new Income Tax Credit is applied from January the 1st to all the French taxpayers living in France and buy or build new housing units in some specific areas characterized by a disequilibrium between supply and demand, if they commit to rent such units without furnitures to a tenant using it as its primary residence. The lease should be of at least 9 years. For one fiscal year, only one unit can entitle to a tax credit. The purchase of the dwelling or the demand for building permit should have occurred at last before the 31st of December 2012. This tax credit can also benefit to taxpayers buying shares into some Civil Society for Real Estate Investments realizing such investments. The tax rebate should be computed using the price paid for the unit or the amount paid for the shares with a maximum amount of 300 000 euros. Its rate is set to 25% for the investments realized between 2009 and 2010 and to 20% for these realized in 2011 and 2012. If the lease respects the rules of the Intermediate sector, the taxpayer also benefits from an additional rebate representing 30% of the gross rental income received from the unit. In addition, if the dwelling still respects the conditions of the intermediate sector after the first lease, the taxpayer can benefit per period of 3 years during a maximum of 6 years from an additional rebate of 2% of the price of the unit. For 2009, the taxpayer can chose between the ”Robien” , ”Borloo” and this new fiscal device but cannot cumulate them for the same unit. ”

3.B Information on the STC

As illustrated in Table 3.B.1, the STC is subject to a maximum rent which varies according to the type of fiscal rebate (regular or intermediate), the area and the year of investment.

	Regular		Intermediate	
	2009-2010	2011-2012	2009-2010	2011-2012
Abis	-	21.70	-	17.36
A	21.84	16.10	17.47	12.88
B1	15.19	13	12.15	10.40
B2	12.42	10.40	9.94	8.48

Note: All the values are expressed in euros.

Table 3.B.1: Maximum Monthly Rents per square meter for the STC

In addition, while the potential tenants for a regular STC are not subject to any income limit, the tenants of the intermediate STC should have an income below a certain limit, described in Table 3.B.2, when signing the contract. It is worth noting that such an income constraint is not very binding, since we can easily infer that more than 70% of the households fulfill these criteria. Indeed, these income limits are well above the income limit of one of the less restrictive social housing category (the "Prêt Locatif Social" or PLS), for which Chapelle 2015 reports that more than 70% of the households were eligible in 2010.

	Area		
	A	B1	B2
Single	44793	33272	30500
couple	66943	48860	44789
single or couple with 1 child	80471	58493	53619
single or couple with 2 children	96391	70790	64891
single or couple with 3 children	114109	83085	76163
single or couple with 4 children	128402	93720	85911
per additional child	+14312	+10646	+9758

Note: All values are expressed in euros.

Table 3.B.2: Maximum Yearly Income for the Intermediate STC

3.C Descriptive Statistics on Sections

Distance (km)	Area		
	B	C	Total
0-1	10,406	10,733	21,139
1-2	7,126	5,742	12,868
2-3	6,262	5,041	11,303
3-4	5,047	4,877	9,924
4-5	4,017	4,667	8,684
5-6	3,025	4,443	7,468
6-7	2,290	4,416	6,706
7-8	1,645	4,385	6,030
8-9	1,423	4,472	5,895
9-10	1,268	4,413	5,681
10-11	1,016	4,329	5,345
11-12	979	4,199	5,178
12-13	751	4,357	5,108
13-14	583	4,172	4,755
14-15	517	4,187	4,704
15-16	500	4,165	4,665
16-17	444	4,138	4,582
17-18	465	4,165	4,630
18-19	452	4,041	4,493
19-20	463	3,863	4,326
20-21	386	3,753	4,139
21-22	325	3,699	4,024
22-23	313	3,479	3,792
23-24	309	3,318	3,627
24-25	315	3,251	3,566
Total	50,327	112,305	162,632

Source: Author's computations.

Note: The values refer to the number of cadastral sections present in each ring.

Table 3.C.1: Distance of Sections by Area

Variable	Mean	Std. Dev.	N
<i>Existing stock</i>			
Number of dwellings	115.9	271.902	220051
Income	19646	24275.586	219293
Persons per household	2.243	0.598	219870
Vacancy rate	0.083	0.086	219742
Share of owners	0.779	0.181	219880
Share of renters of private dwellings	0.137	0.128	219880
Share of social renters	0.037	0.117	219880
Consumption unit	2.73	11.255	220051
<i>New dwellings</i>			
Income	16940	22313.361	101866
Persons per household	2.522	1.267	101901
Vacancy rate	0.059	0.184	100039
Share of owners	0.762	0.348	100039
Share of renters of private dwellings	0.179	0.304	100039
Share of social renters	0.019	0.118	101903
Distance from B/C frontier	16998	15904	220358

Table 3.C.2: Summary statistics of Area B and C

	B Areas		C Areas		Comparison	
	Average	Obs	Average	Obs	Difference	T-test
<i>Existing Dwellings</i>						
Number of units	243.08 (470.53)	52068	72.86 (134.87)	167888	170.22	131.80
% of flats	0.26 (0.31)	52068	0.09 (0.16)	167888	0.18	171.34
% built in 1949-1970	0.19 (0.19)	52068	0.10 (0.12)	167888	0.09	128.12
Surface per person	45.64 (9.29)	52008	49.31 (10.74)	167456	-3.67	-70.24
Income	21770.21 (6185.96)	51988	17375.33 (7272.26)	167217	4394.88	28.43
People per household	2.42 (0.59)	52039	2.22 (0.61)	167739	0.21	68.58
% vacant	0.07 (0.08)	51915	0.09 (0.09)	167727	-0.02	-45.24
% owners	0.70 (0.23)	52040	0.80 (0.16)	167746	-0.09	-106.43
% private tenant	0.18 (0.16)	52040	0.12 (0.11)	167746	0.06	93.29
% social tenant	0.08 (0.17)	52040	0.03 (0.09)	167746	0.05	87.13
<i>New Dwellings</i>						
Number of units built	4.81 (17.78)	52068	1.66 (5.60)	167888	3.16	63.35
Income	19098.33 (19569.00)	26574	15191.43 (14137.80)	70894	3906.90	34.37
Surface per person	2.61 (1.28)	26574	2.59 (1.30)	70934	0.03	2.97
% vacant	0.06 (0.18)	25927	0.05 (0.17)	69530	0.01	10.34
% owners	0.75 (0.35)	25927	0.82 (0.32)	69530	-0.07	-29.58
% private tenant	0.19 (0.31)	25927	0.13 (0.28)	69530	0.06	27.71
% social tenant	0.04 (0.17)	26574	0.02 (0.12)	70940	0.02	18.98

Note: The statistics are for the year 2005. Standard errors are in parenthesis.

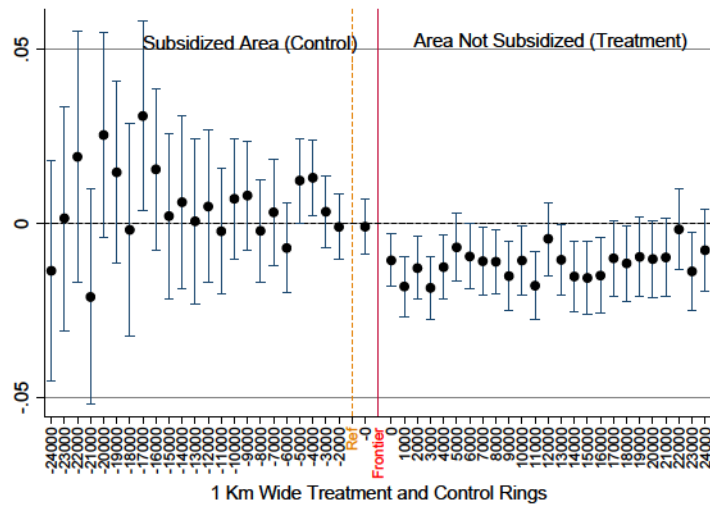
Table 3.C.3: Summary statistics of Areas B and C

	B Areas		C Areas		Comparison	
	Average	Obs	Average	Obs	Difference	T-test
<i>Existing Dwellings</i>						
Number of units	255.47 (398.83)	25391	84.05 (146.91)	24721	171.42	63.51
% of flats	0.29 (0.32)	25391	0.10 (0.16)	24721	0.20	86.60
% built in 1949-1970	0.20 (0.20)	25391	0.10 (0.12)	24721	0.10	65.06
Surface per person	45.61 (8.46)	25378	47.85 (9.75)	24677	-2.24	-27.44
Income	20770.10 (9513.55)	25371	19086.42 (7089.33)	24651	1683.68	22.39
People per household	2.42 (0.54)	25381	2.47 (0.54)	24703	-0.05	-10.12
% vacant	0.07 (0.08)	25314	0.07 (0.08)	24701	0.001	1.27
% owners	0.68 (0.24)	25381	0.80 (0.15)	24703	-0.12	-69.05
% private tenant	0.19 (0.17)	25381	0.13 (0.11)	24703	0.06	49.92
% social tenant	0.09 (0.19)	25381	0.03 (0.09)	24703	0.07	50.33
<i>New Dwellings</i>						
Number of units built	4.86 (16.23)	25391	2.43 (6.62)	24721	2.43	21.85
Income	18853.04 (18523.49)	12904	16634.10 (14365.50)	12756	2218.94	10.71
Surface per person	2.60 (1.26)	12904	2.72 (1.19)	12763	-0.11	-7.39
% vacant	0.07 (0.18)	12551	0.05 (0.17)	12613	0.02	7.44
% owners	0.72 (0.36)	12551	0.81 (0.32)	12613	-0.09	-21.02
% private tenant	0.22 (0.32)	12551	0.14 (0.28)	12613	0.07	19.58
% social tenant	0.05 (0.18)	12904	0.02 (0.11)	12765	0.03	15.66

Note: The statistics are for the year 2005. Standard errors are in parenthesis.

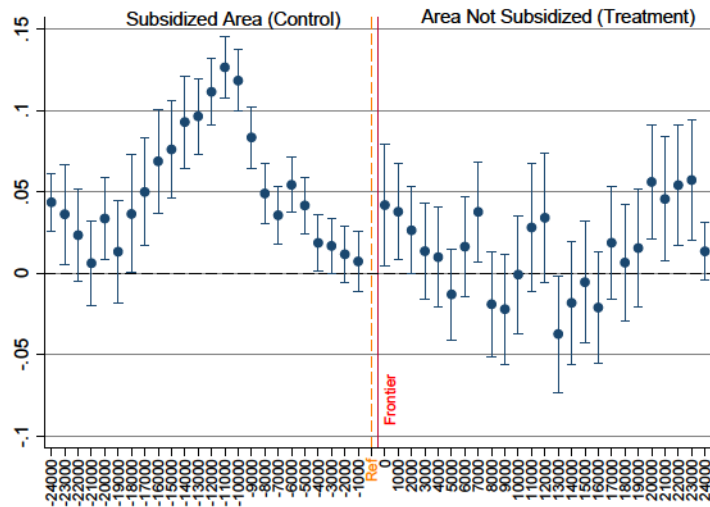
Table 3.C.4: Summary statistics of Area B and C between 1 and 5 km

3.D Robustness check



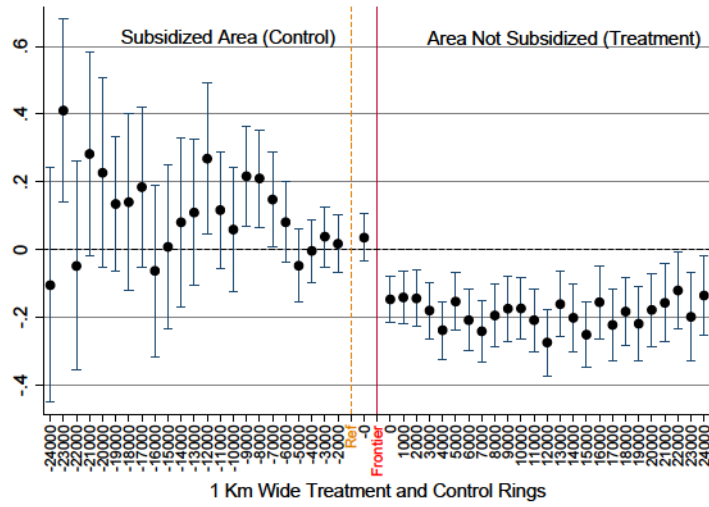
Note: Difference-in-difference estimates by 1km-wide control and treatment rings. The outcome is the rate of new vacant dwellings on total new dwellings built. The reference category is the 1 to 2km control ring.

Figure 3.D.1: Scellier effect on the vacancy rate around the boundary



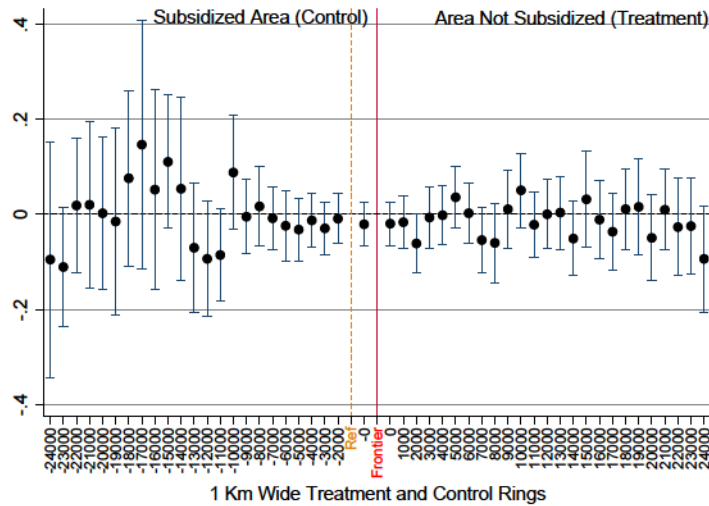
Note: Difference-in-difference estimates by 1km-wide control and treatment rings. The outcome is the log of the price of flats. The reference category is the 1km control ring.

Figure 3.D.2: Scellier effect on the Price of Flats



Note: Difference-in-difference estimates by 1km-wide control and treatment rings. The outcome is the log of the number of renters in new dwellings. The reference category is the 1 to 2km control ring.

Figure 3.D.3: Scellier effect on the number of renters around the boundary



Note: Difference-in-difference estimates by 1km-wide control and treatment rings. The outcome is the log of the number of renters in new dwellings. The reference category is the 1 to 2km control ring.

Figure 3.D.4: Scellier effect on the income of renters in new dwellings around the boundary
labelboundrevnewloc2km

	All Areas		Within 1-5 km	
	(1) Placebo	(2) STC	(3) Placebo	(4) STC
Treatment	-0.007 (0.005)	-0.013*** (0.005)	0.004 (0.004)	-0.005 (0.003)
Controls	Yes	Yes	Yes	Yes
Observations	218870	219117	42505	42567
R^2	0.003	0.003	0.005	0.003
Estimation Period	2005-2009	2009-2013	2005-2009	2009-2013

Note: In this long-differences regression, the dependent variable is the growth rate of the stock of private housing over 4-year periods. The treatment variable is a dummy taking the value one for the treated groups. Controls include the household revenues, the share of owners, the number of dwellings, the average square meters per person, the share of apartments, the share of dwellings built between 1949 and 1970, at the beginning of the period (2005 or 2009). The standard errors are clustered by 1999 urban areas.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.

Table 3.D.1: Impact of the STC on the Housing Stock: Long-differences

	All Areas		Within 1-5 km	
	(1) Placebo	(2) STC	(3) Placebo	(4) STC
Treatment	-0.005 (0.003)	-0.015*** (0.004)	0.000 (0.005)	-0.029*** (0.004)
Controls	Yes	Yes	Yes	Yes
Observations	63486	61612	14813	14243
R^2	0.001	0.002	0.002	0.003
Estimation Period	2005-2009	2009-2013	2005-2009	2009-2013

Note: In this long-differences regression, the dependent variable is the variation of the vacancy rate of new dwellings over 4-year periods. The treatment variable is a dummy taking the value one for the treated groups. Controls include the household revenues, the share of owners, the number of dwellings, the average square meters per person, the share of apartments, the share of dwellings built between 1949 and 1970, at the beginning of the period (2005 or 2009). The standard errors are clustered by 1999 urban areas.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.

