Promoting Social Housing : Insights from Redevelopment Policies in Paris

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Abstract

The issue of income segregation plagues numerous cities, and in particular Paris which is studied here. To mitigate this problem, the local government has implemented redevelopment policies that increase incentives to convert offices and other commercial units into social housing in high-demand areas. We find that these policies have a negligible effect. Only the most restrictive legislation slightly stimulated the conversion of social housing in the city center; all subsequent policies had no effect.

JEL Classification: R12, R20, R52.

Keywords: Neighborhoods, Real Estate Demand, Redevelopment Supply, Gentrification

1 Introduction

Income segregation is a major problem in many cities around the world, leading to unequal access to employment, education, healthcare, and other important resources and opportunities. Housing scarcity in high-demand areas is one of the causes of this social phenomenon, which has, for example, led the movement of YIMBY (*Yes In My Back Yard*) in the United States to support more private and public housing (Dougherty, 2020).

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In this study, we investigate a range of urban regulations in Paris, where the YIMBY label is not used, but where the arrival in power of a socialist mayor, and its re-election in 2008, was in part driven by the same narrative of ensuring affordable housing in Paris.[1] Indeed, Paris has a long history of concentrating a disproportionately high level of wealth in its center compared to its metropolitan area and the rest of France.[2] To combat this long-term trend, several laws have been voted in the past decade, including rent control[3] and a steady increase in the minimum quota of social housing, hereafter called HLM (*Habitations à Loyer Modéré* which means moderate rent dwellings).[4]

In addition to these standard policies, the city of Paris has passed in 2009 a new act on the conversion of Offices and Commercial use (hereafter OC)[5] in housing which encourages the redevelopment of private housing or public housing. More precisely, three laws have been voted in 2009, 2011 and 2014 under the same principle that one square meter of private housing redeveloped for OC should be compensated by the redevelopment of two square meters of OC unit into private housing (1:2 rule). There is, however, one important exception to this rule, if the conversion goes to the redevelopment of public dwelling (and not private), then the compensated surface should be identical to (only) the initial change (1:1 rule). This offers a distinct economic benefit for the redevelopment of social housing, and through this channel, the housing composition of Paris may gradually shift. In the spatial context of Paris, where the construction of new buildings is limited, redevelopment already represents the lion share of the supply of social housing (more than 80% in the center of Paris).[6]

[1]The website of the candidate and future mayor, Bertrand Delanoe, is no longer online but can be accessed via waybackmachine. One of its main campaign promise in 2008 was the building of 40,000 additional social housing units in the capital over the period 2008-2014.

[2]According to Piketty et al. (2006), just before the World War I, the estates of Paris decedents made up over 26 percent of the French total.

[3]Rents were regulated in Paris discontinuously between 2015 and 2017 and have been regulated again since 2019.

[4]HLM are intended to provide housing for disadvantaged or low-income people. They are are owned by specific entities, private or public.

[5]Shops but also warehouses, restaurants, hotels, cinema, etc. The complete list is defined by Art R151-28

[6]Additionally, these regulations support environmental objectives by targeting market failures that ignore the ecological impacts of unoccupied spaces in densely populated cities. These unoccupied OCs and/or private housing contribute to urban sprawl and then to the soil artificialization, energy inefficiency from dispersed single-family homes, and high CO2 emissions from commuting (Blaudin de The et al., 2021; Castells-Quintana et al., 2021). Furthermore, compared to new construction projects that heavily rely on materials like concrete and steel, which produce significant greenhouse gas emissions, redeveloping existing structures is more environmentally sustainable

We find that these three regulations have had little impact on social housing conversions. The subtle differences between these laws have had different and contradictory spatial effects, making them more or less effective in stimulating social diversity. For example, the 2009 regulation, which was the most restrictive since it imposed compensation within each district, succeeded to foster the redevelopment of public dwellings in the center of Paris. In contrast, the 2011 law, and to a lesser extent the 2014 law, were less restrictive in high-demand area because the compensation could be done in other districts.[7] We show that this relaxation of the spatial constraint increased the redevelopment of social housing at the periphery but not in the center, where the concentration of the richest population is the most deeply rooted. In general, very little commercial space has been converted into social housing as a result of these various laws.

Our paper contributes to a large literature on the effects of local regulations on the supply of housing in general (Turner et al., 2014, Gyourko and Molloy, 2015, and Glaeser and Gyourko, 2018) and in public dwelling in particular. In the US, public housing development is no longer a major policy objective (replaced by housing vouchers), and in several cities, plans for demolition have been implemented. Several studies have then analyzed the effects of these demolitions on income and racial segregation (Almagro et al., 2023, Chyn, 2018, Jacob, 2004).

In France, much of the research has focused on the consequences of the Solidarity and Urban Renewal (SRU) act[8] that aimed to promote public housing in cities where this supply was scarce (Gobillon and Vignolles, 2016, Beaubrun-Diant and Maury, 2022, Jaupart, 2020).[9]

Our analysis complements these approaches. Instead of focusing on demolition (as in the US case) or on national laws, such as the SRU in France, that foster social housing in a general way, we analyze three laws that specifically target redevelopment of public housing from commercial units. To our knowledge, there are no articles on this type of policy. Most of the literature has focused either on office conversion toward private housing or on Airbnb's laws that limit redevelopment

(Rock et al., 2020). Thus, it seems interesting to analyze whether these redevelopment policies can have a significant role, at least with respect to their basic goal of fostering public dwellings.

[7]For instance, an investor that want to transform x square meters of private housing in OC (including short-term rentals) at the foot of the Eiffel Tower, could compensate by converting x square meters of offices into public dwelling at the periphery of the compensation area.

[8]Since the Solidarity and Urban Renewal (SRU) law ("loi de solidarité et renouvellement urbain") of 2000, a minimum quota of social housing per municipality has been established: social housing should represent at least 20% of the total stock of housing. Municipalities under the quota are required to build affordable housing or be subjected to penalties.

[9]By analyzing the effect of segregation within the municipality under this law, during the 1998-2008 period, Chapelle et al. (2022) find a significant positive effect on the construction of public dwellings, but little impact on low-income segregation.

for short-term rentals. For example Beauregard (2005) analyzes how office conversion in private housing has changed Lower Manhattan after the revitalization plan of New York City. Cheshire and Kaimakamis (2021) analyzes a new British regulation implemented in 2013 that provides an automatic right to convert offices to residential use. They find a statistically significant increase in the value of buildings that became entitled to conversion (a 50% premium for these offices). The regulation of conversion into housing for short-term rentals has been studied by Robertson et al. (2023), they find that this policy has reduced the number of Airbnb rentals in Bordeaux by a significant number of 316 rented days per month per district on average. We share with this literature a similar empirical strategy based on regression by discontinuity and synthetic difference-in-differences but we study a very different type of redevelopment.

Section 2 presents the different laws and the historical urban background in Paris. Our empirical analysis is divided into two parts; in Section 3 we analyze the effect of the laws at the border of the compensation area and in Section 4 in its center. The last Section concludes.

2 Background

2.1 Growth of redevelopments toward housing

The basic idea of conversion laws is that the conversion of residential units to office and commercial units (OC), in areas with high market potential, could be used to encourage conversion in the opposite direction (from office to residential) in less dynamic neighborhoods. This type of policy is feasible only if there is sufficient OC available for these types of redevelopment. This assumption, often made by the media and politicians, is based on the number of vacant commercial and office spaces, which is considered as an indicator of the potential for conversion. For instance, it has been highlighted in the media that the Paris region (Ile-de-France) has around 4.5 million m² of office space available, leading to a simple calculation that "based on an average surface area of 75 m² per home, vacant offices represent a theoretical potential of 60,000 homes in the Paris region".[10] However, not only do these figures overestimate the region's redevelopment potential, but they also do not represent the situation in inner Paris, where vacancy rates are much lower.

If we analyze the total number of redevelopments in housing (both private and public) in central Paris as shown in Table (1), considering both the compensation

[10] See for instance l'Institut Paris Region

area where the policy has been enforced and the rest of the Parisian region,[11] we indeed observe smaller numbers. However, the total number of redevelopments is significant, representing 76,293 conversions of OC in housing *over the whole period* (2006-2019). Table (1) also reveals that the number of redevelopments towards housing has increased rapidly over the past decade. Starting from 2,571 between 2006 and 2008, the numbers increased to 14,203 after 2014 in the reinforced area and to 24,514 outside this area.

	Inside the reinforced area	Outside the reinforced area
Between 2006 and 2009	2571	6360
Between 2009 and 2011	2142	4248
Between 2011 and 2014	8184	14071
Between 2014 and 2019	14203	24514

Table 1: Number of conversions toward private and public housing

2.2 Price and share of private and social housings

After describing the rise in housing redevelopment, it might be interesting to analyze the different costs of redeveloping an OC into private or public housing. In this study, we do not analyze the costs associated with purchasing commercial space and reselling it as private / social housing due to the lack of data on conversion costs. However, we have data on the selling prices per square meter for properties converted to private or social housing from 2011 to 2019.[12] These data allow us to briefly discuss how expensive the housing market for redevelopment in Paris is.

