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Evidence from France

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Ownership incentives and housing affordability: Evidence from France

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Abstract

Are ownership incentive policies inevitably accompanied by detrimental inflationary effects? To address this issue, we develop a theoretical model in which owners of new housing benefit from a homeownership subsidy or a rental investment incentive. We show that while both incentives increase the price of the new housing, they reduce old housing prices and have an ambiguous impact on the average housing price. These effects result from residential spillovers from the old housing market to the new housing market. We test these findings empirically by exploiting a 2014 French reform in the metropolitan area of Lyon which intensified both incentives. Difference-in-difference estimates confirm our theoretical predictions: two years after the reform, the price of new housing increased by 30% and the price of old housing decreased by 7%. Taking both markets together, the overall effect is non-significant. The share of new housing transactions increased by 25%.

Keywords: House prices; Interest-free loan policy; Rent ceiling; Difference-in-difference

JEL: R14; R30; R31; R52

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1. Introduction

While housing is a fundamental need and is considered a human right in many national constitutions and international human right agreements such as the Charter of Fundamental Rights of the European Union, lack of access to affordable housing is a persistent concern in world metropolitan areas. In the OECD countries, 25% of owner-occupants with a mortgage and 31% of private market tenants are overburdened by housing expenditure that is, their housing costs exceed 40% of their disposable income (Salvi del Pero et al., 2016). The lack of access to housing results in a range of harms to city dwellers such as overcrowded dwellings, poor performance of children at school and transitional homelessness (Busch-Geertsema et al., 2010).

These critical issues have put access to housing at the core of housing market regulations in many countries. OECD (2016) surveyed the housing policies in 26 countries and found that all mention support for access to housing as one of the five most important objectives. Governments address this issue through a mix of numerous housing policy instruments including among others public housing provision, tax rebates for housing buyers, subsidized mortgages and rent controls (OECD, 2016). Many of these instruments belong to the category of housing ownership incentives.¹ Some typical examples of subsidies are the US tax credit provided to landlords under the Low Income Housing Tax Credit (LIHTC) program, and the French interest-free loans guaranteed to homeowners for the purchase of new housing.

Ownership incentives are aimed at encouraging the purchase of new housing to promote new constructions and reduce housing shortages. However, a major drawback of these incentives, confirmed empirically in many studies such as Gobillon and Le Blanc (2008) and Baum-Snow and Marion (2009), is their inflationary effect on housing prices resulting from the increased demand for housing.² The present paper argues that this inflationary effect is only part —and not necessarily the main part— of the picture. Our research question is: are ownership incentive policies inevitably accompanied by pernicious inflationary effects? For instance if the demand for housing targeted by the incentive increases, should demand in other parts of the housing market not decrease? What if these other parts of the market are of a significant size? What will be the expected effect on the overall average housing price? These questions would seem to challenge the assumed inevitable trade-off faced by governments between providing better access to housing and keeping housing prices at a reasonable level.³

To investigate these issues, we develop a tractable theoretical model in which households choose

¹Homeownership is perceived as having economic and social benefits by providing housing stability which is associated to better child education and a deeper involvement in the community (Glaeser, 2011). Rental investment acts to supplement workers' wages and older people's pension and is provided in a number of OECD countries such as Australia, Germany and Finland (De Boer and Bitetti, 2014).

²See section 2 for a more detailed discussion of this literature.

³Since most ownership incentives are in the form of subsidies provided to new owners, it could be argued that there is no trade-off since subsidies provide better access to housing and decrease the owners' purchase price net of the subsidy. However, from a social viewpoint the key variable is the raw housing price not the subsidized price, since ultimately subsidies are financed by taxes paid by households.

their tenure type (renter or owner) and their housing type (old or new). We examine the effects of two ownership incentives. The first is a homeownership incentive consisting of a subsidy to purchasers of new housing. The second is a rental investment incentive consisting of a tax rebate to landlords and an increase in the controlled rent i.e. the level of rent imposed on landlords renting new housing.⁴

Our theoretical analysis shows that both incentives increase the prices of new housing but reduce the prices of old housing due to renter and homeowner spillovers from the old housing market to the new housing market. The overall average price of housing increases only if there is a large enough share of new housing in all housing due to a strong consumer preference for new housing, or a large initial level of ownership incentive instruments. Otherwise, the overall average housing price decreases.