Table 3.D.2: Impact of the STC on the Vacancy Rate of New Dwellings: Long-differences

	All Areas		Within 1-5 km	
	(1) Placebo	(2) STC	(3) Placebo	(4) STC
Treatment	-0.001 (0.028)	-0.312*** (0.036)	-0.045 (0.042)	-0.244*** (0.049)
Controls	Yes	Yes	Yes	Yes
Observations	11660	12078	3523	3738
R^2	0.006	0.027	0.007	0.026
Estimation Period	2005-2009	2009-2013	2005-2009	2009-2013

Note: In this long-differences regression, the dependent variable is the growth of the number of tenants in new dwellings over 4-year periods. The treatment variable is a dummy taking the value one for the treated groups. Controls include the household revenues, the share of owners, the number of dwellings, the average square meters per person, the share of apartments, the share of dwellings built between 1949 and 1970, at the beginning of the period (2005 or 2009). The standard errors are clustered by 1999 urban areas.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.

Table 3.D.3: Impact of the STC on the Number of Tenants in New Dwellings: Long-differences

	All Areas		Within 1-5 km	
	(1) Placebo	(2) STC	(3) Placebo	(4) STC
Treatment	0.004 (0.021)	-0.049** (0.020)	0.025 (0.028)	-0.097*** (0.031)
Controls	Yes	Yes	Yes	Yes
Observations	11337	11705	3444	3645
R^2	0.001	0.002	0.002	0.005
Estimation Period	2005-2009	2009-2013	2005-2009	2009-2013

Note: In this long-differences regression, the dependent variable is the growth of the income of tenants in new dwellings over 4-year periods. The treatment variable is a dummy taking the value one for the treated groups. Controls include the household revenues, the share of owners, the number of dwellings, the average square meters per person, the share of apartments, the share of dwellings built between 1949 and 1970, at the beginning of the period (2005 or 2009). The standard errors are clustered by 1999 urban areas.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.

Table 3.D.4: Impact of the STC on the Income of Tenants in New Dwellings: Long-differences

Chapter 4

Does Social Housing crowd out private construction ?

4.1 Introduction

Housing programs for low income households are an important concern for both policy makers and scholars. One particular reason for this interest results from the fact that housing is usually perceived as a merit good. In other words, scholars usually consider that a suboptimal consumption of housing may have negative externalities for both the society and the poor (Whitehead and Scanlon (2007)). This perception is supported by some empirical papers suggesting that underconsumption of housing may have a negative impact on health (Rauh, Landrigan, and Claudio (2008)) or on children's schooling outcome (Goux and Maurin (2005)). Among many different types of programs, subsidized housing represents of sizable share of public spendings.¹ It can aims at reducing spatial segregation, improving the housing quality or increasing the housing supply.

Housing programs usually distinguish supply side subsidies (subsidized housing units or loans) and demand side subsidies (allowances or vouchers). Scholars have been trying to disentangle which type of subsidy is the most efficient (Apgar Jr (1990)). It appears that there is no easy answer, and each program should be carefully analyzed accounting for the local context. For example, several papers point out that housing benefits could generate a significant deadweight loss given their inflationary impact in the private sector (Fack (2006); Grislain-Letrémy and Trevien (2014)). Other studies suggest, however, that subsidized units are more costly than vouchers (Deng (2005)). This paper tries to deepen our understanding of the relationship between the public (non profit) and the private sector in a period of sharp housing price growth documenting the existence of a crowding out effect in France. As suggested in Cook and Part-

1. This point appears of particular importance since subsidies to the non-profit sector represents 0.9% of the French GDP of which 60% are supply side subsidies

ner (2007), the assessment of the overall benefits of place based programs depends on their impact on local economic activity. As a consequence, the existence of a public displacement of private construction (DiPasquale and Wheaton (1996)) might dramatically reduce the benefits of such projects.

Considering that most of the previous studies are based on US data, Section 4.2 briefly defines the social housing sector in Europe and discuss its main differences with the well documented Low Income Housing Tax Credit in the US. In Section 4.3, we discuss the main potential channels likely to explain the crowding out effect. Considering the low supply elasticity of the French housing market and the fact that a wide range of households are eligible to the French social housing system, we argue that competition for land or tenants are possible. Provided that the social housing sector has its specific source of funding we consider that this sector does not compete with its private counterpart for financial resources. Finally, we review the previous studies suggesting that negative spillovers might also generate a crowding out effect within wealthy neighborhoods.

In section 4.4 we discuss the two main problems of endogeneity when trying to identify the impact of public housing on the private sector. First, if social housing is used to compensate a lack of construction from the private sector, a negative bias due to reverse causality might influence naive estimates. Second, if the non-profit sector reacts to similar unobserved drivers as the private sector, a positive bias might arise. To deal with these two problems we develop two complementary identification strategies. In the first one we exploit a national law forcing some municipalities above a population threshold to increase the construction of social housing. Using municipalities around the threshold we identify similar treatment and control groups and use the difference in difference estimate of the impact of the law to quantify the crowding out effect. In the second, we use three instruments : the law already mentioned, the WWII destruction and the predicted growth of the sector due to the national trend. This complementary approach allows us to increase the number of observations in order to identify the potential channels of the effect.

Section 4.5 describes the dataset built to answer this empirical question. In Section 4.6 we report that both strategies suggest that one additional social housing unit crowds out 2 private units. This order of magnitude is robust across our specifications and at several aggregation levels (Urban Areas and groups of municipalities). We then investigate the heterogeneity of the effect. Considering that the effect remains strong in municipalities where the rent level is low, we conclude that that both sectors are competing for tenants. Provided that the crowding out effect disappears in municipalities where few land is already developed, competition for land also appears important. We don't find any evidence of local negative spillovers at the Municipal level. We explain the order of magnitude of our results in Section 4.7 and argue that

the crowding effect is higher than 1 because the social housing sector builds larger units and will thus consume more land per unit. We put forward two main policy implications resulting from our findings. First, we advocate that social housing units should be directed to poorer tenants. Second, we suggest that the central state should provide higher incentives to social landlords to build smaller dwellings. Section 4.8 concludes.

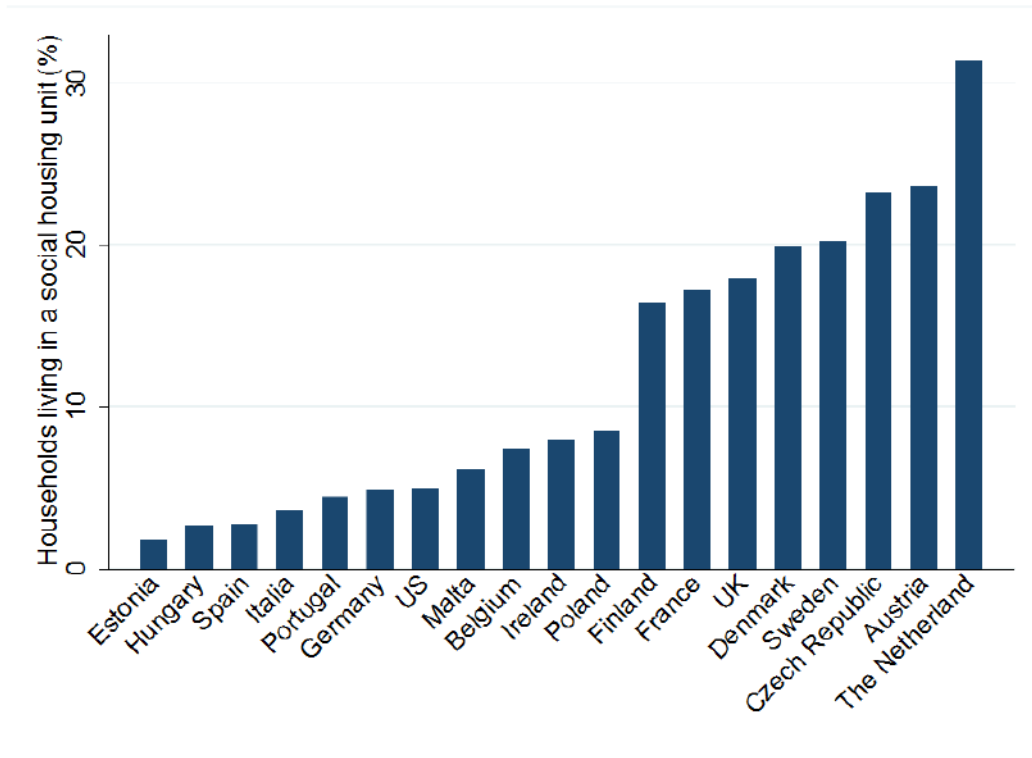
4.2 Social Housing : A European Place Based Policy

Most of the papers investigating the impact of subsidized housing on the housing market use US data. However, it is worth noting that such policies are much more developed in Europe where they can represent an important share of the housing stock, the housing starts and the rental sector as illustrated in Chart 4.1. As we can see while the housing units subsidized by the HUD represent about 5% of the housing stock in the US, they can account for up to 30% of the stock in the Netherland. In France, the social housing sector represents about 17% of the stock and the starts. Interestingly, while the UK has one of the highest rate of homeowners, its social housing sector still represent about 17% of its housing stock and is bigger than the private rental sector. It is also worth noting that the importance of subsidized unit in the housing starts has been dramatically increasing in many countries after the crisis of 2007, partially because of the collapse of the private sector but also because it tends to be considered as a counter cyclical policy.

The concept of social housing covers a wide range of policies that depend on the respective history and institutions of each country. Nevertheless, one can highlight some common traits that allow to define it (see Whitehead and Scanlon (2007) for a review). In Europe, social housing units are usually subsidized units benefiting from subsidized loan and/or public money (1), whose access is not governed by market mechanisms but through an administrative process in which the households income is taken into account (2). The rent is usually controlled (3) and these units are usually owned by non profit or public organizations (4).

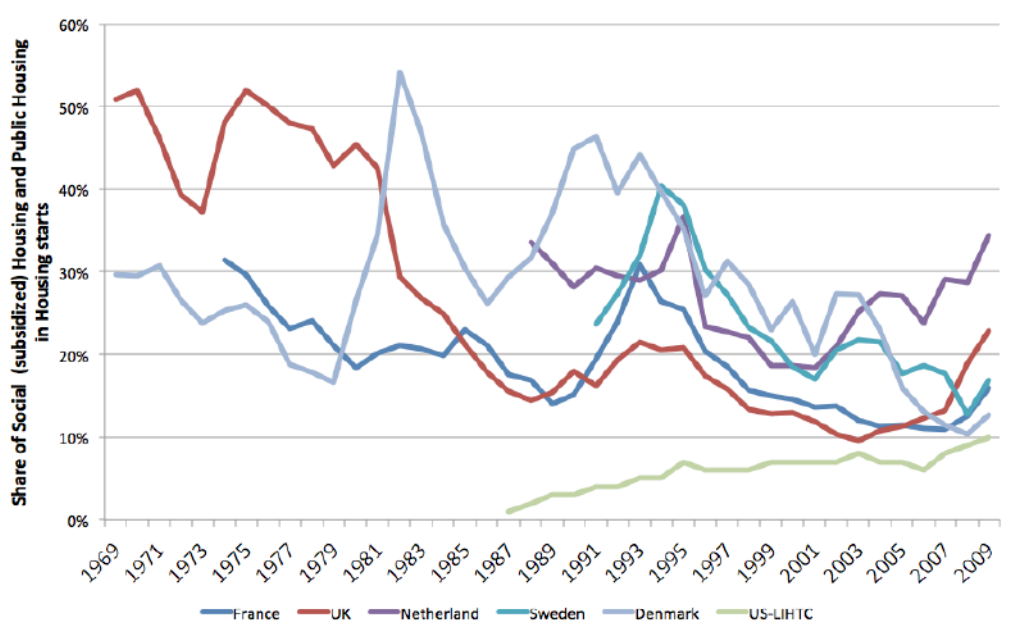
In the US, there is also a system of public housing managed by non-profit landlords (Housing Agencies) but most new developments are made through the Low Income Housing Tax Credit program. In this program, projects combine funds from public subsidies and from private investors in exchange of an income tax credit. This may have an important impact of the external validity and the theoretical framework of the studies realized in the US. Indeed, in France, there exists two types of subsidized units. First, there is an important social housing sector representing 17% of the housing stock that is managed by about 740 public and non profit landlords that receive public subsidies, tax exemptions and subsidized loans when developing new projects. Rents are subject to a strict control determined by the central state and

tenants are assigned administratively. (see Whitehead and Scanlon (2007) and Section 4.C for more details). Second, there has been also several housing tax credits for private households (see Bono and Trannoy (2012) and Chapelle, Vignolles, and Wolf (2016)). In this system, private landlords buy a new housing unit and then commit to rent it under a rent ceiling. As a counterpart they can benefit from an important Income Tax Credit. The US LIHTC appears to be in between both types of subsidies and the diverging calibrations of these systems are likely to generate different consequences on the housing market as discussed in Section 4.3.



source : Author's computation from HUD dataset (US) and Dol and Haffner (2010) (Europe)

(a) Share of the social housing sector in the housing stock



Source : Author's computation from HUD dataset (US), sit@del2 (France), ONS (UK), CBS (The Netherlands), SCB (Sweden) and DST (Denmark)

(b) Share of the social housing sector in the housing starts

Figure 4.1: Share of the social housing sector (and assimilated) in the housing stock and starts in some OECD countries

4.3 The four channels of the crowding out effect

In the US, there has been a growing literature documenting the crowding out effect and its channels. However, while three market mechanisms have been put forward to explain this phenomenon : competition for funds, for land and for tenants. This literature mainly considered that this crowding out effect happened through the competition for funds or for tenants. This is mainly explained by the US context where the supply elasticity is much larger than in Europe as documented in Caldera and Johansson (2013). In this section, we argue that if competition for funds is unlikely in the French context, the fact that an important share of the population can access to the social sector and the low level of the supply elasticity of the French housing market could amplify the crowding out effect through competition for land and for tenants.

4.3.1 Competition for Funds

The seminal contribution documenting a crowding out effect was made by Swan (1973). In this paper, the author estimated a system of supply and demand for housing starts on US data and emphasized the fact that competition for mortgage between subsidized and unsubsidized housing units led to an important crowding out effect such that for one subsidized unit 0.85 unsubsidized unit was not built In addition, Murray (1983) proposed a structural approach in order to address the same question and also assumed that the real resource supply was perfectly elastic whereas financial resources were scarcer.

As far as France is concerned competition for funds is highly unlikely as the system is based on subsidized loans covered by the households' short term deposits managed by the French Deposit and Consignment Office². Nevertheless such a concern might be relevant for the second types of subsidized housing based on the Income Tax Credit already mentioned³.

4.3.2 Competition on the rental sector

An important series of theoretical and empirical papers emphasized that both subsidized and standard housing units were competing on the rental sector.

On the theoretical side, DiPasquale and Wheaton (1996) consider subsidized housing as a negative demand shock for privately owned units. Such a shock should reduce the rent level followed by a decline of real estate prices and housing starts as illustrated in Figure 4.B.1 re-

2. Caisse des dépôts et des consignations

3. Banks might prefer to lend to wealthier investors than to poorer households willing to access to homeownership

ported in Section 4.B. Alternatively, Eriksen and Rosenthal (2010) consider the Low Income Housing Tax Credit as a positive supply shock whose impact should be partially offset because the demand on the rental market is not perfectly elastic while the supply is not perfectly inelastic. For the authors, the more inelastic the demand or the more elastic the supply, the more important the crowding out effect. Their reasoning is illustrated in Figure 4.B.2 in Section 4.B. The difference of interpretation between both contributions is connected with the type of units considered : the first one considers public housing while the second considers the LIHTC which benefits to private investors. Another channel is also investigated in Ménard (2009) who develops a search and matching model calibrated on the French rental market. In this model, an increase in the share of social housing should increase the turnover leading landlords to set higher rents to compensate their loss due to a higher frictional vacancy rate. When simulating an increase of the number of social housing units from 1 to 5 millions, the total housing stock decreases and then increases suggesting a crowding out effect of 99%. His results are reported in Figure 4.B.3 in Section 4.B.