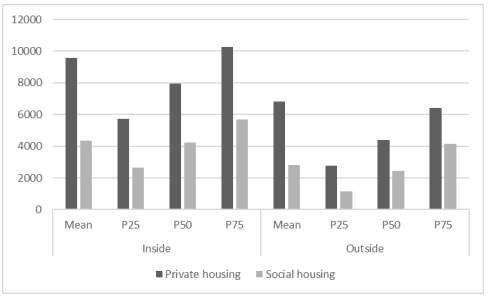

Figure 1: Average price of housing redeveloped (Euro per m², 2011-2019)

[11] The area considered here as "outside the reinforced area" is the area defined as control in Section 4.

[12] For each kind of housing, we analyze conversion occurring during the same year.

Figure (1) shows the difference in square meter price between social and private housing both inside and outside of the compensation area. The first observation is that the prices for both social and private housing are higher inside the compensation area than outside. The difference between social and private housing is smaller outside this area, but remains important. For example, the price of private housing at the top of the distribution (75th percentile) is much higher inside this area than outside (above 10,000 €/m² versus 6,000 €/m²). In contrast, the variation in social housing prices is smaller between the two zones (4,000 to 5,600 €/m² for the 75th percentile). However, we still have a higher price for private housing which is quite significant between each distribution outside the zone (between 1500 €/m² to 2000 €/m² for the 25th percentile, the 50th percentile, and the 75th percentile). These elements indicate that, without considering the cost of compensation laws, it seems always more profitable to redevelop properties into private housing rather than social housing, particularly inside the compensation area.

Since social housing is sold at a significant discount, one might wonder why developers choose this option instead of just selling private housing. The first reason is to reduce risk; developers finance themselves by selling off-plan, in advance, buildings that have not yet been built (called "vente en l'etat futur d'achevement" in French). Selling housing 'en bloc' to HLM institutions allows developers to secure the financial backing needed to launch their projects. This form of risk mitigation proved especially beneficial during recessions when developers faced difficulties selling private homes and received support from social housing organizations, which purchased entire unsold projects. In addition, these units do not incur advertising or marketing costs. Ultimately, developers can maximize profits through price discrimination. By constructing both private and social housing, they often compensate for lower margins on social housing by charging higher prices for private housing (within the limit of market clearance). Finally, the municipality provides several incentives to develop social housing.

This immediately raises the question: What is the share of redevelopment that effectively goes toward social housing? To address this question, we have data prior to 2011. Observations between 2006 and 2008 in Table 2 show that the share of properties redeveloped into social housing was almost nonexistent within the compensation area, representing only 0.35% of the total. However, in 2009, the year that the first compensation law was enacted, this share increased to a level never seen before, reaching 8% of the total. In contrast, outside the compensation area, this share fell from 6% to 3%. In contrast, between 2011 and 2014 and after 2014, we observed more balanced growth.

	Inside the reinforced area	Outside the reinforced area
Between 2006 and 2009	0.35	6.34
Between 2009 and 2011	8.64	3.27
Between 2011 and 2014	2.66	6.53
Between 2014 and 2019	3.28	4.55

Table 2: Share of social housing in the total of housing redeveloped (%)

To understand these changes, we must analyze how the laws of 2009, 2011, and 2014 differ. However, before analyzing these details, it may be interesting to discuss the share of social housing that comes from redevelopment compared to new construction. After all, if new construction represents the main channel for providing social housing, then our analysis of redevelopment might seem secondary. This is not the case.

According to APUR,[13] new construction accounted for 45% of the total number of HLM (Habitations à Loyer Modéré) created between 2001 and 2021. These aggregate numbers indirectly suggest that the redevelopments are significant. However, their importance becomes even more apparent when the differences within and outside the compensation area are examined. In fact, inside the compensation area, the creation of new housing buildings is extremely low and redevelopment takes the lion share of the total, accounting for 82 75% of all the HLM provided on average over our analysis period (2006-2019). Table (3) presents details for different periods showing that the share of new HLM resulting from redevelopment varies from 75, 4% to 100% within the reinforced area.

	Inside the reinforced area	Outside the reinforced area
Between 2006 and 2009	100	67.84
Between 2009 and 2011	92.03	31.51
Between 2011 and 2014	93.56	46.22
Between 2014 and 2019	75.4	20.97

Table 3: Share of social redevelopment in the total supply of social housing (in %)

2.3 Conversion toward public housing in the context of a national law

The previous section documenting the increase in the redevelopment of social housing has to be understood within the national context of the 2000's Urban Solidarity and Renewal Law (SRU). This law required local authorities to provide 20%

[13] https://www.apur.org/fr/nos-travaux/chiffres-logement-social-paris-2021-edition-2022

social housing or face a fine. This law, introduced by socialist and communist ministers, was unanimously contested by wealthy municipalities that fell below this threshold, fearing an increase in insecurity and the impoverishment of their communities. The right-wing party returned to power in 2002, but in a tense political and social atmosphere (suburban riots in 2005), it did not touch on this law. Beyond that background, it quickly became clear that several municipalities simply did not comply, preferring instead to pay a modest financial penalty to build social housing. Chapelle et al. (2022) by comparing the fine with the municipal budget, find a median of 1.6%, and for the municipalities that pay the most, this financial sanction represents only 5.5% of the budget.

Overall, the impact of this policy over the period 2000-2008 appears to have been modest. Gobillon and Vignolles (2016) find that the positive result of the increase in social housing is concentrated in municipalities that were initially furthest away from the 20% threshold, with a share of social housing below 5% in 2000. Chapelle et al. (2022) confirm this finding and show that the law has had little effect on low-income segregation (see also Beaubrun-Diant and Maury, 2022 and Jaupart, 2020). The law was then extended in 2013 by increasing the minimum threshold to 25%, and above all, the law increases the penalties by a factor of 5, making it more expensive to fail to meet the minimum social housing requirement.

The city of Paris follows this law by applying the 20% limit to all the arrondissements in Paris and adds in the center of Paris a condition for large projects (more than 800 m²) that should incorporate 25% of social dwellings.

2.4 What can be expected from the compensation laws?

The 2009 law

The local regulations studied here are the consequence of a significant change toward decentralization that occurred in 2008 with the law called "modernization of the economy." According to this law, the City of Paris has requested the transfer of jurisdiction from the State on the change of use of residential units. In 2009, a compensation zone is created, in which the surface of private housing converted to commercial use should be doubled in the same administrative unit (called *arrondissement*) where the change of use occurs.

To give an example, a Property Redevelopment Developer (PRD) that changes a building of 300m² of private housing into offices in the city center (e.g. Bourse district) should compensate by buying 600m² of offices (or other commercial premises) there and convert them into residential accommodation. In that case, the law promotes the redevelopment of private housing and reduces the surface of offices.

However, to increase the stock of social housing, the rule of doubling the surface does not apply to HLM. Thus in the previous example, if these 300m² private housing are changed into a commercial unit, but with the choice to compensate by redevelopment of the public dwelling, then only 300m² of the commercial unit should be converted (and not 600m²). This provides a clear economic advantage for the redevelopment of public housing compared to private housing. Figure (2) below summarizes these different changes of use,[14] that can be decomposed into two stages with a *first stage* on the choice of commercial redevelopment and the *second one* on the compensation chosen.

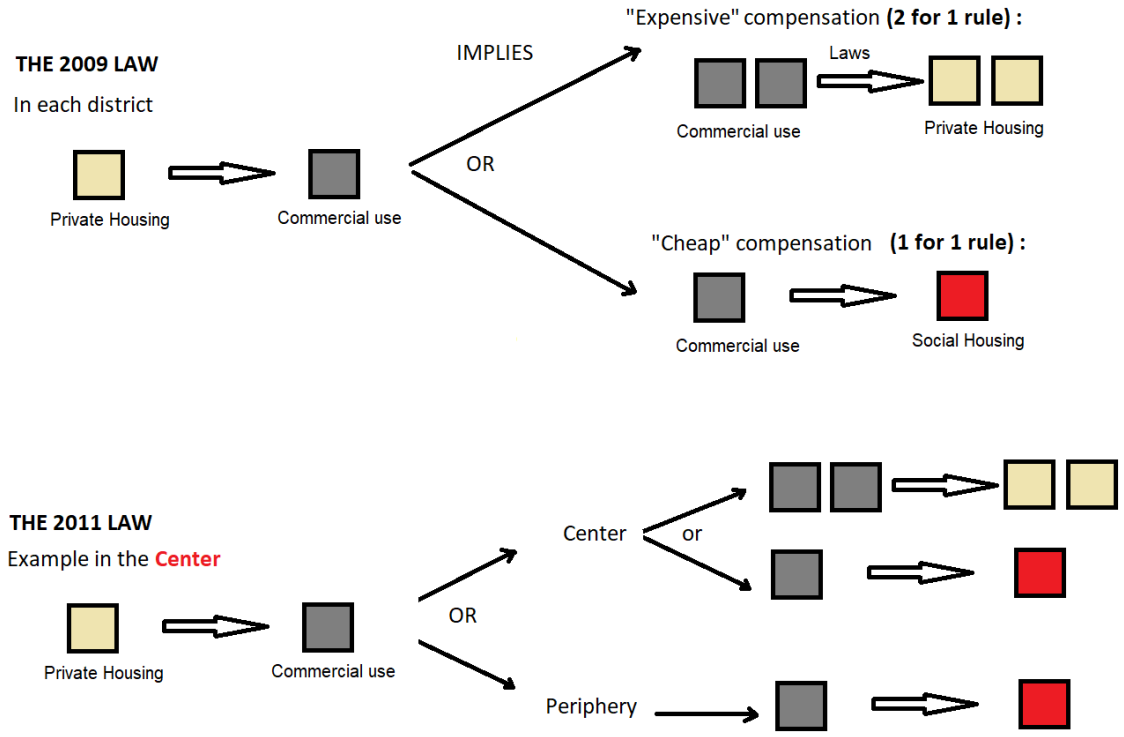

Figure 2: Redevelopment under conversion laws

This policy covers various different situations and investors. For example, in addition to the previous example, a landlord that converts its housing into a short-term rental is also concerned by the law.