To test these theoretical predictions with the data, we exploit a recent variation in the calibration of the housing policy instruments in France, the 2014 Pinel reform. This reform led to a quasi-natural experiment which to our knowledge, has not been evaluated. We use a detailed notarial dataset including more than 30,000 housing sales over 27 months from 2014 to 2016 in the metropolitan area of Lyon which is the second most populous French urban area. The reform aimed at adapting the housing market regulation to the changing tightness of local housing markets. It intensified the two types of housing ownership incentives examined in our theoretical analysis. The reform increased homeownership incentives via interest-free loans which are a type of subsidy. It also intensified rental investment incentives via tax rebates to landlords and an increase in controlled rents.

Difference-in-difference estimates confirm our theoretical predictions: two years after the reform, the price of new housing increased by 30% and the price of old housing decreased by 7%. Taking both markets together, the overall effect is non-significant. The share of new housing sales increased by 25%.

The main contribution of this paper is to question the assumed traditional trade-off between access to property and moderate housing prices. Our empirical results suggest that this trade-off was irrelevant in the metropolitan area of Lyon since the increased prices of new housing were offset by a price cut for old housing due to residential spillovers across markets. These results suggest a more positive picture of ownership incentive policies compared to previous work which almost always predicts inflationary effects (see [section 2](#)). Our theoretical analysis contributes by suggesting that there might be practical cases where the old housing market is sufficiently developed that policy makers could both provide better access to housing and reduce the average housing price. In this case, ownership incentive policies would entail a “win-win” game. This calls for more empirical investigation of this ideal case.

The second contribution of our paper is the new theoretical model we propose. To our knowledge, it is the first tractable unified framework allowing investigation of both households’ tenure choices

⁴In order to guarantee a moderate rent, rent controls are a common counterpart imposed on investors willing to benefit from an ownership incentive subsidy or tax rebate. Thus, an increase in the level of this controlled rent is qualitatively equivalent to directly increasing the incentive subsidy. Both increase the return to the housing investment. See [subsection 3.1](#) for a formal statement.

and landlords' portfolio choices.⁵ There is a small number of papers that use unified models to study the interactions between homeowners, landlords and renters (for example [Berkovec and Fullerton \(1992\)](#)). Our model provides analytical closed-form solutions and complements these earlier models which employ a macroeconomic structural approach based on numerical simulations. See [Leung \(2004\)](#) for a detailed review of these models.

The remainder of the paper is organized as follows. [Section 2](#) introduces the related literature. [Section 3](#) presents the theoretical model and formulates the main predictions. [Section 4](#) describes the institutional context of the 2014 French housing reform in the metropolitan area of Lyon. [Section 5](#) discusses the identification strategy. [Section 6](#) describes the data and reports the descriptive statistics. [Section 7](#) presents the regression results. [Section 8](#) concludes the paper.

2. Related literature

The literature documenting ownership incentive policies is scarce. The results of those papers are generally disappointing and show an inflationary impact of policies with no substantial effect on the quantity of housing produced. In the US, the Low Income Housing Tax Credit (LIHTC) program is associated with an increase in the price of proximate housing ([Baum-Snow and Marion, 2009](#)). These authors also note a decline in median income in the area. Other studies suggest that the LIHTC generates a crowding out effect; the construction of private housing in the areas concerned is negatively affected by the presence of new housing benefiting from the LIHTC program ([Malpezzi and Vandell, 2002](#); [Eriksen and Rosenthal, 2010](#)).

The results in France appear to be consistent with the results of LIHTC studies. [Bono and Trannoy \(2013\)](#) show that one of the constituent laws of the French homeownership scheme, the Scellier Act, has had a positive effect on the price of building land; a result confirmed by [Chapelle et al. \(2018\)](#) who show that the Scellier Act increased the price of housing.

The effect of subsidies to homeowners is studied by [Poterba \(1984\)](#) who shows that subsidies given to homeowners usually lead to higher demand, and therefore to higher prices. These empirical results were observed in France in the case of interest-free loans ([Gobillon and Le Blanc, 2008](#)).

3. Theory

This section develops a tractable model in which renters, homeowners and landlords interact in the rental and purchase housing markets. The objective is to describe the effects of two housing ownership incentive policies targeting new housing: a homeowner incentive, and a rental investment incentive provided to landlords. [Subsection 3.1](#) introduces the framework. [Subsection 3.2](#) describes the raw supply of new and old housing and characterizes landlords' portfolio choice. [Subsection 3.3](#) discusses the tenure choice made by households. [Subsection 3.4](#) summarizes the equilibrium conditions. [Subsection 3.5](#) presents the main results which are summarized in [Propositions 1 to 3](#).

⁵The reduced form of all the endogenous variables in the model can be derived easily by hand as shown in [Appendix C](#).