On the empirical side, Murray (1999) uses US time series from 1935 to 1987, and found that subsidized housing for low income households didn't crowd out unsubsidized ones whereas these built for middle income households did. The author recommends to subsidize units targeted to the poorest who are not served by the unsubsidized sector. These macroeconomics findings based on times series were then confirmed by several cross sectional studies. We can quote Malpezzi and Vandell (2002) who studied the impact of the LIHTC regressing the number of subsidized unit on the the total housing stock per 1000 inhabitants in each State. In addition Sinai and Waldfoegel (2005) found on average that "three government units displace two units that would have been provided by the private market". This effect seemed to be smaller in more populous markets and when there were fewer social housing units per capita. Once again, they advocated for more targeted subsidized housing units programs and noted a decreasing marginal effect of social housing. Finally, the most recent paper written by Eriksen and Rosenthal (2010) used a cross sectional approach to assess the impact of subsidized units on unsubsidized starts. The authors estimated their models using 2SLS with population share of a zone in the subsidized area or with the votes for the party in power as instrument. They found that almost "all LIHTC development is offset by crowd out resulting in a corresponding reduction in unsubsidized construction of rental housing units".

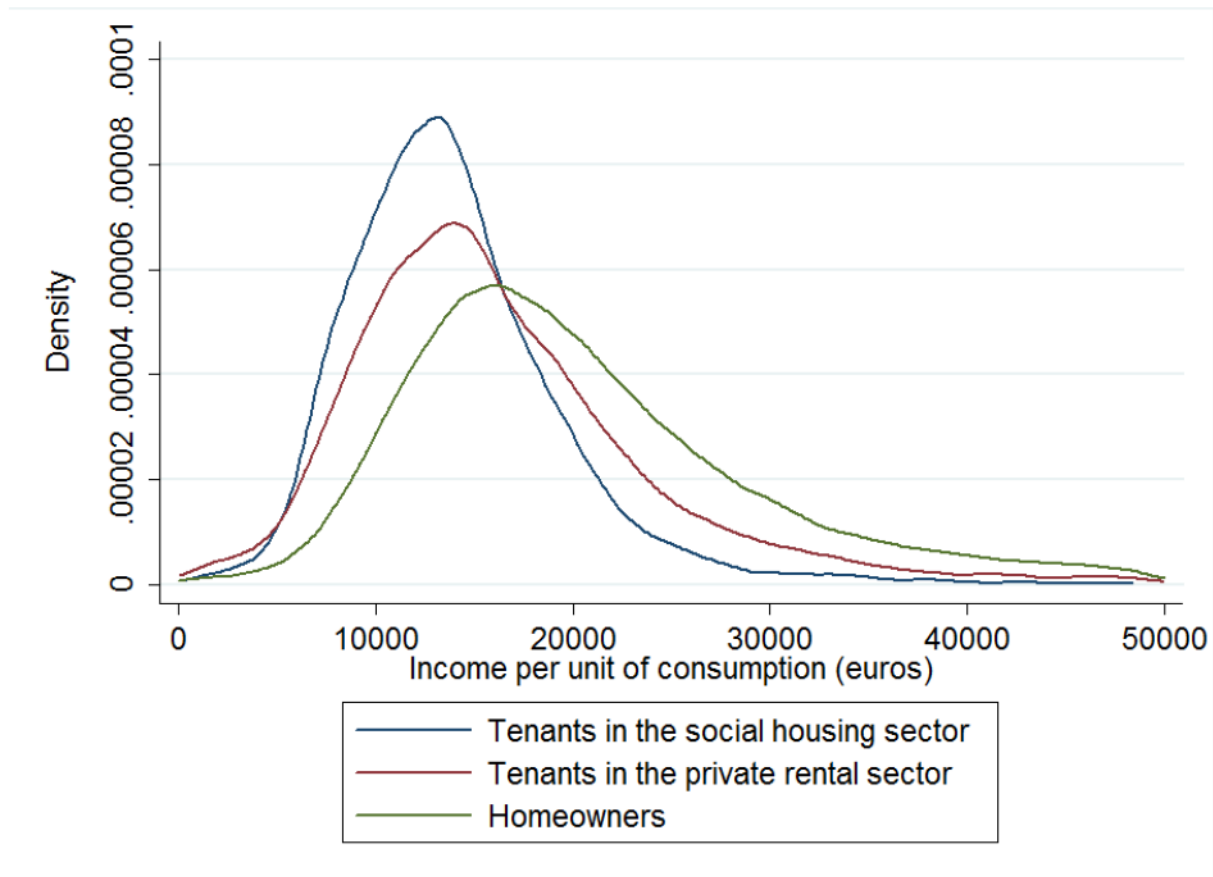
The French context might be viewed as favorable to a competition for tenants. Indeed, one major difference between the US and France is the share of households eligible to subsidized housing. While, the extreme income limit in the US is 80% of the median income of the neighborhood, access to the most common type of unit is granted to up to 60% of the households as illustrated in Figure 4.C.1. If Aubrée (2006) documents that social housing tenants tend to become poorer it is worth noting that their income profile remains extremely close to the ten-

ants in the private sector as illustrated in Figure 4.1. This suggests, that the decline in income due to the fact that the middle class turned to home ownership of single unit affected equally both sectors. Moreover, if single housing units turned much more popular and explained the decline of middle class tenants in the social housing sector in the 80s, over the period under scrutiny only slightly more than half of the new social housing units were flats.

The similarity of the income profile between social housing and private housing tenants is insured through several mechanisms: first poor tenants are entitled the same amount of housing allowances if they are in the private or the social sector. Second, among the new units over the period, we can note an increasing share of PLS units⁴ which is the type of social housing units designed for middle class tenants as reported in Figure 4.C.1. Finally, once the household enters the unit, he can stay even when turning richer⁵. If the landlord can charge them a complementary rent this practice is very limited and the in kind subsidy remains high. Several papers quantified the impact of Social Housing on household's consumption. Le Blanc, Laferrère, and Pigois (1999) found that having access to a subsidized unit increased respectively by 10% and 11% the consumption of housing and other goods. More recently, Trevien (2014) found that tenants of the social housing sectors received an implicit subsidies of 261 euros per month and noted that this subsidy was growing with the level of income. One consequence of this implicit subsidy is analyzed in Goffette-Nagot and Sidibé (2014) who found that public housing allowed households to access more rapidly to homeownership. Moreover, social housing does not seem to worsen the outcome of their tenant on the labor market (Dujardin and Goffette-Nagot (2009)) even if social housing tenants suffer from longer unemployment periods that might be related to their lack of mobility (Costes and El Kasmi (2013)).

4. Prêt Locatif Social : 80 % of the households can pretend to access to such units

5. A reform set in 2010 changed slightly this rules for the tenants whose income is twice higher as the income ceiling



Source : Author's computation from ERF5 2005 (INSEE)

Figure 4.1: Income Distribution of households following their sector of residence

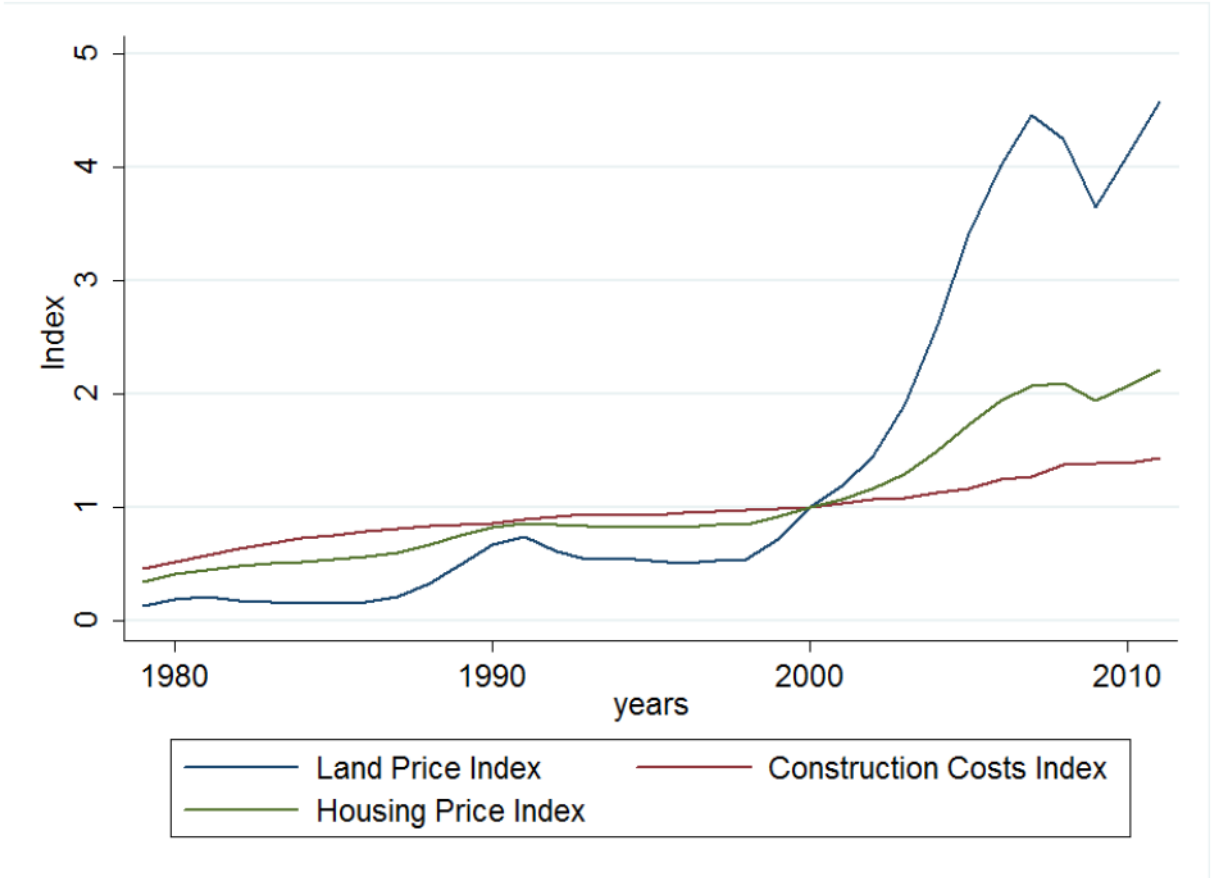
4.3.3 Competition on the Land Market

As we can notice, all the studies investigating the impact of subsidized housing in the US analyze it through the lens of a competition for tenants on the rental market. However, Murray (1999) whose reduced form approach couldn't disentangle the channel of the crowding out effect consider that competition for land was possible but discard this explanation provided that DiPasquale and Wheaton (1996) found that the supply was elastic in the US.

Considering that European Countries and in particular France appear to be much more supply inelastic (Caldera and Johansson (2013)), French scholars have been looking at the impact of subsidized housing through the lens of the land market. A recent contribution was made by Bono and Trannoy (2012) who found that the aforementioned housing tax credit had an important impact on land prices. If one considers the land supply as perfectly inelastic, an additional social housing unit will shift the demand curve resulting in an increase in land price but no increase in the amount of land developed and thus in construction: this is the crowding out effect. In this line Chapelle, Vignolles, and Wolf (2016) didn't find any increase in the number of housing unit built after the Scellier Tax Credit was adopted. Similar conclu-

sions were found for subsidized loans in Beaubrun-Diant and Maury (2014) and Labonne and Welter-Nicol (2016) and for housing allowances (Fack (2006), Grislain-Letrémy and Trevien (2014), and Laferrère and Le Blanc (2004)).

The competition for land might thus be a relevant channel in France as the period under scrutiny went through a major increase in house and land prices as illustrated in Figure 4.2. Between 2000 and 2007, we can observe a dramatic increase in housing prices much faster than the construction cost index resulting in a dramatic rise of the land leverage⁶ and the underlying land index.



Source: Bonnet et al. (2015)

Figure 4.2: Change in the housing price index and its sub-components

4.3.4 Negative Spillovers

Other studies also documented that new place based projects could generate positive or negative externalities. As far as negative externalities are concerned, Baum-Snow and Marion

6. The Share of the housing value attributed to its land component

(2009), documented that the LIHTC increased the turnover of homeowners and crowded out private construction in gentrifying areas while Goujard (2011) found that in Paris new social housing units had a negative impact on housing prices in rich neighborhood. Gobillon and Vignolles (2016) found that cities forced to build new social housing units went through a decline in housing prices but this impact turned not significant in the medium run. As far as positive externalities are concerned Goujard (2011) finds that new social housing blocks had a positive impact on House prices within 50m probably due to the improvement of public amenities in poor neighborhoods. Baum-Snow and Marion (2009) found no crowding out and a positive impact on real estate prices in declining areas. From this literature, we can infer a fourth channel for the crowding out effect : subsidized units might drive private investors away because of the negative externalities perceived by wealthier households. Similar findings were found recently in Diamond and McQuade (2016).

4.4 Empirical identification Strategies

In this paper we try to estimate the causal impact of social (public) housing production on the number of unsubsidized (public) housing starts. To do so, we have to deal with two major endogeneity problems : the unobserved variable bias and the reverse causality bias. The unobserved variable bias arises from the fact that both sectors produce where there are needs (economic growth of the city following a positive shock), this would result in a positive bias when looking at the naive correlation between private and public starts. We thus have to identify exogenous sources of variation of social housing production which are unlikely to influence directly the private sector.

In this respect, the year 2001 was marked by a dramatic change in the policy governing the construction in the social housing sector at the national level. In this year was voted the SRU⁷ Act according to which Municipalities in the main Urban Units ⁸ with more than 3500 inhabitants⁹ have to increase their supply of social housing. One interesting feature of this law is that it didn't put any restriction on the private sector. The local state representatives just put objectives of construction for social housing for periods of three years. Gobillon and Vignolles (2016) showed that using Municipalities around this threshold¹⁰, we could recover similar municipalities having the same market dynamics before the policy. Their findings is relatively similar to Bono, Davidson, and Trannoy (2012) who use a difference in difference strategy with all the French Municipalities. Using this natural experiment in a difference-in-difference

7. Loi de Solidarité et de Renouveau Urbain

8. Urban Units with more than 50 000 inhabitants (Urban Unit are the heart of the French Urban Areas equivalent to the US Metropolitan Statistical Areas)

9. or 1 500 in the Parisian Urban Unit

10. between 2800 and 12 000 in France and 800 and 6000

setting they were able to document the quantitative impact of the law. Our estimation strategy takes their approach one step further and use their difference-in-difference estimate of the impact of the policy as a first stage in order to analyze the impact of these exogenous social housing units on the production of private housing units. The characteristics of the treatment and control groups and their trends on the housing market are reported in Figure 4.D.4 in Section 4.D.

In addition, the literature also documented several drivers of public construction unlikely to be connected with the current drivers of the private sector. The first interesting feature highlighted is the strong path dependency of social housing production : the current level of production of social housing strongly depends on its current size. As a consequence, history might play an important role to explain even many years after the current level of production of the social housing sector. Verdugo (2016) finds that war destruction contributed to increase the importance of social housing within an area. This will constitute a second source of identification. We use a new indicator on the municipalities strongly damaged during the second world war as an instrument to document the long run impact of the production of social housing on the private sector.

We also use this strong path dependency developing a shift share instrument. In such a strategy, we use the share of social housing at the beginning of the period or ten years before multiplied by the national trend net of the observation in order to predict what will be the future growth rate of the stock of social housing. We can think that exploiting the previous characteristics of the municipality combined with the exogenous national trend might be a convenient way to deal with the unobserved variable and the reverse causality bias as the national trend should be independent from the local conditions.

Other contributions highlighted other drivers of public construction, for example Verdugo (2011) highlights that urban unit fragmentation (measured with the split of the population between administrative units) increased the supply of social housing. However, over our period of study, this instrument didn't appear to have any explanatory power. Another importance explanation for social housing could be political : Verdugo (2011) finds that areas where the main municipality is ruled by a left mayor will have a higher share of social housing. However, the color of the political party might also have implications on the private sector as documented in Solé-Ollé and Viladecans-Marsal (2013)

4.4.1 A Difference-in-difference estimate of the crowding out effect

We first use the impact of the SRU law to assess the crowding out effect as the Municipality level. To do so we restrict our sample of Municipalities to the Municipalities around the popu-

lation threshold defining whether the Municipality has to increase its share of social housing. We thus reproduce the estimates of Gobillon and Vignolles (2016) estimating the following specification in the first stage :

$$\begin{aligned} \ln(\text{construction}_{public})_{it} = & \alpha + \beta 1_{\{t>2002\}} 1_{\{SRU(i)=1\}} + \sum_{k=1}^T \delta_k 1_{\{t=k\}} \\ & + \sum_{j=1}^R \sum_{k=1}^T \gamma_{k,j} 1_{\{t=k\}} 1_{\{r(i)=j\}} + \theta_i + \delta X_{it} + \varepsilon_{it} \end{aligned} \quad (4.1)$$

Where $\ln(\text{construction}_{pub})_{ti}$ represents the log the number of private constructions in year t and municipality i, β measures the impact of SRU law, We control with time fixed effect and allow for trend difference across regions thanks to $\sum_{j=1}^R \sum_{k=1}^T \gamma_{k,j} 1_{\{t=k\}} 1_{\{r(i)=j\}}$. The θ_i is a municipality fixed effect. We can also control for the variation of the income in the municipality thanks to X_{it} ¹¹.