[14]There is a distinction in the French administrative vocabulary between a "change of use" and a "change of designation/purpose" (called *destination* in French), that concern, for instance, a *permanent* change from a commercial unit to a private/public housing or vice versa. We come back on this definition/explanation with more details in the data section.

An interesting aspect is that this policy, with its spatial constraint that requires conversion within the same administrative unit, can have vastly different effects depending on the initial demand for redevelopment (first stage). In districts where the growth of redevelopment from housing to commercial unit is strong, such a law introduces an incentive to compensate by redeveloping public dwelling which is always the less costly choice (the redevelopment of private housing requires twice more space). In contrast, in districts where the initial change of use is low, this regulation may not have a significant effect. In other terms, the law introduces a spatial complementarity (in two steps) between the redevelopment of the commercial unit (first step) and that of the public dwelling (second step) at the district level. By defining the "periphery" as neighborhoods located on the internal border of the compensation zone, we can summarize this discussion as follows.

Proposition 1. *Testable Implications (law of 2009). A conversion law that stipulates compensation in the same district (under the assumptions of a high demand of redevelopment in the center and a weak demand of redevelopment at the periphery) implies a significant increase in the number of social housing in the center. No significant effect on social housing in the periphery.*

The map (3) represents by a red line the compensation zone of this law, also called the area "reinforced" or "enhanced". In Section 3 we are going to define more precisely what we consider as the peripheral neighborhoods at the internal border of this compensation zone, and in Section 4, the districts of the center. For now it simply matters to notice that districts/neighborhoods, which are delimited by a (thin) black line on the map (3), are defined by the "IRIS" classification which is the standard unit for infra-municipal data in France (population generally falls between 1,800 and 5,000). During the whole period, the average population is 2,223 inhabitants for 1,060 units. The average surface area of these IRIS in our area is 11 km2.

It is also important to note that the periphery of the compensation zone does not refer to the outer rings of the Paris metropolitan area. Rather, it is still within the city of Paris and is recognized as an area with a shortfall in social and private housing relative to demand.

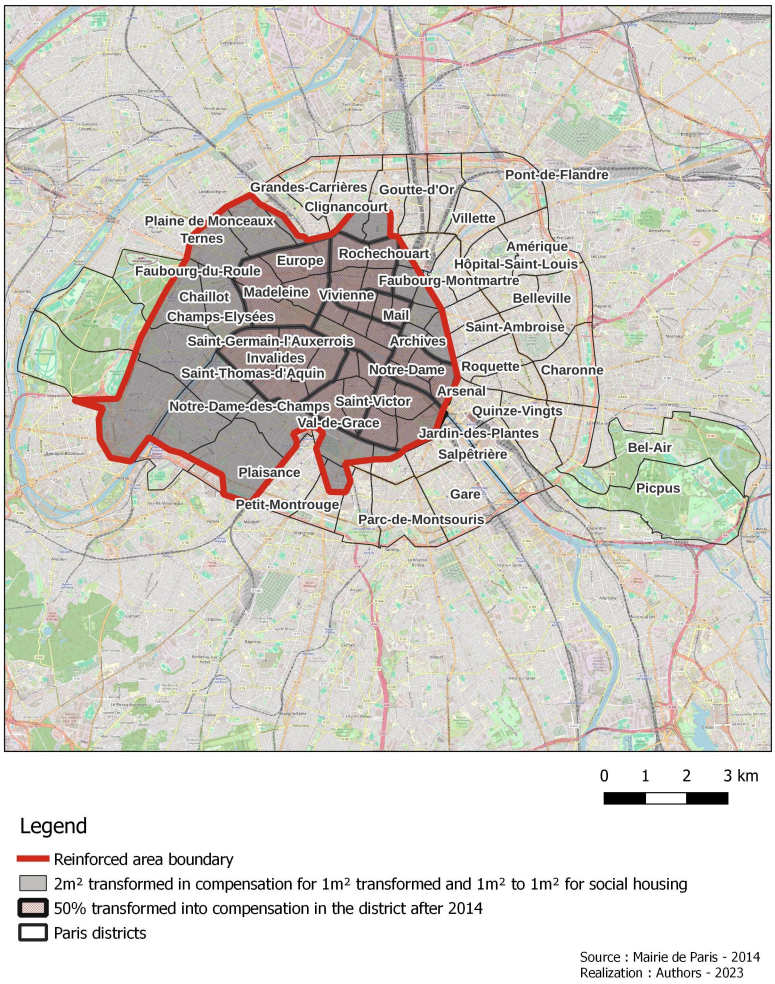

Figure 3: Compensation Zone

The 2011 and 2014 laws

In 2011, the law was amended to be less restrictive in the center. All the enhanced compensation zone is concerned by the possibility to compensate for public dwelling (i.e. not only in the arrondissement in which the change of use/designation occurs) but not for private housing (in that case doubling the area of private housing to compensate should be done in the same arrondissement). To give an example, an owner in the city center that wants to change the use of his dwelling from residential to commercial, for instance, to develop short-term rental (e.g. Airbnb), can compensate by converting commercial unit in public housing at the periphery. This simple change in spatial opportunities to compensate can modify the

different incentives. It becomes easier now to develop commercial units in the center without compensation there, which opens the door to a reduction of public housing in the center. In fact, since the redevelopment of the public dwelling is less costly than private housing (requiring half the space of the commercial unit to change) and less costly in the periphery than in the center (see the descriptive statistics of Figure 1), this law favors public housing in the periphery. Then this new regulation totally reverses the spatial incentive to redevelop HLM. Although the 2009 law encourages their redevelopment where the demand for change of use was high (in the center), the 2011 law may stimulate them in places relatively less attractive (namely, where the price of redevelopment is relatively low).

Proposition 2. *Testable Implications. A conversion law that enables compensating commercial redevelopment in the center by public dwelling at the periphery implies (under the assumption of a high demand of commercial redevelopment in the core, and a weak one at the periphery), a significant increase in the redevelopment of social housing at the periphery and no significant effect at the center.*

In 2014 a new regulation is adopted that partially returns to the seminal law of 2009. Eight districts in the center of the city are targeted with a compensation rule establishing that at least 50% of the surface should be compensated there (the eight districts are represented in dark gray in Map 1). The results of the 2014 are thus less clear and perhaps deserve, even more than the other laws, an empirical investigation.

2.5 Data

Change of what?

As described in Figure (2) the compensation laws can affect two stages of redevelopment[15] but here we analyze only the second stage for two reasons. The main reason is that we are interested in the redevelopment of social housings and not in the redevelopment of OCs, which has already been studied by the literature. To explain our second reason, we need to enter in the French administrative lexicon and discuss the data available. In fact, the first stage of the compensation law concerns *changes of use*[16] of residential units in OC. A change of use requires an administrative authorization that is mandatory for the conversion of a residential property. This authorization applies on an individual basis and is temporary. When the landlord moves out or stops business, the procedure is suspended. In

[15] In Appendix A we provide more details about the market of compensation

[16] Called *"changement d'usage"* in French.

Paris, a change of use must be accompanied by a compensation that gives rise to a *change of designation* ("destination" or "attribution" in French[17]) of another unit. More precisely, a change in designation concerns the redevelopment of OCs (all the conversion of units not intended for residential use) toward residential units (private or social housing). This procedure is attached to the converted unit, it is therefore more definitive and gives rise to a tax change. This is precisely what enables us to study this second stage. The data we use come from property taxes and take into account a change of designation only.

For example, an owner who wants to rent one room on Airbnb (more than 120 nights in 2014), can make a simple *change of use* of its room from a private to a commercial space, but should compensate by generating a *change of designation* from a commercial unit to a private or public unit. Here we have data on this change of designation, and not on the change of use. To put this differently, we cannot study with our data the changes in housing use in OCs, and we focus our analysis on the changes in designation from OCs to social housing.

Dependent variable

The data used here come from the Land Registry Files provided by CEREMA (Center for Studies and Expertise on Risks, Environment, Mobility, and Spatial Planning).[18] This database enables the identification of housing units that have undergone a change of designation, with the date of the last change made (including social housing units). This database includes other types of change, such as construction or renovation, but it is important to note that the dates taken into account here are only for changes of designation. This date corresponds to the date of authorization of the building permit, which is required for all transformations.

The data used cover the housing stock as of January 1, 2020, in the departments of Paris, Hauts-de-France, Seine-Saint-Denis, and Val-de-Marne and provide the changes of designation over the period 2006-2019. These files provide the description and location of all buildings and land parcels.