In a second stage we then regress the exogenous variation in public housing production due to the law $\ln(\widehat{\text{construction}}_{public})_{it}$ on the log of private construction $\ln(\widehat{\text{construction}}_{private})_{it}$ ¹²:

$$\begin{aligned} \ln(\widehat{\text{construction}}_{private})_{it} = & \alpha + \beta^{crowd} \ln(\widehat{\text{construction}}_{public})_{it} + \sum_{k=1}^T \delta_k 1_{\{t=k\}} \\ & + \sum_{j=1}^R \sum_{k=1}^T \gamma_{k,j} 1_{\{t=k\}} 1_{\{r(i)=j\}} + \theta_i + \delta X_{it} + \varepsilon_{it} \end{aligned} \quad (4.2)$$

β^{crowd} should then provide us an estimate of the crowding out effect as an elasticity between the number of private and social housing starts. However, this strategy can only be reproduced at the Municipal level and has a limited external validity as we are restricted to our subsample of municipality. In order to identify the channels investigating the heterogeneity of the crowding out effect, we complete this strategy with an instrumental variable strategy.

4.4.2 An Instrumental Variable estimate of the crowding out effect

It is worth noting that the research question is relatively close to the problem addressed by Faggio and Overman (2014) for the English labor market. As a consequence, We propose to

11. In an alternate specification we also interact the income at the beginning of the period with time fixed effects

12. We thank Gabrielle Fack for this useful suggestion

adapt their identification strategy to the housing sector. In their approach, Faggio and Overman (2014) study the contribution of public and private employment to employment growth. Equivalently, We propose to study the contribution of social and private construction to the change in the total housing stock estimating a supply equation close to Eriksen and Rosenthal (2010). We first define the total housing stock at time t (H_t) as the addition of private (P_t) and social housing (S_t) units:

$$H_t = S_t + P_t \quad (4.3)$$

As a consequence the proportional change in housing units between period s and t can be expressed as :

$$\frac{H_t - H_s}{H_s} = \frac{P_t - P_s}{H_s} + \frac{S_t - S_s}{H_s} \quad (4.4)$$

In order to assess the impact of social housing variation on the housing stock We propose to estimate the following equation:

$$\left(\frac{P_t - P_s}{H_s} \right)_i = \alpha + \beta \left(\frac{S_t - S_s}{H_s} \right)_i + \gamma X_i + \varepsilon_i \quad (4.5)$$

Where $\frac{P_t - P_s}{H_s}$ is the contribution of private construction to the total housing stock $\frac{S_t - S_s}{H_s}$ is the contribution of social housing construction to the total housing stock. We can control with a set of control variables and administrative fixed effect (X_i) as the unemployment level, the density or the share of empty units, the tax rate and the existence of fiscal incentives at the beginning of the period. These variables are standard in the literature trying to estimate to supply function (DiPasquale and Wheaton (1996)) ε is the unobserved heterogeneity. If β is negative then each additional unit of social housing would displace β private units. On the other hand, if β is positive each additional social unit would increase the private housing stock by β .

The way we should interpret the results are as follows :

If	$\beta < -1$	$-1 < \beta < 0$	$\beta = 0$	$\beta > 0$
1 unit of social housing..	displaces more than 1 unit	partially displaces private construction	Doesn't displace private construction	Supports private construction

Table 4.1: Interpretation of the coefficients

As $\frac{S_t - S_s}{H_s}_i$ might be endogenous as discussed previously, we instrument it with the following first stage :

$$\begin{aligned} \left(\frac{S_t - S_s}{H_s}\right)_i = & \alpha + \beta^{shift} Shift Share_i + \beta^{dam} 1_{\{damaged(i)=1\}} \\ & + \beta^{SRU} 1_{SRU(i)=1} + \gamma X_i + \varepsilon_i \end{aligned} \quad (4.6)$$

Where $Shift Share_i$ ¹³, is a Bartik type of instrument in the spirit of Faggio and Overman (2014) after Bartik (1992), Card (1997) and Moretti (2010). This instrument is composed of two part, $\frac{S_{i,s}}{H_{i,s}}$ is the initial share of the social housing sector while $\frac{S_t^{France} - S_s^{France}}{S_s^{France}}$ is the national trend in the growth of the social housing sector net of the observation. The exclusion restriction states that the past share of the social housing sector and the national trend shouldn't directly influence the local private sector contemporaneous dynamics. A potential caveats of this instrument might arise at the local level where one can think that neighborhoods with a high share of social housing might be associated with lower income and be less attractive for private investors. However, as one can see in Goujard (2011), the spatial spillover of social housing declines rapidly with distance while our smaller unit of aggregation is relatively large. Moreover, a nice feature of this instrument is that it can be computed of all level of aggregation as administrative groups of municipalities¹⁴ and Urban Areas¹⁵, where this concern does not appear relevant anymore.

The $1_{\{damaged(i)=1\}}$ is a dummy variable indicating whether to municipality was officially recognized as "severely damaged" after the second World War. For us, the resulting loss in housing units lead the central state to subsidize important programs of social housing in the 1960s. As pointed in Verdugo (2016), the area strongly bombed still tend to construct more social housing units years later because the sector is much more developed. We think that such remotes events are highly unlikely to be directly linked with the current drivers of the private sector. This allows us to estimate a local effect for the city strongly damaged during WWII.

Finally, we also use the SRU act described in the previous section using the variable $1_{SRU(i)=1}$ indicating whether the city is under the national constraint of the SRU act. This allows us to capture a local impact of social housing for the cities that had a low share of social housing units and had to accelerate the development of the sector during our period of study.

13. $Shift Share_i = \frac{S_{i,s}}{H_{i,s}} \times \frac{S_t^{France} - S_s^{France}}{S_s^{France}}$

14. Etablissements Publics de Cooperation Intercommunale (EPCI) : are administrative associations of municipalities designed to provide some services realizing economies of scale

15. The equivalent of US Metropolitan Statistical Areas in France

Instrument	Shift Share	Damaged city	SRU Act
Exclusion Restriction	Current Stock of Social Housing isn't correlated with unobserved drivers of private construction	War Destructions aren't correlated with unobserved driver of private construction	SRU Act hasn't an impact on private sector in another way than through social housing

Table 4.2: Exclusion restrictions

Our instruments and their exclusion restrictions are summarized in Table 4.2. One interesting feature of our instruments comes from the fact that they exploit very different sources of variation. While the Bartik use the fact that the current stock and national trends determines futures growth, the WWII destruction use the fact that cities damaged a long time ago still build more social housing units while the SRU act exploits the fact that municipality with proportionally less social housing units will accelerate the rate of construction of such units. They have thus different sources of variation in the data and we can thus perform meaningful overidentification test. A p-value above 10% will then inform us that each IV do not yield results significantly different suggesting that they are either valid or invalid in the same way and would have the same correlation with the error term if they are invalid which is unlikely given the very different features of the cities under the SRU act having very few social housing and the cities bombed during WW2.

4.5 Data

Our empirical strategy aims to analyze the impact of social housing starts on private construction. To this end, several database can be used. The most important database that we had access to was the sit@del2 database which is an exhaustive description of all the housing projects built over the period. This dataset allows to cross different information as the type of contracting authority (private individual, company, social landlords or municipalities, Private Public partnership) that is used to distinguish social housing projects from private projects, the types of projects (Individual Vs collective buildings) and the year of construction.

Thanks to this data set we could build several aggregate indicators for the number of construction of social and private units at the city level for different periods. It is worth noting that the land reform of 2006 dramatically decreased the quality of this dataset. However, given the period of study the series used were not affected since it stops at the end of 2008 when the effects of the reform were marginal.

In addition, We use the census data of 1999 and 2009 published on the INSEE website in order to collect information on the housing stock and its composition. The census provides us an exhaustive description for each municipality with information such as the population, the share of social housing units or the housing stock. Some information such as median income are provided at broader levels (EPCI or Urban Areas) whereas other are built aggregating information at the municipality level. We also the median income from the database Revenu Fiscaux Localisés and the income series are provided by the ministry of finance and based on income tax declarations.

There are other databases providing information on the social housing stock that we use as a robustness check. The first one is the Enquete sur le Parc Locatif Social (EPLS) of the ministry of sustainable development which provides information on the number of social housing unit in each city. The second one is the Répertoire du Parc Locatif Social which is an exhaustive census of the social housing stock. Using the year of construction, we are also able to reconstruct the construction series. These yield similar results as with `sit@del2`.

We used also some decrees published in *legifrance* in order to control for the different zoning of social housing and of low income housing tax credit (zones scellier) and the SRU zoning was provided by Bono, Davidson, and Trannoy (2012). The data on World War 2 destructions were found in the archives of the Ministry of Finance. In order to measure the market tightness we use the aggregate average rent in 2009 provided by the CNAF to compute the quintiles and perform robustness checks using the rent per square meter from the database scraped by Chapelle and Eyméoud (2016b).

Sinai and Waldfoegel (2005) emphasized the importance of the aggregation level when identifying the crowding out. We perform our baseline analysis with the smallest French administrative units : Municipalities (see Section 4.D) but we aggregate our database at two higher levels of observation : Groups of Municipalities¹⁶ (see Section 4.E) and Urban Areas¹⁷ (see Section 4.F) to perform robustness checks and check whether part of the impact does not come from a displacement of the private projects in an adjacent area.

16. Etablissements Public de Coopération Intercommunale (EPCI)

17. The French Equivalent of the US Metropolitan Statistical Areas

4.6 Estimates of the crowding out effect and its channels

In this section we present the results of our different estimation strategies and document the potential channels of this effect investigating the heterogeneity of the effect across several dimensions.

4.6.1 Assessing the size of the crowding out effect

In Table 4.1, we present the results of the first identification strategy based on the difference-in-difference developed in Gobillon and Vignolles (2016) on a small group of municipalities around the population threshold. Column (1) presents a placebo test in order to check that the treatment and control groups had the same trend before the SRU act was voted.. Column (2) is our first stage which reproduces the difference-in-difference estimate of the impact of the SRU act. This confirms the findings of Gobillon and Vignolles (2016) with a new database¹⁸ : the SRU act did increase the production of social housing units in the treated municipalities. Finally, column (3) is our second stage and presents our main result. As we can see the instrumented production of social housing units is negatively correlated with the production of private housing units. As our variable are in logs, this can be interpreted as an elasticity. A 1% increase in social housing production due to the SRU act lead the private production to decline by 0.4%. Given the average number of construction in our subsample of municipality this means that each additional housing unit displaces about 2.4 private units. As we will see, this order of magnitude is very robust across our identification strategies. One first puzzle that arises when looking at this result is why does social housing units crowd out more than one unit. There are several possible explanations. The first one suggests that private projects relocate in adjacent areas because few land are available at a given moment. The second one might invoke the fourth channel, if one considers the negative spillovers of social housing unit, there is no obvious limit to the size of this coefficient. Finally, one can think that land consumption per housing unit can explain this findings. Indeed it is well documented that households in social housing units tend to have much more space per person and that the sector lacks of small dwellings. Social housing units are thus larger than private units and if a social housing projects substitutes a private housing project less units will be produced on the same land surface.

18. We also performed a robustness checks with the construction series from the RPLS, results remain of similar magnitude

	(1)	(2)	(3)
	<i>ln(construction_public)</i>	<i>ln(construction_public)</i>	<i>ln(construction_private)</i>
Placebo	0.0532 (0.0414)		
SRU		0.200*** (0.0413)	
<i>ln(construction_public)</i>			-0.404** (0.183)
Municipality and year FE	Y	Y	Y
Income	Y	Y	Y
R2	0.00583	0.00666	.
Obs	22311	42143	42143
N. of Municipalities	2479	2479	2479
Estimation period	1990-2000	1990-2008	1990-2008
Placebo	1995-2000		
SRU		2002-2008	2002-2008
Instrument			SRU
F-stat			48.51

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standards errors are clustered at the Urban Unit level. Sample of L. Gobillon et B. Vignolles (2016) - Municipalities between 800 and 6000 in Ile de France and between 2 800 and 12 000 otherwise. The treatment group is adjusted to be similar to Bono et al (2013). Placebo is a dummy variable with value 1 if the city is concerned by the SRU act and the year is posterior to 1995. SRU is a dummy variable with value 1 if the city is concerned by the SRU act and the year is after 2002. F-stat indicates the strength of the first stage in the IV specification in column (3), it passes the standard critical Stock-Yogo critical value of 5%.

Table 4.1: Diff-in-diff estimate of the impact of the SRU act and estimate of the crowding out effect

Table 4.2 presents the results of the IV strategy with our most flexible instrument : the shift share. In column (1), we report the naive regression which shows a positive correlation between the contribution of social housing and the contribution of the private sector while our difference in difference strategy was yielding a negative coefficient. This correlation is certainly driven by a strong unobserved variable bias. Once we instrument with the shift share instrument with no other controls, this correlation turns negative suggesting that the instrumental variable strategy did remove the unobserved variable bias and documents the crowding out effect. The two other instruments have exactly the same property as illustrated in Table 4.D.3 and yields very close estimates of the crowding out effect. This impact is also close to the one given by the diff-in-diff strategy. In column (3-6) we include additional controls leaving the estimates of the crowding out effect qualitatively unchanged. This strategy suggests a crowding out effect of about 2 units. As already discussed , the fact that the social housing sector might displace more than one unit can be explained by the negative spillover channel and by the fact that social housing units are usually bigger.

In Table 4.3, we perform a serie of robustness checks with our three instruments. As illustrated in column (1-3) the three instruments yield very close estimates. It is also very close our first strategy. The three instruments appear relatively strong, the weakest being the World War II destructions. The instruments pass the overidentification test two by two and together. We perform a last robustness check, computing our shift share instrument for two periods and estimating the crowding out effect in a two period setting in Table 4.D.5 in Section 4.D. The resulting crowding out effect is around 1.2. However, the use of a Bartik instrument in a panel setting may be harder to interpret in particular when there is only two periods. The time fixed effects might be colinear with the national trend that's why we allow for differentiated trend across regions¹⁹. We then try to identify the heterogeneity of the effect with our instrumental approach taking advantage of the large number of observations at our disposal.

	(1)	(2)	(3)	(4)	(5)	(6)
	$\frac{P_t - P_s}{H_s}$	$\frac{P_t - P_s}{H_s}$	$\frac{P_t - P_s}{H_s}$	$\frac{P_t - P_s}{H_s}$	$\frac{P_t - P_s}{H_s}$	$\frac{P_t - P_s}{H_s}$
$\frac{S_t - S_s}{H_s}$	0.726*** (0.132)	-2.782*** (0.236)	-2.380*** (0.225)	-2.380*** (0.223)	-1.579*** (0.171)	-1.721*** (0.242)
% empty units				-0.345*** (0.0274)	-0.459*** (0.0355)	-0.384*** (0.0360)
Unemployment					-0.117*** (0.0141)	-0.123*** (0.0141)
ln(income)					0.120*** (0.00496)	0.0629*** (0.00545)
Department FE	Y	Y	Y	Y	Y	Y
Density	N	N	Y	Y	Y	Y
Local Taxes	N	N	N	N	N	Y
Fiscal Incentives	N	N	N	N	N	Y
R2	0.111	.	.	.	.	.
Obs	36699	36566	36566	36566	30691	30653
Shift Share	N	Y	Y	Y	Y	Y
F-stat		936.9	953.7	954.4	1295.9	733.1

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standards errors are clustered at the groupment of municipalities level. $\frac{P_t - P_s}{H_s}$ represents the contribution of the private sector to the housing stock growth. $\frac{S_t - S_s}{H_s}$ the contribution of the social housing sector to the housing stock growth. Shift share is the Bartik type instrument multiplying the initial share of social housing with the national trend net of the observation. The F-stat shows the strength of the first stages reported in Table 4.D.2. We can see that the instrument is always strong and passes all the standard stock yogo test thresholds. The number of observation decreases when including income which is only available for municipalities above 50 inhabitants.