This database is exhaustive and provides all the redevelopment of social housing that is owned by social landlords or private landlords.

The data are aggregated at the IRIS neighborhood level (often called districts or neighborhoods in what follows) and correspond to the number of square meters that have undergone a change of designation.

[17] See for instance the urban code planning here and here.

[18] The CEREMA is a public institution responsible for processing files from the DGFiP (Directorate General for Public Finance), which centralizes fiscal information and characteristics of properties in France.

About zeroes (no change in use)

We take into account neighborhoods where no housing units have undergone changes in designation (the value is equal to 0). The choice to keep these neighborhoods in the analyses is justified by the fact that many neighborhoods, particularly in the compensation area before the regulation was put in place, have a few square meters converted. For example, in 2006, 87.53% of the neighborhoods in the compensation zone had not undergone changes in use towards social housing, a share that rises to 97.59% in the high-income districts of the 1st, 7th, and 8th arrondissements of Paris. This proportion decreases by 12 percentage points in 2019. These figures show the importance of considering neighborhoods without transformation. As the goal of this study is to identify the impact of the implementation of compensation rules in Paris, keeping these zeroes enable to observe the evolution of transformations in neighborhoods previously not subject to change of designation (and which are, in fact, implicitly targeted by the different laws).

3 Effects of conversion laws at the dividing line

3.1 Spatial Regression Discontinuity Design in Differences

The simple fact that these laws may have particular effects at the periphery of the compensation zone logically drives the empirical strategy towards a Spatial Regression Discontinuity design (SRD, Keele and Titiunik, 2015). The housing market and even the characteristics of the neighborhoods are similar on both sides of the border (see the black line on the map 4), allowing us to defend that the only difference between treated and untreated districts around the dividing line comes from the law of compensation.

Obviously, we cannot rule out significant differences between treated and untreated units that may bias our analysis. However, Table 4 presents a number of descriptive statistics showing several common characteristics between treated and untreated areas. The systematic difference that does not vary over our period of analysis (e.g., the higher intellectual professions) is controlled with individual fixed effects (and by the first difference).

	Treated	Control
Average median income between 2006 and 2019	30631.62	24865.61
Share of workers	5.67%	8.81%
Share of higher intellectual professions	47.16%	39.81%
Price by m² (between 2012 and 2014)	5224.74€/m²	4599.8€/m²
Unemployment rate (before 2009)	10.07%	11.65%
Unemployment rate (after 2008)	10.66%	11.65%
Number of Airbnb on total housing (after 2009)	0.44%	0.34%
Average growth rate of housing 2006-2019	0.26%	0.47%
Average growth rate of housing price 2012-2019	4.64%	2.06%
Number of observations	910	1442

Table 4: Descriptive statistics for treated and control districts at the periphery (600m)

It is also possible that for each year the compensation law was enforced, other policies have been implemented within the compensation area and not outside this zone. We are not aware of such a possibility; in particular, the SRU of a minimum requirement of 20% of HLM has been applied both inside and outside the compensation area. The only exception is the definition of a zoning area similar to the enforcement area in which new buildings or redevelopments with a surface area of more than 800 m2 for residential use must allocate at least 25% of this surface area to social housing. However, this exception does not affect our data (only 4% of our observations might be affected by this law; see Appendix C for an analysis without these observations), either because only new buildings have been affected or because this SRU law does not concern the same type of redevelopment. We may have overlooked other policies or interventions of the city of Paris, but for another policy to influence our results, it would need to have a distinct impact on each side of the compensation zone boundary and be implemented precisely within the territories we studied.

We carried out a number of placebo tests, in particular, by changing the dates on which the policies were implemented and by extending the period of analysis (Appendices C and D). The results did not reveal a significant effect, suggesting that no other major policy biased our estimates. If other measures had played a role, significant effects would have been observed.

We thus use a difference in discontinuity (Grembi et al., 2016), hereafter diff-in-disc, that enables to control for multiple treatments and time-invariant factors by time differentiation.

Our framework finds its origin in border fixed effects model *à la* Black (1999)

and to the geographic difference-in-discontinuities presented by Butts (2021).

We then estimate the following equation:

$$Y_{it} = exp(\lambda_i + \sum_j \beta_j Z_i T_j + \sum_j \varphi_j T_j D_i + \sum_j \gamma_j T_j D_i Z_i + \theta_t + \Gamma_{it})\varepsilon_{it}, \quad (1)$$

where Y_{it} is the number of square meters of social housing newly created (i.e. resulting from a change of designation) in the neighborhood i at the time t. As explained in the data section, this variable includes neighborhoods with no transformation and then leads us to use the Pseudo Poisson Maximum Likelihood estimator.[19]

This dependent variable is geographically delimited according to a particular distance from the border treatment zone. We have chosen different bandwidths such as $[-300, 300]$, where 300 meters are taken on both sides of the limit of the treatment area. We estimate this equation seven time by increasing this spatial window to 100 meters, namely $\{[-300, 300]; ..., [-900, 900]\}$.

Figure 4 presents an example with a bandwidth at [-600,600] for the year 2014. The treated districts are represented in dark gray, the control group is in bright gray.

[19]Similar results are obtained with OLS (without zeroes) in our online appendix.

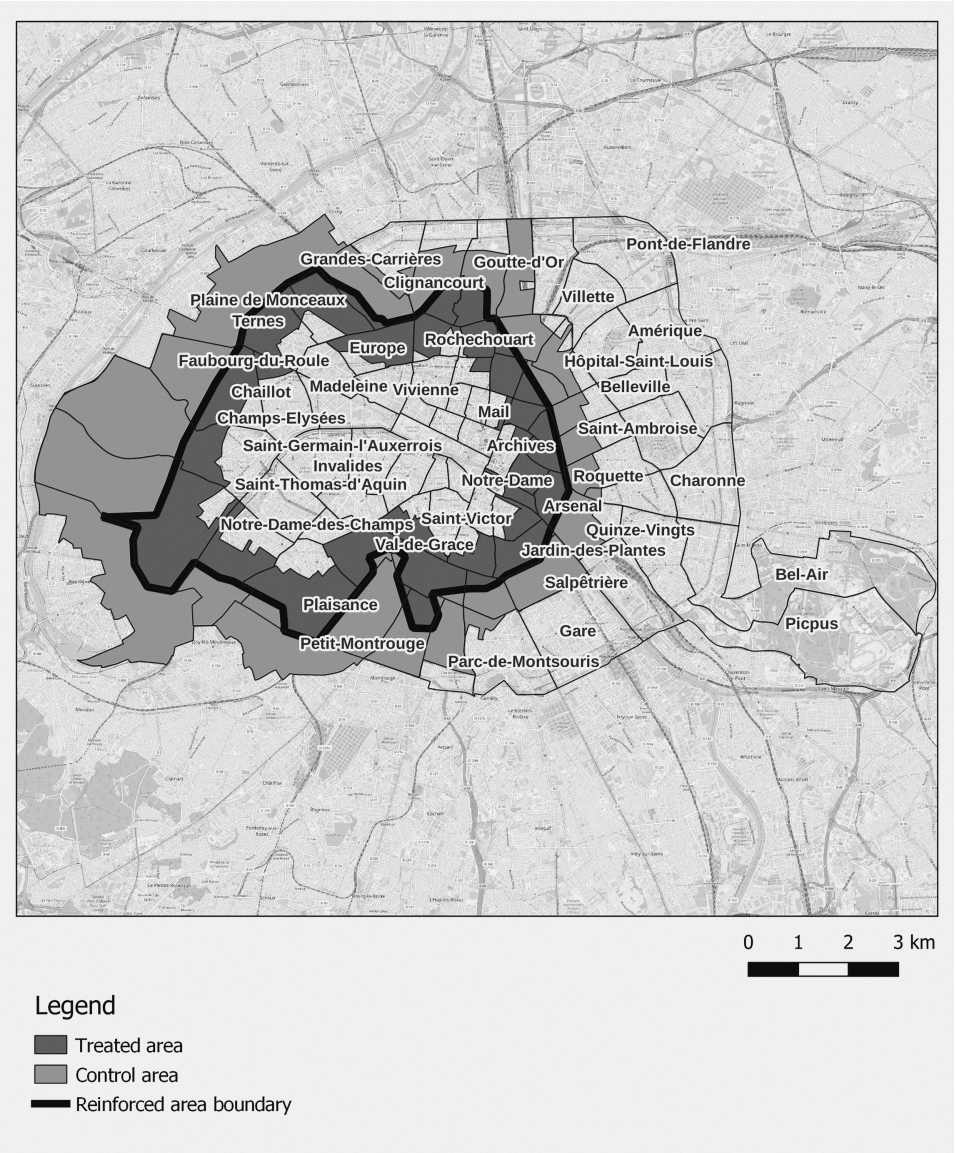

Figure 4: Treated and Control Areas in the Difference in Discontinuity (bandwidth: 600 meters)

T_j is a dummy taking one for each period j implemented and zero before the period, with $j = \{[2009, 2019], [2011, 2019], [2014, 2019]\}$. Then, $T_{[2009,2019]}$ takes one from 2009 to 2019 and zero otherwise, $T_{[2011,2019]}$ equals 1 for 2011 to 2019 and zero otherwise and $T_{[2014,2019]}$ is 1 for 2014 and onward and zero otherwise. These dummies measure the additional impact of each change in law, always comparing the effects with the pre-treatment trend (before 2009), which exhibits parallel

trends. For comparison, if we had changed the dummies by 0 before 2009, 1 between 2009 and 2010, 2 between 2011 and 2013, and 3 between 2014 and 2019, we would have observed the cumulative effects of each law (we have done this estimation in a companion paper and we found that these cumulative effects are, in fact, weak). Here, we are only interested in the additional effect of each law. This is particularly relevant for the 2009 law, since the compensation area defined at that time remained unchanged until the end of the period. The 2011 and 2014 laws only changed the rules of compensation within this area.