Table 4.2: Estimate of the crowding out effect at the Municipal level with the Shift Share instrument

19. We thank A. Goujard for this useful suggestion

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	$\frac{P_t-P_s}{H_s}$	$\frac{P_t-P_s}{H_s}$	$\frac{P_t-P_s}{H_s}$	$\frac{P_t-P_s}{H_s}$	$\frac{P_t-P_s}{H_s}$	$\frac{P_t-P_s}{H_s}$	$\frac{P_t-P_s}{H_s}$
$\frac{S_t-S_s}{H_s}$	-1.721*** (0.242)	-2.428* (1.411)	-2.402+ (1.481)	-1.766*** (0.252)	-1.720*** (0.259)	-2.419* (1.236)	-1.765*** (0.253)
% empty units	-0.384*** (0.0360)	-0.397*** (0.0531)	-0.396*** (0.0351)	-0.384*** (0.0430)	-0.384*** (0.0427)	-0.396*** (0.0555)	-0.384*** (0.0429)
Unemployment	-0.123*** (0.0141)	-0.124*** (0.0164)	-0.124*** (0.0151)	-0.123*** (0.0159)	-0.123*** (0.0158)	-0.124*** (0.0159)	-0.123*** (0.0159)
ln(income)	0.0629*** (0.00545)	0.0605*** (0.00849)	0.0606*** (0.00781)	0.0627*** (0.00673)	0.0629*** (0.00671)	0.0605*** (0.00755)	0.0627*** (0.00673)
Department FE	Y	Y	Y	Y	Y	Y	Y
Density	Y	Y	Y	Y	Y	Y	Y
Local Taxes	Y	Y	Y	Y	Y	Y	Y
Fiscal Incentives	Y	Y	Y	Y	Y	Y	Y
R2	.	.	.	.	.	.	.
Obs	30653	30653	30653	30653	30653	30653	30653
Shift Share	Y	N	N	Y	Y	N	Y
SRU Act	N	Y	N	Y	N	Y	Y
Damaged in WWII	N	N	Y	N	Y	Y	Y
F-stat	733.1	32.78	18.47	407.5	366.5	25.82	271.7
p-value				0.609	0.771	0.992	0.842

Standard errors in parentheses

+ $p < 0.11$, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standards errors are clustered at the groupment of Municipalities level. $\frac{P_t-P_s}{H_s}$ represents the contribution of the private sector to the housing stock growth. $\frac{S_t-S_s}{H_s}$ the contribution of the social housing sector to the housing stock growth, this coefficient is directly interpretable in terms of number of units crowded. SRU is a dummy indicating whether the municipality was under the SRU act, Damaged WWII indicates whether the municipality was strongly damaged during WWII. Shift share is the Bartik type instrument multiplying the initial share of social housing with the national trend net of the observation. The F-stat shows the strength of the first stages reported in Table 4.D.4, we can see that all the instruments are strong and passe the 5% level stock yogo test except the Damaged WWII instrument which pass the test at 10%. The p-value shows that w can't reject the exogeneity of the instruments in any specifications.

Table 4.3: Estimate of the crowding out effect at the Municipal level with different instruments

4.6.2 Identifying displacement in adjacent areas

A first concern when identifying the crowding out effect is to determine whether displaced projects are a net loss or just displaced to adjacent areas. Given the magnitude of the effect, this might be an important concern. To do so, we follow Sinai and Waldfogel (2005) and use higher aggregation level as urban areas and groups of municipalities as illustrated in Tables 4.4 and 4.5. For the groups of municipalities we can still use the World War destruction and the shift share as instruments. The SRU act is too weak at aggregate level and does not predict any increase in the number of social housing units. In Table 4.4, we can observe that the estimated impact is of the same order of magnitude when comparing the estimates for groups of municipalities and for municipalities. The World War destruction instrument is weaker, but instruments still pass the over-identification test when jointly used. We also perform a robustness check in a panel framework using the Shift share instrument which still suggest a crowding out effect but, as already mentioned, we are less confident in the use of such instrument when using time fixed effects. Finally, table 4.5 reproduces our estimation strategy using the shift share instrument in cross section and in panel. The order of magnitude of the effect remains the same. We can thus conclude that displacements in adjacent areas remain limited. We thus investigate the different channels at the Municipal level where our instruments are stronger.

	(1)	(2)	(3)	(4)	(5)	(6)
	$\frac{P.t-P.s}{H.s}$	$\frac{P.t-P.s}{H.s}$	$\frac{P.t-P.s}{H.s}$	$\frac{P.t-P.s}{H.s}$	$\frac{P.t-P.s}{H.s}$	$\frac{P.t-P.s}{H.s}$
$\frac{S.t-S.s}{H.s}$	1.638*** (0.572)	-1.948*** (0.570)	-3.245* (1.807)	-1.959*** (0.570)	0.376*** (0.0668)	-4.392*** (1.525)
Unemployment	0.00216*** (0.000729)	0.00250*** (0.000776)	0.00242*** (0.000854)	0.00250*** (0.000776)	0.000532 (0.000478)	0.00117** (0.000486)
% Empty units	-1.058*** (0.148)	-1.091*** (0.192)	-1.161*** (0.225)	-1.092*** (0.192)	-0.392*** (0.0580)	-0.985*** (0.214)
REG FE	Y	Y	Y	Y	N	N
Regional Shocks	N	N	N	N	Y	Y
Density	Y	Y	Y	Y	Y	Y
Time & EPCI FE	N	N	N	N	Y	Y
R2	0.389	.	.	.	0.649	.
Obs	2427	2427	2427	2427	4844	4844
N of EPCI	.	.	.	.	2422	2422
period	1999-2009	1999-2009	1999-2009	1999-2009	1990-2009	1990-2009
Shift Share	N	Y	N	Y	N	Y
Damaged in WW2	N	N	Y	Y		
F-stat		227.4	13.12	113.8		15.44
p-value				0.440		

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standard Errors are clustered at the department level. $\frac{P.t-P.s}{H.s}$ represents the contribution of the private sector to the housing stock growth. $\frac{S.t-S.s}{H.s}$ the contribution of the social housing sector to the housing stock growth, this coefficient is directly interpretable in terms of number of units crowded. Damaged WWII indicates whether at least one municipality of the group was strongly damaged during WWII. Shift share is the Bartik type instrument multiplying the initial share of social housing with the national trend net of the observation. The F-stat shows the strength of the first stages reported in Table 4.E.2, we can see that all the instruments are strong and pass the 5% level stock yogo test except the Damaged WWII instrument and the Bartik in the panel specification (column (6)) which pass the test at 10%. The p-value shows that we can't reject the exogeneity of the instruments in any specifications. We allow for differentiated regional trends in the panel specification (columns (5) and (6)).

Table 4.4: Estimates of the crowding out effect in groups of Municipalities (EPCI)

	(1)	(2)	(3)	(4)
	$\frac{P.t-P.s}{H.s}$	$\frac{P.t-P.s}{H.s}$	$\frac{P.t-P.s}{H.s}$	$\frac{P.t-P.s}{H.s}$
$\frac{S.t-S.s}{H.s}$	0.951*** (0.174)	-1.971* (1.079)	0.471*** (0.142)	-1.366* (0.825)
Unemployment	0.00110 (0.000774)	0.00234** (0.00111)	0.000429 (0.000753)	0.00199* (0.00103)
% Empty units	-0.716*** (0.118)	-0.814*** (0.140)	-0.195 (0.150)	-0.353*** (0.134)
Region FE	Y	Y	N	N
Type of UA	Y	Y	N	N
Regional Shocks	N	N	Y	Y
Density	Y	Y	Y	Y
Time & UA FE	N	N	Y	Y
R2	0.437	.	0.568	.
Obs	765	765	1530	1530
N of UA	.	.	765	765
period	1999-2009	1999-2009	1990-2009	1990-2009
Shift Share	N	Y	N	Y
F-stat		35.69		10.23

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standard errors are clustered at the regional level. $\frac{P.t-P.s}{H.s}$ represents the contribution of the private sector to the housing stock growth. $\frac{S.t-S.s}{H.s}$ the contribution of the social housing sector to the housing stock growth, this coefficient is directly interpretable in terms of number of units crowded. Shift share is the Bartik type instrument multiplying the initial share of social housing with the national trend net of the observation. The F-stat shows the strength of the first stages reported in Table 4.F.2, we can see the instrument pass the 5% level stock yogo test in cross section (column (2)) and the 15% in the panel specification (column (4)). We allow for differentiated regional trends in the panel specification (columns (3) and (4)).

Table 4.5: Estimates of the crowding out effect at the Urban Area Level

4.6.3 Competition for Land or for tenants

We then try to disentangle the channels of the crowding out effect. To do so our idea is simple and close to the intuition of Sinai and Waldfogel (2005) who looks at the heterogeneity of the effect in areas with different levels of density. We can summarize our strategy to identify the channels with the two following ideas. First, areas where the market is tight and rent are high (as the last quintile of rent) will have important waiting list in the social housing sector, the competition for tenants will thus be limited. On the other hand, in lower rent quintiles the rent difference between the social and the private sector will be lower. Shorter waiting lists will thus encourage competition between both sectors on the rental market. Second, areas with a limited surface already developed will be less prone to a competition for land between both sectors while areas where the developed surface is already high will be sensitive to the land competition channel. We thus reproduce our identification strategy for quintiles of rent and of surface developed. In Table 4.6, we present our results for the different rent quintiles. As we can see, there is enough variation in the instruments with the five groups to deal with the endogeneity bias. In addition, the overidentification tests remain satisfactory. We can observe a U-shape effect : the crowding out effect seems to be weaker for the first and the last quintile. Such a pattern are compatible with both competition for land and for tenants. First, the low effect in the first quintile might be related with the fact that these areas are also less land constrained. Second, the fact that the crowding out effect is declining between the fourth and the fifth quintile is consistent with the patterns observed in the US in Sinai and Waldfogel (2005) who found a lower crowding out effect in more population areas interpreted as the symptom of competition for tenants. Table 4.7 presents the results in the different developed land quintile The first stage is weak for the second quintile and the exogeneity test is not satisfactory for the third one. However, we can compare the first and the fifth quintile that present a pattern consistent with a competition for land : there is no crowding out in the first quintile while it remains high and significant in the last quintile. From this analysis, we can conclude that both competition for land and for tenants appear relevant to explain the crowding out effect.

	(1)	(2)	(3)	(4)	(5)
	$\frac{P_t - P_s}{H_s}$	$\frac{P_t - P_s}{H_s}$	$\frac{P_t - P_s}{H_s}$	$\frac{P_t - P_s}{H_s}$	$\frac{P_t - P_s}{H_s}$
$\frac{S_t - S_s}{H_s}$	-1.448*	-2.473***	-2.089***	-2.443***	-1.555***
	(0.843)	(0.563)	(0.705)	(0.520)	(0.548)
% empty units	-0.187***	-0.512***	-0.587***	-0.631***	-0.0407
	(0.0584)	(0.0455)	(0.0766)	(0.0738)	(0.0837)
Unemployment	-0.151***	-0.101***	-0.134***	-0.134***	-0.329***
	(0.0395)	(0.0300)	(0.0518)	(0.0498)	(0.0618)
ln(income)	0.0888***	0.0569***	0.0338	-0.00981	-0.0335*
	(0.0197)	(0.0144)	(0.0209)	(0.0178)	(0.0184)
Department FE	Y	Y	Y	Y	Y
Density	Y	Y	Y	Y	Y
Local Taxes	Y	Y	Y	Y	Y
Fiscal Incentives	Y	Y	Y	Y	Y
R2	.	.	.	.	.
Obs	4204	4404	4484	4533	4554
quintile	1	2	3	4	5
Shift Share	Y	Y	Y	Y	Y
SRU Act	N	Y	Y	Y	Y
Damaged in WW2	N	Y	Y	Y	Y
F-stat	97.91	45.63	36.08	35.90	39.24
p-value		0.166	0.507	0.817	0.306

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standards errors are clustered at the Department level. $\frac{P_t - P_s}{H_s}$ represents the contribution of the private sector to the housing stock growth. $\frac{S_t - S_s}{H_s}$ the contribution of the social housing sector to the housing stock growth, this coefficient is directly interpretable in terms of number of units crowded. SRU is a dummy indicating whether the municipality was under the SRU act, Damaged WWII indicates whether the municipality was strongly damaged during WWII. Shift share is the Bartik type instrument multiplying the initial share of social housing with the national trend net of the observation. The F-stat shows the strength of the first stages which pass the standard critical values. The p-value shows that we can't reject the exogeneity of the instruments in any specifications. In column (1) the Act and the damaged Municipalities are dropped because no observations are concerned : it is mostly rural municipalities. The rent quintiles are computed at the national level we the observation of the year 2009. Quintile 1 corresponds to the municipalities with the lowest average rent in the private sectors whereas quintile 5 corresponds to the area with the highest average rent. The quintiles are the same when using the rent per square meter in 2016 using Chapelle and Eyméoud (2016a).

Table 4.6: Estimate of the crowding out effect at the Municipal level for different rent quintile

	(1)	(2)	(3)	(4)	(5)
	$\frac{P_t - P_s}{H_s}$	$\frac{P_t - P_s}{H_s}$	$\frac{P_t - P_s}{H_s}$	$\frac{P_t - P_s}{H_s}$	$\frac{P_t - P_s}{H_s}$
$\frac{S_t - S_s}{H_s}$	-0.268 (0.642)	-3.171** (1.405)	-1.849** (0.933)	-1.711*** (0.513)	-1.829*** (0.511)
% empty units	-0.384*** (0.0341)	-0.525*** (0.0926)	-0.275*** (0.0782)	-0.506*** (0.0585)	-0.668*** (0.0814)
Unemployment	-0.0977*** (0.0215)	-0.158*** (0.0582)	-0.154*** (0.0500)	-0.150*** (0.0394)	-0.209*** (0.0557)
ln(income)	0.0690*** (0.0104)	0.0413* (0.0222)	0.0271 (0.0209)	0.0246 (0.0150)	0.0329* (0.0189)
Department FE	Y	Y	Y	Y	Y
Density	Y	Y	Y	Y	Y
Local Taxes	Y	Y	Y	Y	Y
Fiscal Incentives	Y	Y	Y	Y	Y
R2	.	.	.	.	.
Obs	7017	2470	4937	5641	5404
quintile	1	2	3	4	5
Shift Share	Y	Y	Y	Y	Y
SRU Act	Y	Y	Y	Y	Y
Damaged in WW2	Y	Y	Y	Y	Y
F-stat	28.66	6.557	24.13	44.52	37.89
p-value	0.577	0.148	0.0288	0.143	0.297

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standard errors are clustered at the Department level. $\frac{P_t - P_s}{H_s}$ represents the contribution of the private sector to the housing stock growth. $\frac{S_t - S_s}{H_s}$ the contribution of the social housing sector to the housing stock growth, this coefficient is directly interpretable in terms of number of units crowded. SRU is a dummy indicating whether the municipality was under the SRU act, Damaged WWII indicates whether the municipality was strongly damaged during WWII. Shift share is the Bartik type instrument multiplying the initial share of social housing with the national trend net of the observation. The F-stat shows the strength of the first stages which pass the standard critical values. The p-value shows that we can't reject the exogeneity of the instruments except in column (3). The space quintiles are computed at the national level with the observation of Corine Landcover 2000. Quintile 1 corresponds to the municipalities with the lowest share of developed land whereas quintile 5 corresponds to the area with the highest share of developed land.

Table 4.7: Estimate of the crowding out effect at the Municipal level for different developed land quintile

4.6.4 Negative Spatial Spillovers

We now try to identify whether negative spillovers might be responsible for the observed crowding out effect. To do so, we follow the intuition of Baum-Snow and Marion (2009) who investigate the heterogeneity of the crowding out effect between gentrifying areas and declining areas. They identified negative spillovers showing that the crowding out was strong in gentrifying areas whereas it was not significant in declining areas. In the same spirit, Goujard (2011) found that social housing projects had a negative impact on prices in rich neighborhoods and a positive one in poor neighborhoods. To identify such a channel we divide our sample in quintile of income computed within urban areas to distinguish rich from poor neighborhoods. Table 4.8 presents our results. The patterns remain puzzling and do not allow us to have a clear interpretation. We can observe a rather stable effect around 2 across quintiles. If there is a slight increase in the coefficient between the third and the fifth quintiles, estimates are

also less precise. This absence of clear patterns tends to be in line with the findings of Goujard (2011) who shows that spatial spillovers decline rapidly in space and with our findings at higher aggregation levels.