Z_i a binary variable that takes one for the treated housing within the compensation zone and zero for the housing in the control group outside of this zone. These two zones are obviously defined spatially by the different bandwidths. D_i is the distance between the district (IRIS) and the border treatment zone. λ_i and θ_t are, respectively, individual fixed and time effects. Γ_{it} is the vector of controls discussed in the theoretical model and described in the data section.

Standard errors are clustered at the district level to account for an arbitrary serial correlation in the error term (Bertrand et al., 2004, Abadie et al., 2022). The coefficients of interest are $\beta_{[2009,2019]}$, $\beta_{[2011,2019]}$ and $\beta_{[2014,2019]}$.

The elements representing the double differences correspond to $\sum_j \beta_j Z_i T_j$ and $\sum_j \gamma_j T_j D_i Z_i$.

The raw data presented in Figure (5) show the number of square meters converted. It clearly shows that the treated and control groups followed a similar trend before the implementation of the first law. Subsequently, there is a noticeable increase in the conversion of areas within the treated group as compared to the control group, particularly after the year 2010.

It is important to note that this figure represents unadjusted data, and one might expect that the parallel trends to the pre-2011 and pre-2014 laws would be partially corrected when controlling for other factors, as opposed to the trends depicted in this basic plot. In particular, the fact to introduce simultaneously the dummies of these three laws in the same equation partially controls the effect of each of them.

We have also done these estimations using a longer period (2000-2019) and found similar results (see Appendix D for an example).

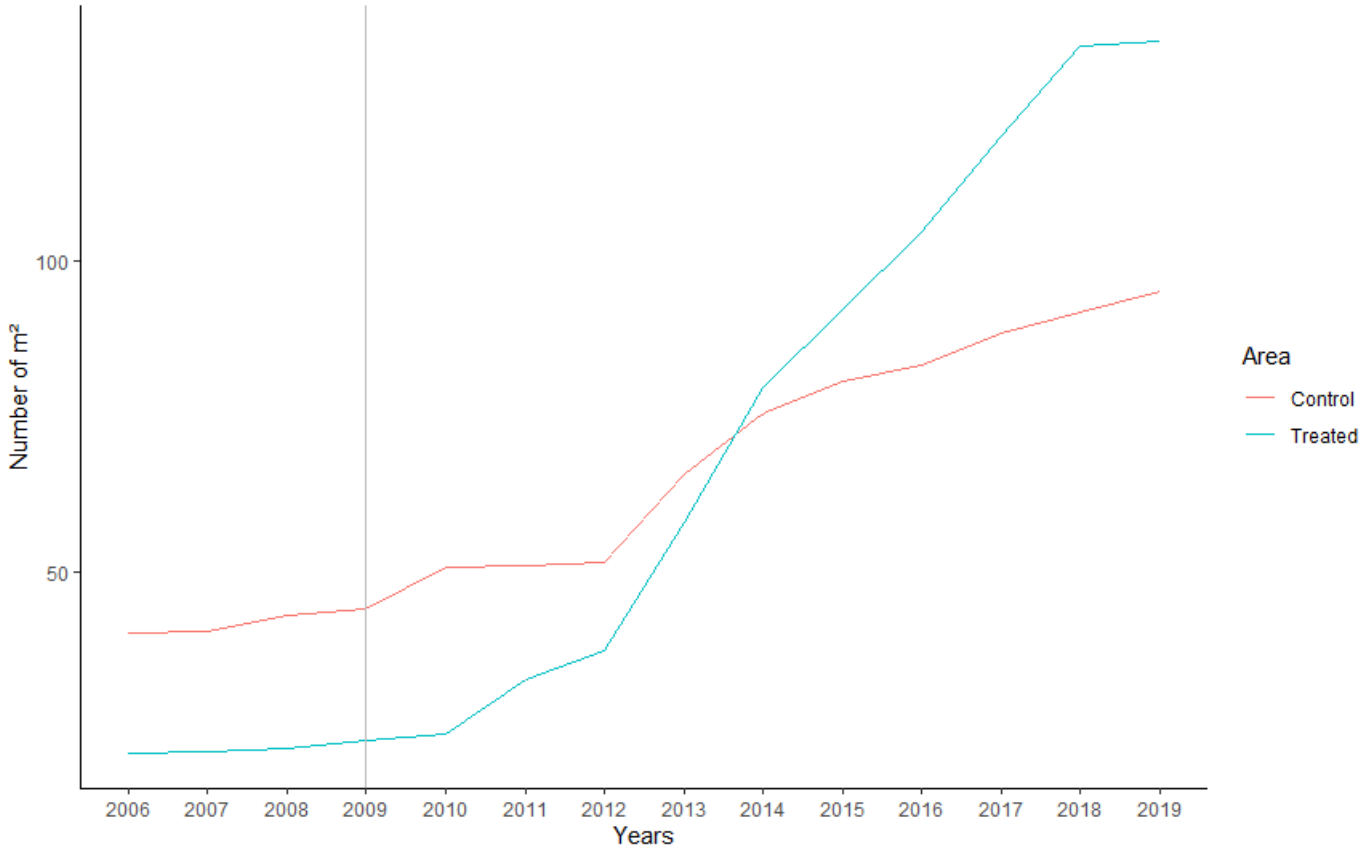

Figure 5: Treated and Control Areas in the Difference-in discontinuities (bandwidth: 600 meters)

Furthermore, by examining the three estimates across various spatial windows, we perform another type of robustness check. The estimation with the narrowest bandwidth is likely to best satisfy the conditions of the Diff-in-Disc approach, as treated and untreated individuals are geographically close enough that we can reasonably expect them to be similar. By employing a triangular kernel that assigns weights based on each observation's distance to the border, we also give more importance to observations near the spatial cutoff. [20]

Finally, instead of using this list of ad-hoc bandwidths, we use the Mean Squared Error (MSE) optimal bandwidth choice for the local-linear regression point estimator proposed by G. Imbens and Kalyanaraman (2011) as well as the CE-optimal

[20] As a result, even with a larger bandwidth, the potential outcome of the treated group can still be approximated by the untreated district, given that observations closer to the border are prioritized. We also provide similar results with the Epanechnikov and uniform distribution of weights.

neighborhood of Calonico et al. (2014) that provides a smaller neighborhood and enables to have the smallest coverage error (CE) probability.

Identification issues of the Difference in Discontinuity. As in standard RDD, manipulation of the assignment variable threatens the validity of identification (McCrary, 2008; G. W. Imbens and Lemieux, 2008; Lee and Lemieux, 2010). Such a manipulation is unlikely here; agents in the treated group that request a conversion cannot pretend to be in the control group where there is no regulation without taking significant risks. As explained in the previous section, the conversion is based on the address of the housing, inspectors control requests, and a fine of 80000 euros is set for false declaration. Moreover, once the manipulation is detected, the unit should return to the previous use (with additional fines).

An issue that can jeopardize the identification is the endogeneity of the zone, in particular, the spatial discontinuity (the border line) may not be exogenous. Such a possibility is not obvious since the compensation zone has been drawn on a past regulation that concerns parking lots, and thus for a very different motive than the one study here.

Finally, like in standard difference-in-difference analysis, the identification rests on the assumption of parallel trends, here local parallel trends. Figure (5) shows the parallel trend before 2009, and we provide in Table 5, the F-statistics that measure how much the mean outcomes in the treated and control groups deviate from each other in the pretreatment period. The results indicate that there are no statistically significant differences in trends between the treatment and control groups before each of the intervention years tested (2009, 2011, and 2014).

Parallel trend test before 2009	F(1, 709)	0.23
	Prob $>$ F	0.635
Parallel trend test before 2011	F(1, 709)	0.02
	Prob $>$ F	0.884
Parallel trend test before 2014	F(1, 709)	1.14
	Prob $>$ F	0.285

Table 5: F-tests for parallel trends

3.2 Results at the Periphery

Table (6) presents the results of the spatial difference-in-discontinuity with different bandwidth choices and various weight distributions to study the robustness of our result at the periphery of the compensation zone.

We find that no matter the assumptions made on the bandwidth, the 2009 law's initial implementation is not statistically significant.

This finding is in line with the expected results discussed in Proposition 1. During that period, the demand to redevelop private housing into commercial units was likely low in the periphery of the compensation zone. For example, this period is in the aftermath of the financial crisis, which may have hit the periphery harder than the center, limiting the demand for commercial redevelopment. Consequently, the law did not have a significant impact on public housing in this area. This situation highlights the complementarity effect that this regulation establishes between commercial and public redevelopment. During periods of economic downturn, this regulation fails to promote the redevelopment of public housing, yet it is precisely during such periods that the availability of commercial spaces (or offices) due to bankruptcies could facilitate the redevelopment of public housing at minimal costs.