	(1)	(2)	(3)	(4)	(5)
	$\frac{P_t - P_s}{H_s}$	$\frac{P_t - P_s}{H_s}$	$\frac{P_t - P_s}{H_s}$	$\frac{P_t - P_s}{H_s}$	$\frac{P_t - P_s}{H_s}$
$\frac{S_t - S_s}{H_s}$	-2.098***	-2.422***	-0.938*	-1.631***	-2.030***
	(0.540)	(0.407)	(0.521)	(0.386)	(0.489)
% empty units	-0.288***	-0.397***	-0.425***	-0.373***	-0.389***
	(0.0417)	(0.0410)	(0.0556)	(0.0505)	(0.0559)
Unemployment	-0.120***	-0.152***	-0.0727**	-0.129***	-0.158***
	(0.0273)	(0.0271)	(0.0365)	(0.0333)	(0.0416)
ln(income)	0.0546***	0.0188	0.0175	0.0434	-0.0421**
	(0.0192)	(0.0292)	(0.0361)	(0.0291)	(0.0208)
Department FE	Y	Y	Y	Y	Y
Density	Y	Y	Y	Y	Y
Local Taxes	Y	Y	Y	Y	Y
Fiscal Incentives	Y	Y	Y	Y	Y
R2	.	.	.	.	.
Obs	6497	6095	6151	6092	5818
quintile	1	2	3	4	5
Shift Share	Y	Y	Y	Y	Y
SRU Act	Y	Y	Y	Y	Y
Damaged in WW2	Y	N	Y	Y	Y
F-stat	73.38	97.97	51.87	60.72	42.80
p-value	0.191	0.980	0.845	0.393	0.686

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standards errors are clustered at the Department level. $\frac{P_t - P_s}{H_s}$ represents the contribution of the private sector to the housing stock growth. $\frac{S_t - S_s}{H_s}$ the contribution of the social housing sector to the housing stock growth, this coefficient is directly interpretable in terms of number of units crowded. SRU is a dummy indicating whether the municipality was under the SRU act, Damaged WWII indicates whether the municipality was strongly damaged during WWII. Shift share is the Bartik type instrument multiplying the initial share of social housing with the national trend net of the observation. The F-stat shows the strength of the first stages which pass the standard critical values. The p-value shows that we can't reject the exogeneity of the instruments in any of the specifications. The income quintiles are computed within each urban area with the observation of Corine Landcover 2000. Quintile 1 corresponds to the municipalities with the lowest average income within their urban area whereas quintile 5 corresponds to the municipalities with the highest average income within their urban area.

Table 4.8: Estimate of the crowding out effect at the Municipal level for different income quintile within the Urban Area

4.7 Interpretation and Policy Implications

4.7.1 Why is the crowding out effect larger than 1 ?

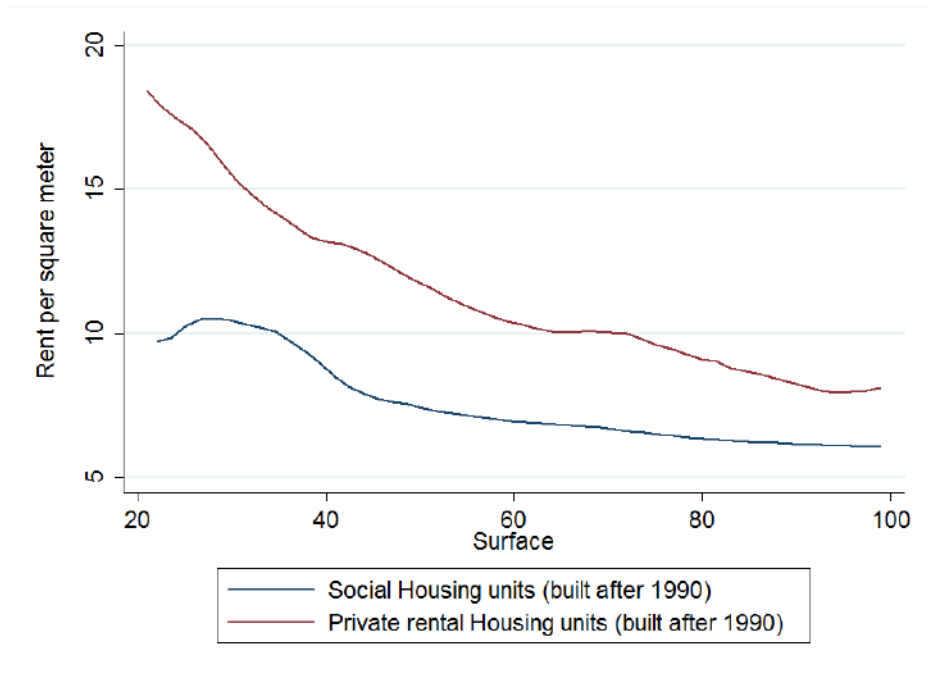
Our results at several aggregation levels and within several quintiles of income, land use and rents robustly estimated a crowding out higher than 1. At first look, this robust result looks puzzling. For us there are actually two possible and complementary answers.

First, as suggested in Ménard (2009), competition for tenants can actually generate a crowding out higher than one and decrease the housing stock through its influence on the frictional vacancy rate. Reducing the attractiveness of the rental sector for private investors, social housing is likely to drive private rents up²⁰ and to decrease the number of housing units. However, this interpretation is only mildly supported by our data. Applying our identification to the variation of the number of vacant units²¹ in Table 4.D.7, the impact of social housing is not robust across our specifications. The positive impact is only driven by the shift share instrument.

Our favorite explanation is based on the land channel under the light of the organization of the social housing sector. As we already mentioned, this sector is strongly regulated : the construction norms, the amount of subsidies per square meter , the rent per square meter are set by the central state exerting an important constraint on social landlords. As a consequence, their optimization behavior does not mimic market behavior. This was already noted in Chapelle and Wasmer (2016), who showed that the social sector rent gradient in Paris Urban Area is almost flat while it is strongly sloppy in the private sector. To our concern, the construction norms, the way the subsidies are allocated and rents are set seem to drive social landlords to build bigger units and thus less housing units than the private sector on a similar land surface. Indeed, while small surfaces have a higher rent per square meter and a higher rent price ratio in the private sector, we do not find such a pattern in the social housing sector. We illustrate this in in Figure 4.1. As we can see, the rent per square is almost flat in the social housing sector while it has a strong declining slope in the private sector. Moreover, we can observe that the social housing sector almost didn't built any units between 25 and 50 square meters while the private rental sector appears strongly present. Finally, we tried to estimate our models on the number of square meters bui, the first stages turn very weak. We only have our difference in difference strategy for which the first stage passes the 15% critical value and the estimates points at 0.98 private square feet displaced for 1 public square foot but it is only significant at the 12% level. There are positive and negative consequences for such a system. On the positive side, the average space per person in the social housing sector should be higher and avoid overcrowding. As already mentioned this may have important positive implications for health (Rauh, Landrigan, and Claudio (2008)) or children's schooling outcome (Goux and Maurin (2005)). On the negative side, there is a lack of small dwellings in the social housing and some households, as parent's whose children left the home, are over-consuming space. This second interpretation is in line with the low elasticity of the French housing market and is thus our favorite.

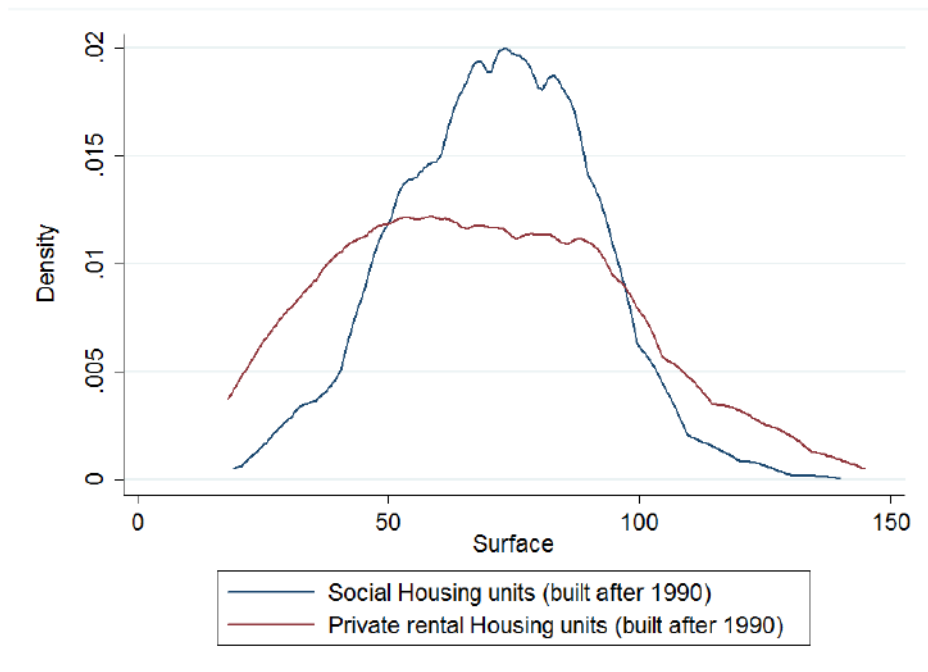
20. This prediction can also be found in Boulhol (2011) and in Chapelle and Wasmer (2016)

21. We thank Alain Trannoy for this useful suggestion



Source: Author's computation from the French Housing Survey 2013 (INSEE)

(a) Rent profiles in social and private rental sectors



Source: Author's computation from the French Housing Survey 2013 (INSEE)

(b) Surface of the new units in social and private rental sectors

Figure 4.1: Comparison of the rent profile and the surface in the social and private rental sectors

4.7.2 Policy implications

Housing efficiently the urban poor appears to remain an important puzzle for policymakers and scholars (Apgar Jr (1990)). The impact of both types of policies may vary according to the state of the housing market and the way programs are calibrated. We thus think that providing additional empirical evidence on the topic could improve the understanding of the mechanisms at stake.

As far as allowances and vouchers are concerned, one of their major advantage would be to allow households to find the place that better fit their needs reducing their rent to income ratio. However, some scholars suggested that households could dedicate their surplus of revenue to other goods and thus wouldn't increase their housing consumption reducing the benefits of such a system. In addition, there is also a debate on the impact of allowances on household's rent to income ratio. On the one hand, some theorists suggest that allowances may be captured by landlords leading to an increase in rent prices (Fack (2006)). On the other hand, some authors suggest that this effect might only happen on the short run since this increase in rent level should boost the supply (Apgar Jr (1990)). Empirical papers usually suggest that allowances do increase the rent level even in the long run (Fack : 2005; Grislain-Letrémy and Trevien (2014)). It is worth noting that the magnitude of the effect varies widely between the US and France. This might be due the fact that supply elasticity is much lower in France (OECD : 2011). In support to this view, Eriksen and Ross (2015) showed that the inflationary impact is much stronger in relatively supply inelastic US cities.

On the other hand, if place based programs allow to control that households consume the appropriate amount of housing, they might be less efficient and face higher construction costs. They also generate long waiting lists and as documented here might crowd out private construction when the supply elasticity is low or when competing with the private rental sector.

If we document a strong crowding out effect probably also explained by the low supply elasticity, this study does not deny that social housing might be an interesting and useful policy. In addition, despite this strong crowding out effect and a low supply elasticity, France is one of the developed country that builds the most important number of units when reported to the evolution of its population. Second, social housing might be an interesting way to cope with the housing problems of poor tenants, for example granting them access to wealthier neighborhood. Such argument is developed in Chapelle and Wasmer (2016) who use a monocentric model to show that such controlled sector allows to decrease spatial segregation by granting access of unemployed to the city center. However, the way the French social housing sector is calibrated might reduces this benefit as documented empirically in Laferrère (2013). In this study, the author noted that within the social sector the poorest and the richest tend

to live in different areas and buildings (richer being in the more comfortable ones) in particular in Paris. Her model and empirical analysis conclude that there could be a phenomenon of “filtration” related with the right of security of tenure and the disconnection between the level of income and the rent paid. In other words people who get richer will stay in the social housing sector if their housing unit is of good quality. This is supported by some empirical evidences: the level of income is positively correlated with the time people stay in the same housing unit in the social sector (contrary to the private sector). Such findings are thus in favor of reducing the tenant’s limit of tenants. However, this recommendation should be balanced with the desire to create social mixity within buildings but such a concern has been challenged in Del Bello, Patacchini, and Zenou (2015) who shows that school interactions are much more important than neighborhoods one. In other words, the externalities that children receive at school are much stronger than the externalities they can receive from their close neighbors.

Considering the land channel and the size of the effect, a second policy recommendation arises. For us the size of the crowding out effect tends to support that competition for land is mostly responsible for such phenomenon. In this light of the discussion of the previous section, we would thus recommend to relax the constraints of social landlords providing them more incentive to provide small dwellings in order to improve the access of singles to this sector. Indeed, if the fact that social housing offers larger units allows to avoid overcrowding and allows to increase households’ housing consumption, it also generates an under-representation of poor singles in the sector.

4.8 Conclusion

In this paper we document a strong and robust crowding out effect of private construction by social housing projects. Our specifications converge to the fact that one social housing unit crowds out 2 private units. The patterns suggest that both competition for land and for tenants are possible. Nevertheless, given the magnitude of the effect and the numerous evidence on the low supply elasticity of France (see Chapelle and Eyméoud (2016b) for a complete review), we can think that the land channel is the most important. The fact that one subsidized unit displaces more than one private unit is probably explain by the internal constraint of the social housing sector. Indeed, social landlords tend to build bigger units and will thus consume more land per unit. The policy recommendations from our study are twofold. We first suggest that the social housing sector could reduce the income ceiling for its access and concentrate our poorer tenants. Second, it might be interesting to change the constraint on the sector in order to produce more small social housing dwellings.