In contrast, Table (6) presents the significant role that the 2011 and 2014 reforms have played in shaping the changes in social housing. The coefficient of 0.643 and the corresponding elasticity around 90%[21] suggest that the 2011 reform, in particular, has had an impact, representing an additional 7,500 m² of converted space. This confirms the mechanism behind the results presented in Proposition 2. The displacement of compensation from the center to the periphery has changed the geography of HLM redevelopment. These laws appear to have led investors to focus on redeveloping commercial units in the city center, opting to compensate by redeveloping public dwellings in the periphery, which typically represents the most optimal choice for them. Furthermore, this period is marked by the growth of Airbnb, initially concentrated in the center. This growth may have stimulated the redevelopment of public dwellings in the periphery, in response to these legislative changes. However, the peripheral area is relatively small and, beyond statistical significance, the economic impact is low; according to our estimates, fewer than 200 social housing units were developed between 2011 and 2013 due to the law.

The 2014 reform seems to have an even smaller effect, with a coefficient ranging between 0.4 and 0.5. This is consistent with its definition, as it is more restrictive in the Center than the 2011 law (50% of the compensation should be done in the Center, which reduces the displacement effect of compensation at the Periphery) but less so than the 2009 law.

[21]The model is a PPML model, and the interpretation of the coefficients is as follows : (exp(coefficient)-1)*100

Distrib of weights	Uniform		Epanechnikov		Triangular		Triangular	
Bandwidth choice	ad-hoc						CE-opt	MSE-opt
Bandwidth (in meter)	[-300,300]	[-600,600]	[-300,300]	[-600,600]	[-300,300]	[-600,600]	[-461,461]	[-1314,1314]
Treated in 2009	0.179	0.0416	0.247	0.116	0.240	0.144	0.208	0.0114
	(0.192)	(0.155)	(0.185)	(0.143)	(0.184)	(0.146)	(0.165)	(0.167)
Treated in 2011	0.643*	0.766***	0.666*	0.669**	0.665*	0.658**	0.634*	0.620***
	(0.376)	(0.279)	(0.389)	(0.309)	(0.390)	(0.322)	(0.359)	(0.222)
Treated in 2014	0.562**	0.564***	0.488**	0.564***	0.460*	0.545**	0.507**	0.522***
	(0.245)	(0.208)	(0.246)	(0.218)	(0.244)	(0.221)	(0.234)	6.426***
Constant	6.659***	6.164***	6.769***	6.459***	6.879***	6.592***	6.726***	(0.137)
	(0.116)	(0.166)	(0.0877)	(0.134)	(0.0742)	(0.114)	(0.0997)	
Observations	1,568	2,352	1,568	2,352	1,568	2,352	2002	4,004
R^2 adj.	0.895	0.879	0.902	0.888	0.908	0.895	0.900	0.875

Notes: Standard errors are clustered at the neighborhood level in parentheses, *** p<0.01, ** p<0.05, * p<0.1. The results are obtained from a spatial difference in discontinuity using the PPML estimator. Individual fixed effects and time effects are introduced in all estimations. The dependent variable is the number/area of HLM converted (in m^2). Columns (1, 3, 5) and (2, 4, 6) present results for areas that are respectively delineated by 300 meters, and 600 meters on both sides of the boundary of the treatment area. The difference between these columns lies in the distributions of weights that follow a uniform, Epanechnikov, and triangular distribution, respectively. Column (7) presents results with the Coverage Error (CE) probability neighborhood, and Column (8) utilizes the Mean Squared Error (MSE) optimal bandwidth. Each estimate includes neighborhood and year fixed effects

Table 6: Social Housing Change from Difference in Discontinuities

4 The effects of conversion laws in the heart of Paris

To study how these laws have affected redevelopments in the center of Paris, we can no longer use the empirical strategy based on discontinuity. Indeed in that case the observations outside the compensation zone but near the border cannot be considered as valid counterfactuals of the treated in the center, districts are simply too different. One solution in that case is to build synthetic controls of the treated units; then we use the synthetic difference-in-differences approach of Arkhangelsky et al. (2021), hereafter SDID, which reweights and matches pre-exposure trends. One prerequisite for using synthetic controls is the absence of anticipation regarding the implementation of the laws. Given the specific timing of these laws, anticipation is unlikely. The 2009 law emerged after a series of reforms that were somewhat unexpected in a centralized country like France. Indeed, these local regulations resulted from a significant shift toward decentralization that occurred in 2008 with the enactment of the "modernization of the economy" law. Following this legislation, the City of Paris requested the transfer of authority from the State concerning the conversion of residential units in 2009. Such rapid decentralization likely minimized the possibility of anticipation. Finally, the 2011 and 2014 laws are very technical, and one can reasonably assert that agents did not anticipate these changes.[22]

4.1 Synthetic Difference-in-Differences approach

The goal of this method is to weight the control units in the pretreatment period to make these different units comparable with the treated units such that the weighted control units are approximately equal to the pretreatment treated units, such as :

$$\sum_{i=1}^{N_{control,pre}} w_i^{sdid} Y_{it} \approx \sum_{i=1}^{N_{traited,pre}} Y_{it},$$

with w_{it}^{sdid} the time weights t and units i multiplied by the dependent variable Y_{it} in the neighborhood i in year t. The time and unit weights are then used in a regression where the weights $\hat{\omega}_i^{sdid}$and $\hat{\Delta}_t^{sdid}$ minimize the difference between the treated and control units before treatment Z_{it} such as:

[22]Another assumption of the SDID is a significantly long pre-treatment period. Here, we use all the reliable data available before 2009, which allows us to go back to 2006. This means that we have a pre-treatment period that is similar to the post-treatment periods between the different laws (2009-2011 and 2011-2014). In Appendix C, we extend this time analysis over the period 2000-2019 and find similar results. In our online appendix, we perform a different SDID by computing synthetic control before each policy. For instance, for the 2014 law, we have a synthetic control that is built on the period from 2006 to 2014, allowing us to have a much longer pre-treatment period. We obtain similar results with this empirical strategy.

$$Y_{it} = \hat{\omega}_i^{sdid} \hat{\Delta}_t^{sdid} exp(\lambda_i + \sum_j \beta_j Z_i T_j + \sum_j \varphi_j T_j D_i + \sum_j \gamma_j T_j D_i Z_i + \theta_t) \varepsilon_{it},$$

with λ_i the neighborhoods, θ_t the years, ϵ_{it} the error term, and Y_{it} the dependent variable. The weights used to build the synthetic controls are presented in Appendix B.[23]

The SDID strategy is still estimated from Equation (1) with PPML with the objective of estimating as previously the coefficients $\beta_{[2009,2019]}$, $\beta_{[2011,2019]}$ and $\beta_{[2014,2019]}$.[24]

Considering the buffer area that has its limit at 600 m of the treatment zone, we take as treated the districts that are inside the reinforced area but not in this buffer zone. Figure (6) presents this example for the year 2014, the treated districts are shown in dark gray, the synthetic control is built on districts located in the bright gray area.

[23] We have also led analysis with the nonparametric synthetic control method developed by Cerulli (2020), and we found similar results.

[24] Synthetic control and classical difference-in-differences estimations have been performed in Appendix D.