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Appendix

4.A Structure of the housing stock in several OECD countries

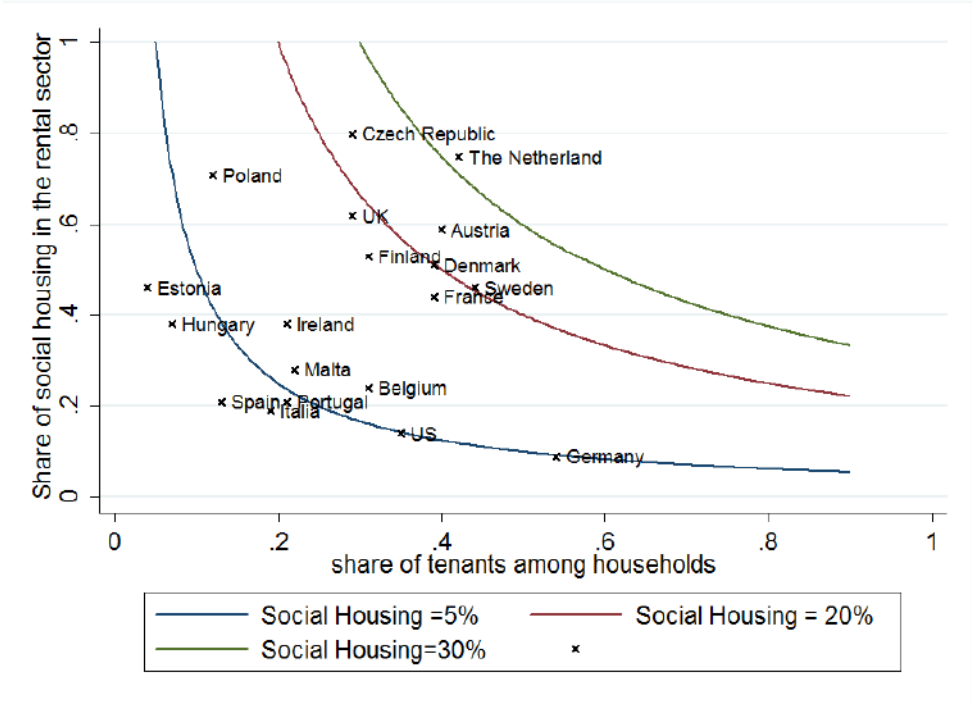
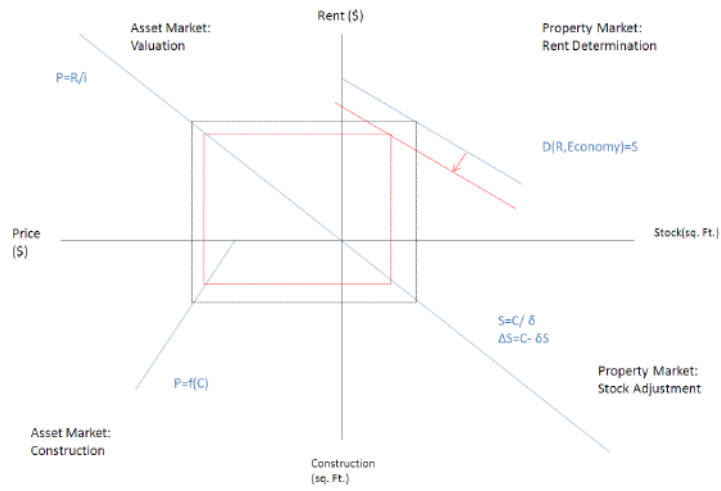


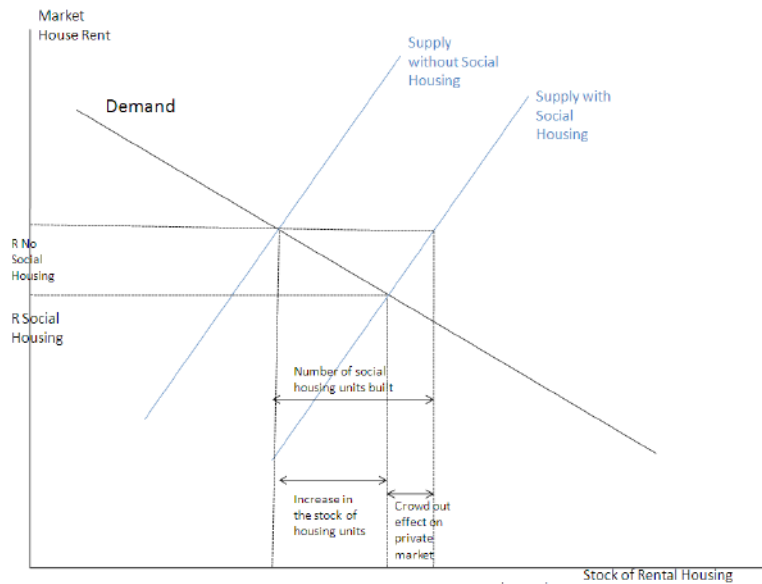
Figure 4.A.1: Occupation status in some OECD countries

4.B Illustrations of the crowding out effect



Source : DiPasquale and Wheaton (1996)

Figure 4.B.1: Public Displacement of Private Construction



Source: Eriksen and Rosenthal (2010)

Figure 4.B.2: Crowding Out effect on the Housing Market

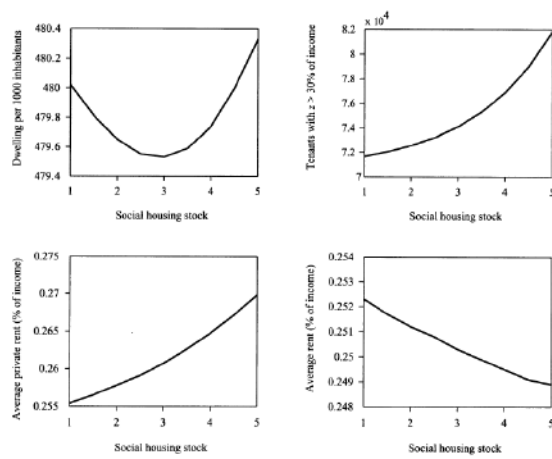


FIGURE 1. — The Effects of Social Housing.

Source : Ménard (2009)

Figure 4.B.3: Crowding Out effect in a frictional rental market

4.C Description of the French Social Housing Sector

In France, up to 60% of the households is eligible to the most common type of housing unit (PLUS) whereas this figure can raise up to 80% for some specific units. In addition, while LIHTC units are allocated by Local Housing Authorities, in France, one third of social housing units of each projects are allocated to the central state whose local representative propose potential tenants to the landlords' assignment commission. The remaining units are shared between the social landlord, the local entities and employers' representative who contribute to finance the project Each entity proposes their tenants to the assignment commission. It is worth noting that tenants are required to respect the income ceiling when If some landlords developed some objective systems in order to rank tenants, the way units are allocated is usually considered as a black box (Bourgeois (2013)).

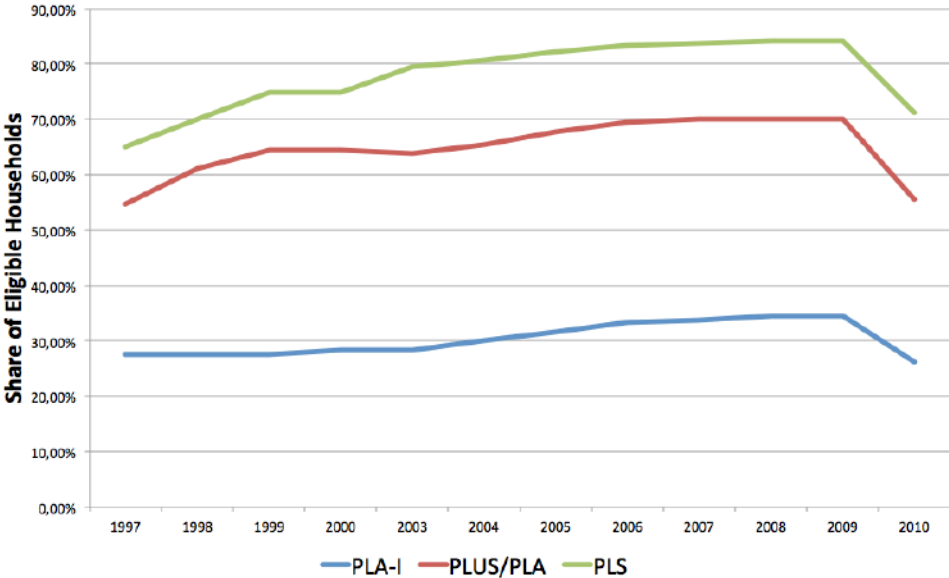


Figure 4.C.1: Share of households eligible to a social housing unit according to the type of units

	PLA-I	PLUS (Most common)	PLS	PLI
Subsidized interest rate (wrt to livret A)	-0.2 percentage points	+0.6 pp	+1.1 pp	+1.4 pp
Eligible Tenants	Less wealthy households (1/3 of the HHS)	Middle and working class (2/3 of the HHS)	4/5 of the HHS	90pct of the HHS
Maximum Rent	5.42(Ibis)	6.09(Ibis)	9.14 (Ibis)	16.82 (Paris)
Eur per sq m(area)	5.09(I) 4.46(II) 4.14(III)	5.73(I) 5.03(II) 4.67(III)	8.60(I) 7.54(II) 7.01(III)	14.01(A) 9.74(B) 7.01(C)
Local Subsidies	Yes	Yes	Yes	
State Subsidies	-Subsidized loans -Brick and mortar (up to 20pct) -reduced VAT -No tax on Housing property during 25 years	-Subsidized loans -Brick and mortar up to 5pct -reduced VAT -No tax on Housing property during 25 years	-Subsidized loans -reduced VAT -No tax on Housing property during 25 years	-Subsidized loans

Table 4.C.1: Different Types of social housing in France

4.D Descriptive statistics and First stage for Municipalities

The first level of observation is the municipality, the smallest administrative level in France with an elected council. Many decisions in terms of housing policies are taken at this level and a neighborhood quality can often be associated with the name of the municipality. However, there are many municipalities in France and a continuous urban area may be composed of several municipalities which might form a broader and more relevant market. In addition, municipalities have progressively delegated part of their power to EPCIs which are association of municipalities with fiscal instruments that were built in order to realize economies of scale implementing public policies. There are more than 36 000 municipalities in France.

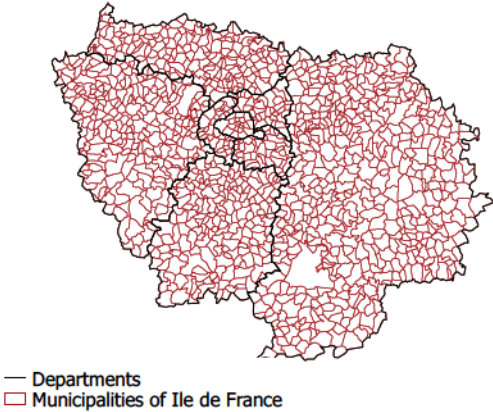


Figure 4.D.1: Municipalities : the example of Ile de France

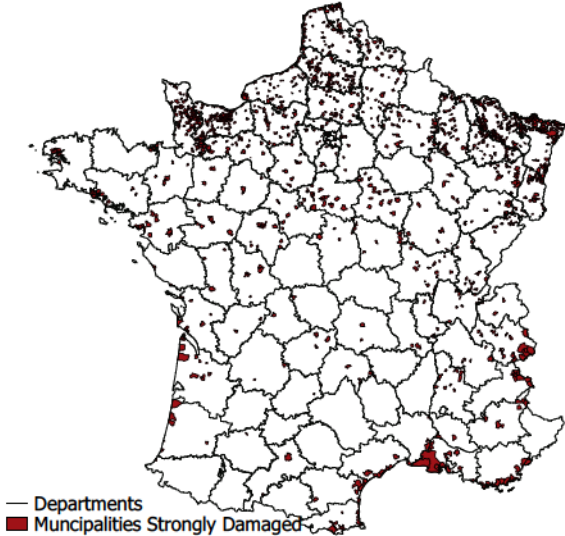


Figure 4.D.2: Municipalities damaged during the Second World War

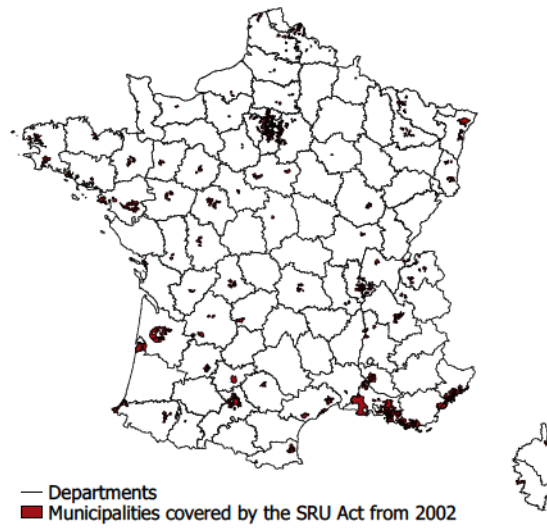
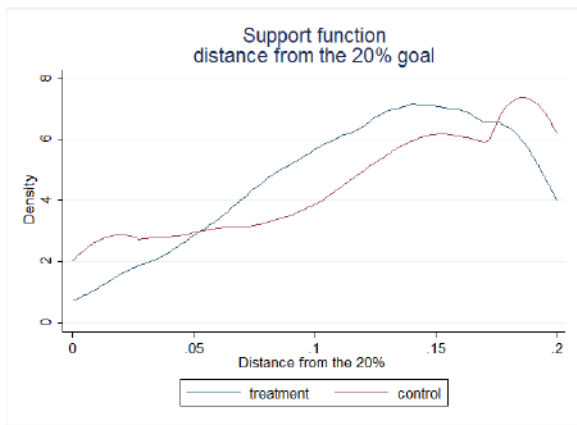
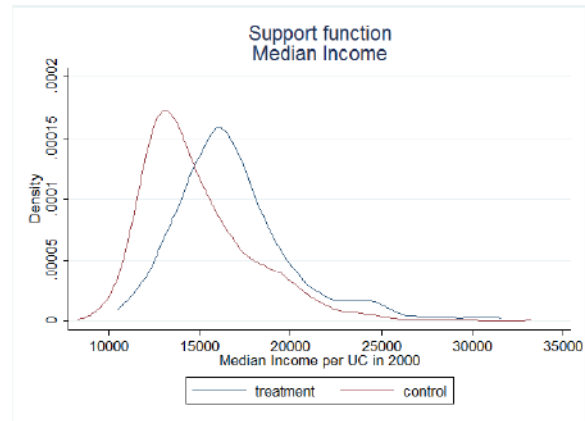


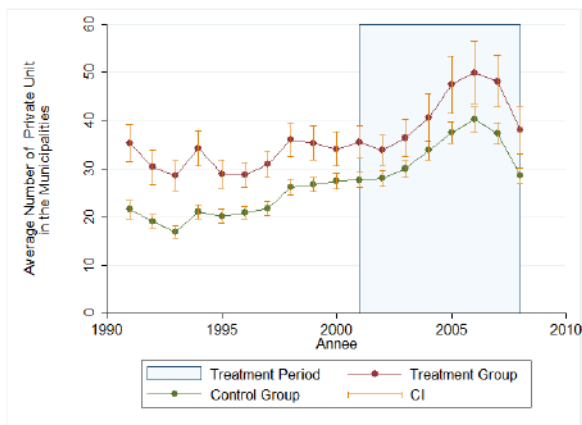
Figure 4.D.3: Municipalities under the SRU Act between 2000 and 2008



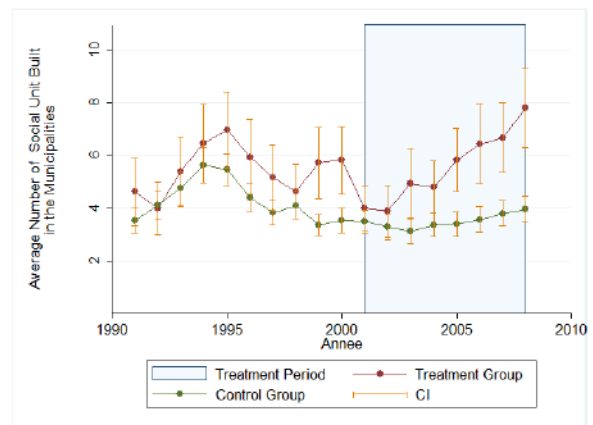
(a) Distance From the Goal of 20% in the Municipalities



(b) Median Income of the Municipalities



(c) Average Number of Private housing units built



(d) Average Number of Social Housing units built

Figure 4.D.4: Comparison of the Control and treatment groups around the exogenous population threshold

Variable	Mean	Std. Dev.	Min.	Max.	N
N. of private Units built	103.852	481.76	0	32006	36706
Contribution of Private construction	0.162	0.147	0	8.658	36659
Share of empty units	0.067	0.044	0	1	36699
N. of social Housing Units built	15.01	116.578	0	11581	36746
Contribution of Social Housing	0.01	0.023	0	0.703	36699
Share of social Housing	0.028	0.061	0	0.733	36587
instrument1	0.004	0.008	0	0.099	36587
Population	1730.598	14341.786	0	2125851	36704
Density	162.169	899.529	0	40644.69	36704
Median Income	16463.921	2989.58	0	42537	30731
Property Tax	13.134	6.176	0	61.432	36235
Land Tax	41.882	26.465	0	328.815	36235
Housing Tax	9.068	4.19	0	44.018	36235

Table 4.D.1: Descriptive Statistics at the Municipality Level

	(1)	(2)	(3)	(4)	(5)
	$\frac{S_t - S_{-t}}{H_{-t}}$	$\frac{S_t - S_{-t}}{H_{-t}}$	$\frac{S_t - S_{-t}}{H_{-t}}$	$\frac{S_t - S_{-t}}{H_{-t}}$	$\frac{S_t - S_{-t}}{H_{-t}}$
Shift Share	0.530*** (0.0228)	0.530*** (0.0228)	0.551*** (0.0236)	0.632*** (0.0237)	0.530*** (0.0267)
% empty units			-0.0140*** (0.00285)	-0.0183*** (0.00363)	-0.0150*** (0.00361)
Unemployment				-0.00701*** (0.00193)	-0.00859*** (0.00192)
ln(income)				0.00802*** (0.00103)	0.00206** (0.00103)
Department FE	Y	Y	Y	Y	Y
Density	N	N	Y	Y	Y
Local Taxes	N	N	N	N	Y
Fiscal Incentives	N	N	N	N	Y
R2	0.0833	0.0833	0.0846	0.0907	0.101
Obs	36566	36566	36566	30691	30653

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4.D.2: First Stages of the Estimates of the crowding out effect at the Municipal level (Table 4.2)

	(1)	(2)	(3)	(4)
	$\frac{P.t-P.s}{H.s}$	$\frac{P.t-P.s}{H.s}$	$\frac{P.t-P.s}{H.s}$	$\frac{P.t-P.s}{H.s}$
$\frac{S.t-S.s}{H.s}$	0.726*** (0.132)	-2.258*** (0.172)	-1.564* (0.808)	-3.607*** (0.833)
R2	.	.	.	.
Obs	36699	36587	36699	36699
Shift Share	N	Y	N	N
SRU Act	N	N	Y	N
Damaged in WW2	N	N	N	Y

Standard errors in parentheses

+ $p < 0.11$, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standards errors are clustered at the groupment of Municipalities level. $\frac{P.t-P.s}{H.s}$ represents the contribution of the private sector to the housing stock growth. $\frac{S.t-S.s}{H.s}$ the contribution of the social housing sector to the housing stock growth, this coefficient is directly interpretable in terms of number of units crowded. SRU is a dummy indicating whether the municipality was under the SRU act, Damaged WWII indicates whether the municipality was strongly damaged during WWII. Shift share is the Bartik type instrument multiplying the initial share of social housing with the national trend net of the observation. The F-stat shows the strength of the first stages we can see that all the instruments are strong and passe the 5% level stock yogo test except the Damaged WWII instrument which pass the test at 10%.