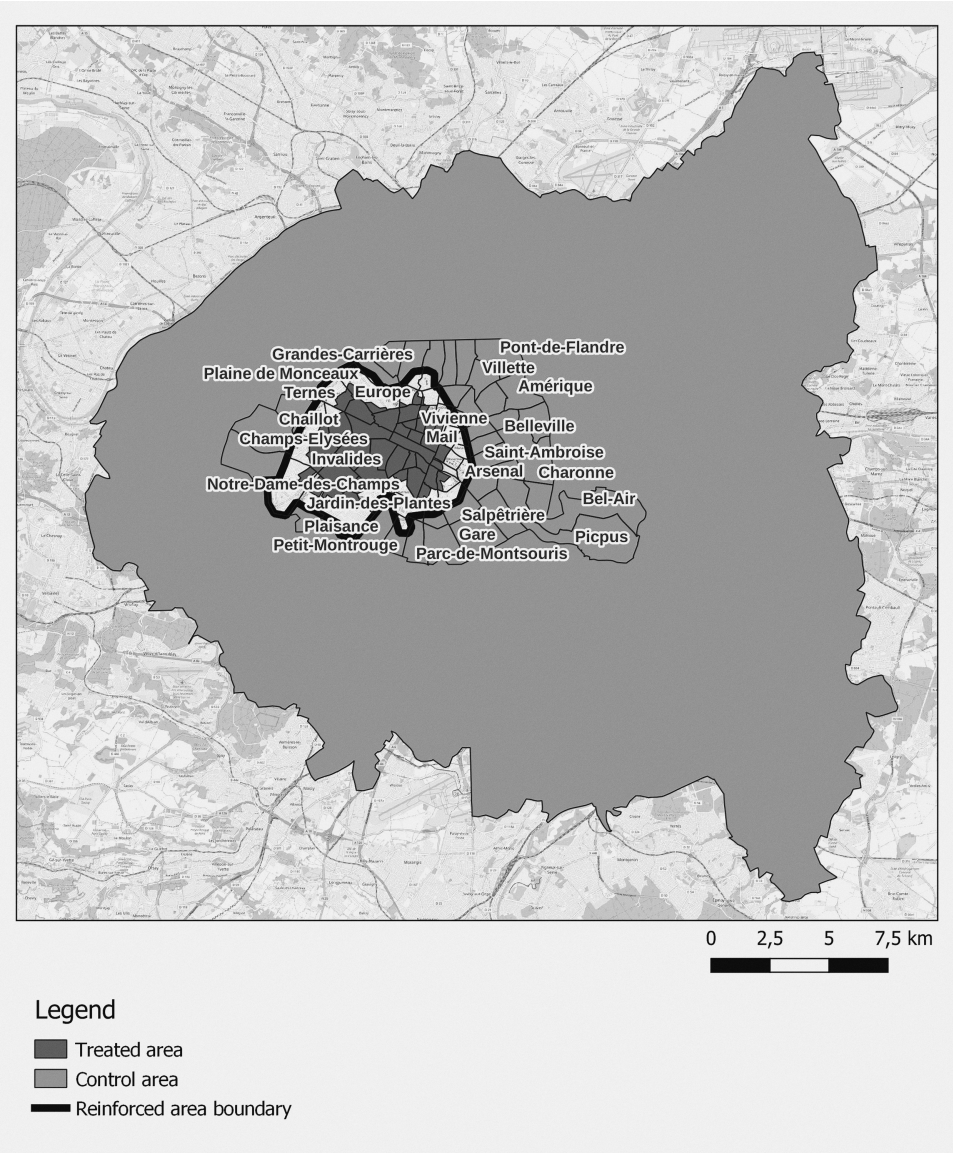

Figure 6: Treated and Control Areas in the Synthetic Difference-in-Differences (bandwidth: 600 meters)

Table (7) presents the descriptive statistics for SDID. The center and the synthetic center differ in various characteristics. Incomes are significantly higher in the treated center, as are prices, the level of employment, and the tourist demand approximated by the number of Airbnb. All these structural differences between the two areas are accounted for by fixed effects at the IRIS level. What matters for our empirical analysis is that these characteristics have not evolved in radically

different ways that could bias our identification strategy. It appears they have not; for example, there is a 4% difference in the unemployment rate between the treated and the control, both before and after the year 2009. Similarly, the growth rates of housing prices have been very similar on average in the two areas (less than 1% in both cases).

	Treated	Control
Average median income between 2006 and 2019	31759.31	26461.51
Share of workers	5.13%	8.11%
Share of higher intellectual professions	50.05%	42%
Price by m² (between 2012 and 2014)	8764.5€/m²	5068.77€/m²
Unemployment rate (before 2009)	10.14%	14.79%
Unemployment rate (after 2008)	9.16%	13.61%
Number of Airbnb on total housing (after 2009)	0.43%	0.12%
Average growth rate in unemployment 2006 and 2019	0.71%	0.79%
Average growth rate of housing 2006-2019	0.47%	0.76%
Average growth rate of housing price 2012-2019	1,97%	2,01%
Number of observations	770	6804

Table 7: Descriptive statistics for treated and control districts at the center (600m)

Our testable hypothesis is that the law of 2009 had a more concentrated effect in the center of Paris due to its restrictive implementation in this area.

Figure 7 presents the change in the number of m² for the synthetic region (in red) and for the treated area in the central area (in green). We notice a significant rise after 2009 in the treated region, which however experiences a hiatus when the 2011 law is implemented. Between 2012 and 2014, the conversion of HLM in both the counterfactual area and the treated zone appears to progress similarly. After 2014, the pace of increase in the synthetic region seems to decelerate in comparison to the area where 2014's law has been implemented.[25] Maybe one of the most striking results of this graph is the reversal between the control group and the treated group in the redevelopment of social housing after the 2009 law. Although the square meter was initially higher in the synthetic center than in the treated center at the start of the period, the situation reversed at the end of the period.

It is important to note that such a reversal is not observed for other characteristics of these two groups. For example, housing prices were consistently higher in the treated group than in the control group throughout the period. Similarly,

[25]We have also led a different strategy where three different synthetic groups are built before each laws and then analyzed separately in our online appendix. We find similar results.

unemployment was structurally higher in the synthetic center than in the treated center, and income was also always higher in the treated group than in the control group, among other differences. To account for these structural differences, fixed effects were systematically introduced in all our estimates.[26]

Figure 7: Treated and Control Areas in the Synthetic difference-in-differences in the Core (bandwidth: 600 meters)

4.2 Results in the Center

Table 8 presents the SDID results with different bandwidths. Our objective is to assess the distinct spatial impacts of these policies. The 2009 policy, by enforcing a compensation rule within each district, may exert a more substantial influence in the central areas compared to other reforms, mainly because the 2011 and 2014 laws facilitate compensation through HLM situated on the outskirts of the compensation zone. Both of our estimates corroborate this observation, as only the 2009 law significantly affects social housing construction in central Paris.

[26]Not reported here but available in an online appendix we have considered several other control variables such as the total number of conversions, median income, school added value, and the number of Airbnb listings. Our results remained robust to the introduction of these additional controls.

This is a second validation of Proposition 1, now for the Core. However, in that case, we still have a wide definition of the Core. By reducing this definition, the coefficient first doubles as we approach the center (0.6 in Column 1 compared to 1.2 in Column 2).[27] To provide a measure of economic significance, this indicates a robust growth in the redevelopment of social housing, increasing from 85.89 % ($\approx (\exp(0.62) - 1) \times 100$) in the wide center (300m) (representing approximately 11,000 m² additional) to 244.18% ($\approx (\exp(1.236) - 1) \times 100$) in the reduced area starting at 600m from the compensation border (representing approximately 14,000 m² additional). But while the growth is strong, it starts from a very low level and the effect in terms of the number (or space) of social dwelling redeveloped is still small. These results align well with the stylized facts presented in the first section. Before the 2009 law, the number of redevelopments in social housing was particularly low. In many neighborhoods, this number was even zero. The proportion of square meters converted into social housing in total housing redevelopment was only 0.39% over the period 2006-2008 (within a 300m border) but increased to 9% in the year following the law.

One may notice that these small effects and, in particular, the lack of impact of the most recent laws (2011 and 2014) implies that these regulations have been ineffective in reducing the level of segregation in the city. We reinforce this interpretation by finding a lack of impact from these redevelopments on Theil's index of social diversity in our online appendix.

[27] Regarding Column 3 (using the MSE optimal bandwidth with an upper limit at 1314, which is even more centered on the center), it is possible that we do not have enough observations in these limited areas to reach an interesting (and statistically significant) conclusion.

Treated:	Core			
Bandwidth choice	ad-hoc		MSE-opt	CE-opt
Bandwidth (in meter)	]300-center]	]600-center]	[1314-center]	[461-center]
Treated in 2009	0.620**	1.236**	4.783	0.929**
	(0.291)	(0.620)	(3.320)	(0.469)
Treated in 2011	0.0567	-0.433	0.909	-0.411
	(0.255)	(0.406)	(2.742)	(0.299)
Treated in 2014	-0.184	-0.607	6.506	-0.470
	(0.425)	(0.720)	(4.764)	(0.598)
Constant	5.547***	5.719***	5.096***	5.641***
	(0.242)	(0.279)	(0.453)	(0.262)
Observations	7,910	7,574	6,930	7,714
R^2 adj.	0.833	0.847	0.865	0.836

Notes: . Standard errors are cluster at the neighborhood level in parentheses a: p<0.01, b: p<0.05, c: p<0.1. Results are obtained from a Synthetic difference in differences using the PPML estimator. Column (1) use 300m of bandwidth to the center. Column (2) use 600m bandwidth to the center. Column (3) use the MSE optimal bandwidth. Column (4) and (5) use the Coverage Error (CE) probability neighborhood method. Column (6) and (7) represent high demand neighborhoods. The dependent variable is the number/area of HLM conversions (in m^2). Each estimate includes neighborhood and year fixed effects

Table 8: Social Housing Change from Synthetic Difference in Differences

5 Conclusion

To paraphrase Hirschman (1970), the silent exit of the working class from inner cities has accompanied the increase in prices in many global cities. In some places, voices of opposition to gentrification have been raised[28] and several local policies have been implemented. In this study, we examine three successive laws implemented in 2009, 2011, and 2014 that promote the conversion of offices and other commercial premises into private or social housing. A certain amount of trial and error can be observed in the policy imposed by these laws. The 2009 law was enacted in the particular political context of the 2008 re-election campaign of a socialist candidate. Although this law was not explicitly a promise, it can be viewed as the main tool to fulfill the commitment to provide more than 40,000 social housing

[28]The YIMBY movement in particular has organized several demonstrations in California to protest against areas significantly disrupted by rapid gentrification. In France, the "Yellow Vest" movement has also been driven by individuals considering that they have been excluded from the economic prosperity of metropolitan areas. See Brown-Saracino (2017) which surveys the literature in sociology that analyzes the public resistance to gentrification.

units in the capital, including in the center of Paris, between 2008 and 2014. According to our estimate less than 4,000 units have been converted to social housing due to compensation laws. Perhaps the 2009 regulation appeared too restrictive after its enforcement, or, in the absence of any assessment, it was considered ineffective. Regardless of the reason, the 2011 law completely relaxed the district compensation constraint. Finally, the 2014 law has represented a compromise that remains in effect today.

Our analysis shows that the law of 2009, in fact, significantly encouraged the redevelopment of social housing in the city center. In contrast, the 2011 and 2014 laws have only a significant effect on the border of the compensation area but not in the city center. Our analysis thus shows that the stipulations regarding where redevelopment is allowed can significantly shape the distribution of social housing. We further reinforced this interpretation through various robustness checks using different estimators and control groups. The fact that the most recent laws only have an effect on districts located in the periphery, which is a relatively small area, and not in the broadly defined center signifies a failure of these regulations in terms of their primary objective. This is all the more worrying as the 2014 law seems to have no effect.

Although our analysis presents an internal validity, it obviously lacks an external one. More research needs to be conducted in various cities and across different periods to gain a deeper understanding of how redevelopment influences the spatial and social fabric of cities.

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Appendix A: Some details about the compensation laws

Compensation rights

Compensation can be carried out directly by the applicant, who offers as compensation a unit that he owns or buys (as in our previous examples), or indirectly by purchasing a compensation title/right (called "droit de commercialité") from a third party that transforms the OC unit into housing. To obtain titles of compensation, the applicant can turn to specialized companies or to social landlords, who carry out operations of transformation of offices/shops (and so on) into housing and can thus propose units in compensation.

This transfer from a property for use other than housing to a residential property allows the applicant to obtain a permanent change. For him, the compensation title looks like an administrative cost to convert its building.

It is important to note that there is no official price for these titles; the prices are negotiated between the buyer and the seller. They vary depending on the location of the property. According to the Paris City Housing and Habitat Department,[29] the average price during the period is around 1,600 euros per square meter, with very significant variations, from about 400 euros per square meter to 3,000 euros per square meter in the western and central districts of the capital where demand

[29] https://cdn.paris.fr/paris/2021/06/11/e22f26b33f762b28aae60e1866c10041.pdf

is highest. Artigalas and Richaud (2018) and Morel (2017) confirm that the cost of the compensation title is less than the prices of housing, but still significant.

Exceptions and implementation

Since its origin, the law has taken into account exceptions (i.e., no conversion) for liberal professions, first floors, and organizations exercising a mission of general interest. The team in charge of the implementation of this regulation is relatively small (twenty people in 2014 according to Plottin, 2016) but composed of inspectors with wide-ranging prerogatives who carry out on-site investigations. Infractions are severely repressed, the fine amount has been set at 25,000 euros in 2009 and has doubled in 2016.[30] The court president orders the return to the previous use for the converted housing without authorization in a given period of time. At the end of this period, the court can impose a fine of up to 1,000 euros per day and per square meter of the unlawfully converted housing. A fine of 80,000 euros and one year imprisonment are also included in the law for false declarations.

Appendix B: Size of Weights

The weights used to build the synthetic controls are presented in Figure 8 and present relatively few extreme values.

[30] Article L651-2 of the "Code de la construction et de l'habitation"

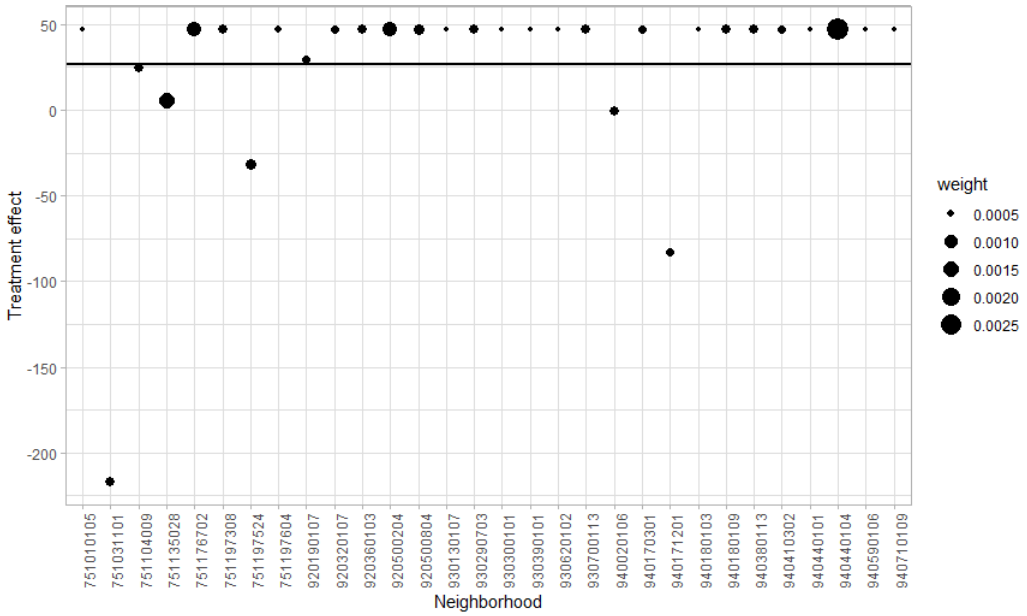

Figure 8: Weights of the top 30 neighborhoods in the Synthetic Difference-in-Differences (bandwidth: 600 meters)

Appendix C: time and geographical changes

As stated in the text, the zoning area used for the identification strategy could overlap with another policy aimed at promoting social housing. In fact, the SRU law has defined a zoning area (called area U.G.2.3) and, within this area, all new construction or restructuring projects with a residential floor area of more than 800 square meters must allocate at least 25% of this area to social housing. We therefore exclude from our analysis all social housing conversions of this size (800*0.25), which represent around 4% of our observations. Table (9) below presents the results using the synthetic control method, and we get results similar to those presented in the text.

One can also notice that in Table (9) we extend the period from 2000 to 2019. Indeed, data before 2006 are not numerous and may not be reliable, which is the reason why we decide to start in 2006. However, all the estimations presented in the text have also been done over that long period of 2000-2019 and we get similar results.

Dependent variable	Social housing	
	Synthetic difference-in-differences	
Bandwidth (m)	1*[0-400]	]400-center]
	(1)	(2)
Treated in 2009	0.2783	0.8366***
	(0.182)	(0.348)
Treated in 2011	0.8211***	-0.1142
	(0.394)	(0.397)
Treated in 2014	0.2734*	-0.0001
	(0.171)	(0.180)
Constant	4.79***	5.140***
	(0.196)	(0.195)
Neighborhood FE	✓	✓
Year FE	✓	✓
Observations	8,780	9,260
R^2 adj.	0.75	0.79

Notes: Standard errors are cluster at the neighborhood level in parentheses [a] p<0.01, [b] p<0.05, [c] p<0.1. Results are obtained from a Synthetic difference in differences using the PPML estimator. Columns (1) presents social housing transformations and use 400m bandwidth at the periphery using Synthetic difference-in-differences. Columns (2) represents social housing transformations and uses 400m bandwidth at the center using Synthetic difference-in-differences.

Table 9: Regression between 2000 and 2019 without 800m2 parcel

Appendix D: Other estimations (synthetic control, difference-in-differences and synthetic difference-in-differences)

This table presents the results for synthetic control (SC), difference-in-differences (DID), and synthetic difference-in-differences (SDID) estimations. We find similar results with the three different methods.

Dependent variable	Social housing change					
Bandwidth (in meter)	Center			Periphery		
	(1)	(2)	(3)	(4)	(5)	(6)
	SC	DID	SDID	SC	DID	SDID
Treated in 2009	1.3454***	0.8062***	1.236***	-0.0108	0.2158*	0.0632
	(0.628)	(0.292)	(0.620)	(0.164)	(0.115)	(0.156)
Treated in 2011	-0.4119	0.0047	-0.4330	0.5665***	0.2598*	0.4990*
	(0.463)	(0.140)	(0.406)	(0.279)	(0.149)	(0.289)
Treated in 2014	-0.5514	0.0838	-0.6069	0.4234***	0.2438***	0.4672***
	(0.734)	(0.172)	(0.720)	(0.188)	(0.113)	(0.188)
Constant	5.6328 ***	6.4741***	5.7188***	6.0509***	6.4351***	5.1461***
	(0.432)	(0.039)	(0.279)	(0.077)	(0.021)	(0.199)
Observations	7,574	7,574	7,574	7,714	7,714	7,714
R^2 adj.	0.8528	0.8549	0.8469	0.8303	0.8490	0.7602

Notes: Standard errors are clustered at the neighborhood level in parentheses ^{a} p<0.01, ^{b} p<0.05, ^{c} p<0.1. Results are obtained from a Synthetic difference in differences, synthetic control and difference in differences using the PPML estimator. Columns (1) in the center and (4) in the periphery use 600m bandwidth and represent the change in social housing from synthetic control. Columns (2) in the center and (5) in the periphery use 600m bandwidth and represent the change in social housing from difference-in-differences. Column (3) in the center and (6) at the periphery use 600m bandwidth and represent the social housing change from the synthetic difference-in-differences. Each estimate includes fixed effects and year fixed effects.

Table 10: Social housing change according to different estimators in the center and at the periphery