Table 4.D.3: Estimate of the crowding out effect at the Municipal level with different instruments and no controls

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	$\frac{S.t-S.s}{H.s}$	$\frac{S.t-S.s}{H.s}$	$\frac{S.t-S.s}{H.s}$	$\frac{S.t-S.s}{H.s}$	$\frac{S.t-S.s}{H.s}$	$\frac{S.t-S.s}{H.s}$	reg07
Shift Share	0.530*** (0.0267)			0.550*** (0.0286)	0.531*** (0.0295)		0.551*** (0.0288)
SRU Act		0.00518*** (0.00108)		0.00805*** (0.00112)		0.00521*** (0.00108)	0.00805*** (0.00112)
Damaged in WW2			0.00244*** (0.000568)		-0.0000561 (0.000632)	0.00247*** (0.000651)	-0.000117 (0.000631)
% empty units	-0.0150*** (0.00361)	-0.0185*** (0.00388)	-0.0185*** (0.00344)	-0.0150*** (0.00380)	-0.0150*** (0.00380)	-0.0185*** (0.00388)	-0.0150*** (0.00380)
Unemployment	-0.00859*** (0.00192)	-0.00141 (0.00211)	-0.00192 (0.00233)	-0.00859*** (0.00208)	-0.00859*** (0.00208)	-0.00175 (0.00211)	-0.00858*** (0.00208)
ln(income)	0.00206** (0.00103)	-0.00370*** (0.00114)	-0.00324*** (0.000941)	0.00177 (0.00112)	0.00206* (0.00112)	-0.00356*** (0.00114)	0.00177 (0.00112)
Department FE	Y	Y	Y	Y	Y	Y	Y
Density	Y	Y	Y	Y	Y	Y	Y
Local Taxes	Y	Y	Y	Y	Y	Y	Y
Fiscal Incentives	Y	Y	Y	Y	Y	Y	Y
R2	.	.	.	.	.	.	.
Obs	30653	30653	30653	30653	30653	30653	30653

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4.D.4: First stage of the Estimates of the crowding out effect at the Municipal level with different instruments (Table 4.3)

	(1)	(2)	(3)	(4)
	$\frac{P.t-P.s}{H.s}$	$\frac{P.t-P.s}{H.s}$	$\frac{P.t-P.s}{H.s}$	$\frac{P.t-P.s}{H.s}$
$\frac{S.t-S.s}{H.s}$	0.697***	-1.270***	-1.234***	-1.107***
	(0.168)	(0.356)	(0.351)	(0.331)
% Empty units			-0.579***	-0.538***
			(0.0313)	(0.0311)
Unemployment			-0.0196*	-0.0104
			(0.0108)	(0.0106)
Regional Shocks	N	N	N	Y
Density	Y	Y	Y	Y
Time Fixed Effect	Y	Y	Y	Y
R2	0.227	.	.	.
Obs	73074	73074	72696	72696
N of Municipalities	36537	36537	36348	36348
Shift Share	N	Y	Y	Y
F-stat		3124.9	3123.6	3097.1

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standards errors are clustered at the groupment of Municipalities level

Table 4.D.5: Robustness check using a panel estimator at the Municipal level with the shift share

	(1)	(2)	(3)
	$\frac{S_t - S_{t-1}}{H_{t-1}}$	$\frac{S_t - S_{t-1}}{H_{t-1}}$	$\frac{S_t - S_{t-1}}{H_{t-1}}$
Shift Share	-0.466*** (0.0448)	-0.467*** (0.0450)	-0.472*** (0.0441)
% empty units		-0.0168** (0.00677)	-0.0141** (0.00645)
Unemployment		-0.00245 (0.00183)	-0.00194 (0.00184)
Regional Shocks	N	N	Y
Density	Y	Y	Y
Time Fixed Effect	Y	Y	Y
R2	0.0940	0.0961	0.102
Obs	73074	72696	72696
N of Municipalities	36537	36348	36348

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4.D.6: First stage of the Estimates of the crowding out effect at the Municipal level in panel (Table 4.D.5)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	$\frac{VAC_{t-1} - VAC_{t-2}}{H_{t-1}}$	$\frac{VAC_{t-1} - VAC_{t-2}}{H_{t-1}}$	$\frac{VAC_{t-1} - VAC_{t-2}}{H_{t-1}}$	$\frac{VAC_{t-1} - VAC_{t-2}}{H_{t-1}}$	$\frac{VAC_{t-1} - VAC_{t-2}}{H_{t-1}}$	$\frac{VAC_{t-1} - VAC_{t-2}}{H_{t-1}}$	$\frac{VAC_{t-1} - VAC_{t-2}}{H_{t-1}}$
$\frac{S_t - S_{t-1}}{H_{t-1}}$	0.325*** (0.0601)	-0.0130 (0.282)	-0.0641 (0.413)	0.304*** (0.0661)	0.326*** (0.0732)	-0.0315 (0.229)	0.304*** (0.0662)
% empty units	-0.623*** (0.00947)	-0.629*** (0.0112)	-0.630*** (0.00977)	-0.623*** (0.0103)	-0.623*** (0.0104)	-0.629*** (0.0108)	-0.623*** (0.0103)
Unemployment	0.0181*** (0.00484)	0.0176*** (0.00519)	0.0175*** (0.00420)	0.0181*** (0.00523)	0.0181*** (0.00524)	0.0176*** (0.00520)	0.0181*** (0.00523)
ln(income)	-0.0244*** (0.00200)	-0.0256*** (0.00248)	-0.0257*** (0.00218)	-0.0245*** (0.00244)	-0.0244*** (0.00245)	-0.0256*** (0.00246)	-0.0245*** (0.00244)
Department FE	Y	Y	Y	Y	Y	Y	Y
Density	Y	Y	Y	Y	Y	Y	Y
Local Taxes	Y	Y	Y	Y	Y	Y	Y
Fiscal Incentives	Y	Y	Y	Y	Y	Y	Y
R2	.	.	.	.	.	.	.
Obs	30653	30653	30653	30653	30653	30653	30653
Shift Share	Y	N	N	Y	Y	N	Y
SRU Act	N	Y	N	Y	N	Y	Y
Damaged in WW2	N	N	Y	N	Y	Y	Y
F-stat	733.1	32.78	18.47	407.5	366.5	25.82	271.7
p-value				0.273	0.347	0.918	0.362

Standard errors in parentheses

+ $p < 0.11$, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standards errors are clustered at the groupment of Municipalities level. $\frac{VAC_{t-1} - VAC_{t-2}}{H_{t-1}}$ represents the increase in the number of vacant dwellings. $\frac{S_t - S_{t-1}}{H_{t-1}}$ the contribution of the social housing sector to the housing stock growth, this coefficient is directly interpretable in terms of number of units crowded. SRU is a dummy indicating whether the municipality was under the SRU act, Damaged WWII indicates whether the municipality was strongly damaged during WWII. Shift share is the Bartik type instrument multiplying the initial share of social housing with the national trend net of the observation. The F-stat shows the strength of the first stages we can see that all the instruments are strong and passe the 5% level stock yogo test except the Damaged WWII instrument which pass the test at 10% but that only the Bartik predicts a positive impact of social housing on the number of vacant dwellings.

Table 4.D.7: Estimate of the impact of social housing on the number of vacant housing units

4.E Descriptive statistics and First stage for the groups of Municipalities

The second level of observation are the groups of Municipalities (EPCI). This second administrative level might be interesting because it is also a level of decision in terms of public policies. However, these groups of municipalities may cover very different situation: in rural areas these groups might cover large and discontinuous areas whereas one dense and populous urban area as Paris is split between many different groups. We took the 2400 groups registered in 1999.

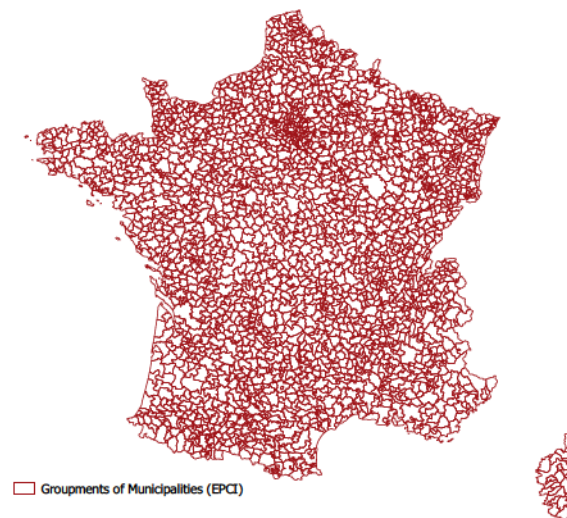


Figure 4.E.1: French groupements of Municipalities

Variable	Mean	Std. Dev.	Min.	Max.	N
N. of Housing Units	10090.112	27139.166	132	568552	2581
Density	174.004	738.204	0.16	15018.48	2581
N. of private Units built	1450.522	3320.64	18	72088	2456
Contribution of Private Construction	0.152	0.082	0.018	1.508	2335
Share of Empty Units	0.068	0.025	0.008	0.205	2581
N. of social housing units built	201.45	681.086	0	12042	2456
Contributino of Social Housing	0.014	0.012	0	0.153	2335
Share of Social Housing	0.063	0.066	0	0.432	2564
Instrument	0.014	0.014	0	0.095	2564

Table 4.E.1: Descriptive Statistics for the groups of Municipalities

	(1)	(2)	(3)	(4)
	$\frac{S_t - S_{-s}}{H_s}$	$\frac{S_t - S_{-s}}{H_s}$	$\frac{S_t - S_{-s}}{H_s}$	$\frac{S_t - S_{-s}}{H_s}$
Shift Share	0.439*** (0.0364)		0.436*** (0.0373)	-0.333*** (0.0856)
Unemployment	0.000212** (0.000108)	-0.0000455 (0.0000941)	0.000213** (0.000108)	0.000137* (0.0000716)
% empty units	-0.0419*** (0.0159)	-0.0502*** (0.0169)	-0.0415*** (0.0159)	-0.140*** (0.0168)
Damaged in WW2		0.00186*** (0.000513)	0.000263 (0.000469)	
Region FE	Y	Y	Y	N
Regional Shocks	N	N	N	Y
Density	Y	Y	Y	Y
Time & EPCI FE	N	N	N	Y
R2	0.177	0.104	0.177	0.132
Obs	2427	2427	2427	4844
N of UA				2422

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4.E.2: First Stage of the Estimates of the crowding out effect at the EPCI Level

4.F Descriptive Statistics and First stage for the Urban Areas

We adopt a broader statistical unit of observation built by the French Statistical Agency (INSEE) in 2010: the urban areas. These pure statistical entities are made of continuous agglomeration with more than 10 000 employments and at least 40% of their workers living inside the area. To reproduce the variables at different level we mostly aggregate the municipality level data (public and private construction, number of housing units).

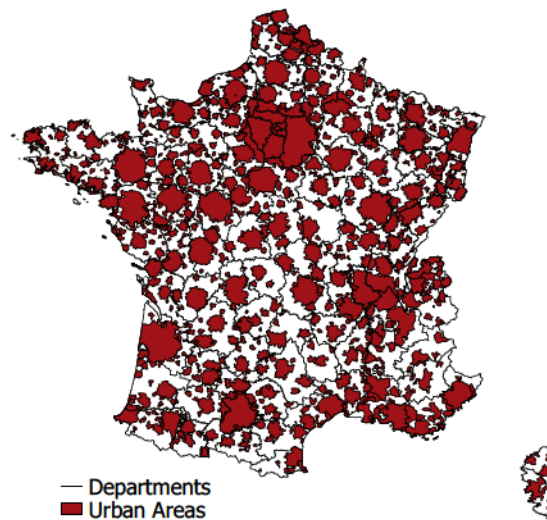


Figure 4.F.1: French Urban Areas

Variable	Mean	Std. Dev.	Min.	Max.
N. of Housing Units	30731.69	200046.274	888	5255845
Density	1.573	1.182	0.196	12.166
N. of Private Units built	3755.601	17501.085	38	409289
Contribution of Private Constr.	0.131	0.069	0.014	0.502
Share of Empty Units	0.07	0.022	0.007	0.154
N. of Social Housing Units Built	564.235	3176.547	0	78993
Contribution of Social Housing	0.016	0.013	0	0.098
Share of Social Housing	0.125	0.074	0.004	0.566
instrument1	0.027	0.016	0.001	0.124
N		771		

Table 4.F.1: Descriptive statistics at the Urban Area Level

	(1) $\frac{S_t - S_{-t}}{H_{-t}}$	(2) $\frac{S_t - S_{-t}}{H_{-t}}$
Shift Share	0.406*** (0.110)	-0.546** (0.244)
Unemployment	0.000499*** (0.000184)	0.000753*** (0.000198)
% empty units	-0.0377 (0.0233)	-0.0867*** (0.0304)
Region FE	Y	N
Type of UA	Y	N
Regional Shocks	N	Y
Density	Y	Y
Time & UA FE	N	Y
R2	0.160	0.172
Obs	765	1530
N of UA	765	765

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4.F.2: First Stage of the Estimates of the crowding out effect at the Urban Area Level

Chapter 5

Conclusion and research agenda

To summarize this dissertation in a nutshell, one could say that Land is Back. This return is probably due to the development of urbanization going along with an increasing regulation of access to residential land. As one could see, such a phenomenon constitutes a major challenge for policymakers willing to intervene on the housing market. Indeed, many public policies tend to be capitalized into land price, the low supply elasticities neutralizing part of their quantitative effect. If this dissertation tried to answer some precise empirical questions, it also raised many complementary questions regarding the role of public authorities on the land and housing market which constitute a research agenda for the years to come.

The first chapter documented the return of land representing an increasing share of the national wealth. This observation raises an important question about the heterogeneity of capital and more particularly the implication of such heterogeneity for taxation. One particular issue is related with the question of imputed rent taxation.

The second chapter documenting the key role of regulation to determine the level of supply elasticity emphasizes the need for further research on the role of Local Authorities on the housing market. Two perspectives might be adopted : one can be willing to study the impact of the different types of regulation but also the political economy of the French housing market.

The third and the fourth chapters documenting the crowding out effect of two types of subsidized housing raise many questions on the way public authorities can intervene on the housing market when the supply is inelastic. It could be very interesting to study the interaction between such housing policies and the local regulation of access to land. In addition, the fact that housing allowances also have a strong inflationary impact while social housing crowds out private construction leave the debate on the best housing policy for the urban poor open. To go further, it seems important to investigate the global impact of social housing programs with a particular focus on spatial segregation in order to assess the overall costs and benefits of this policy.

More generally, this dissertation combined big administrative datasets and surveys with more innovative techniques to collect data. The latter opens a new field of research allowing researchers to increase their knowledge of the housing market for a reduced cost. Developing web-scraping and big data methods to observe local markets should also be a priority in the next years.

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