3.1. Framework

The economy consists of N single-individual households who may freely choose to become renters or owners of two types $k = n, o$ of housing: new $k = n$ and old $k = o$.⁶ N_{rn} denotes the number of renters of new housing, N_{hn} denotes the number of homeowners of new housing and N_{ro} denotes the number of renters of old housing. Homeownership of old housing is peripheral to the study. In general, government homeownership incentives tend to target renters but not previous homeowners (see [section 4](#)).⁷ For simplicity and without loss of generality, homeownership of old housing is ignored. The population constraint is:

$$N_{rn} + N_{hn} + N_{ro} = N. \quad (1)$$

whereas the total population N is fixed its distribution among the three tenure types varies i.e. N_{rn} , N_{hn} and N_{ro} are endogenous.⁸

New dwellings are built by construction firms and old dwellings are dwellings initially owned by prime owners. The new and old dwellings are supplied at the respective prices P_n and P_o either to homeowners who to occupy them or landlords who supply housing to renters. In the rental market for old housing, the matching between renters' needs and landlords' supply is ensured by adjustments to the rent R_o . However, the rental market for new housing is assumed to be constrained by a relevant exogenous rent ceiling \mathcal{R} , so that demand for new housing is rationed.

Homeowners of new housing receive a subsidy \mathcal{S} . For example, \mathcal{S} can be interpreted as a publicly provided interest-free loan as described in [section 4](#). Landlords supplying new housing are subject to the controlled rent \mathcal{R} but receive a subsidy θ , so that the unit return to new housing investment is $\mathcal{R} + \theta$. For example, θ can be interpreted as a tax rebate, as described in [section 4](#). We are interested in two housing ownership incentive policies in particular. The first is a homeowner incentive consisting of an increase in the subsidy \mathcal{S} . The second is a landlord incentive consisting of an increase in both the rent ceiling \mathcal{R} and the subsidy θ . Since θ simply represents extra rent income, an increase in θ is equivalent to an increase \mathcal{R} . Thus, to simplify the notations, we ignore the landlord subsidy by setting $\theta = 0$, and letting the landlord incentive refer only to an increase in the controlled rent \mathcal{R} .

The basic purpose of the next subsections describe the effects of the ownership incentives described above on the new housing price P_n , the old housing price P_o , the average housing price \bar{P} defined later in [\(13\)](#), and the residential populations N_{rn} , N_{hn} and N_{ro} .

⁶Since our model is a static, “new” and “old” must be considered intrinsic characteristics of the housing. This short-run approach implies that new housing does not become old housing.

⁷Excluding homeowners of old housing is formally equivalent to assuming a fixed positive number of such homeowners. Including an endogenous number of homeowners of old housing would not change the qualitative results, their behavior being similar to that of renters of old housing.

⁸A fixed total population N is in line with the short-run scope of the study. It is indeed unlikely that in the short run changes in a regional housing market would be significantly influenced by household inter-regional mobility.

3.2. Raw housing supply and landlords' portfolio choices

New housing is built by a construction firm whose profit function is $P_n H_n - cH_n^2/2$, where H_n is the amount of new housing supplied and P_n is its unit price. The term $cH_n^2/2$ includes all building costs whose level depends on parameter $c \in [0, 1]$. The first-order condition of the construction firm with respect to H_n entails the following supply function $H_n(P_n)$ of raw new housing:

$$H_n(P_n) = \frac{P_n}{c}. \quad (2)$$

which states that the higher its price, the more new housing is built by the construction firm.

Old housing is composed of a continuum of dwellings initially owned by absentee owners.⁹ Each absentee prime owner incurs a specific rehabilitation cost to put the housing on the market. Assuming that these costs are uniformly distributed among all old dwellings, and that the unit price of an old dwelling P_o is sufficiently low, only a fraction of the total stock of old housing is supplied, and the supply function $H_o(P_o)$ of old housing is:¹⁰

$$H_o(P_o) = P_o \quad (3)$$

which states that the higher the price of old housing, the more prime owners will be willing to supply their dwellings.¹¹ The raw numbers of new and old housing $H_n(P_n)$ and $H_o(P_o)$ defined in (2) and (3) are supplied to landlords and homeowners.

Housing investment is achieved by $m > 1$ identical absentee landlords. Each landlord buys h_n units of new housing and h_o units of old housing from the raw suppliers described above. To supply h_k units of habitable housing of type $k = n, o$ to renters, the landlord needs to pay the raw purchase price of the housing $P_k h_k$, some housing agency costs (related mainly to finding and monitoring renters) and some housing maintenance costs, $h_k^2/2$. In sum, the cost incurred by the landlord from investing in h_k units of housing is:

$$c(h_k) = P_k h_k + \frac{h_k^2}{2}, \quad k = n, o \quad (4)$$

The return to h_n (resp. h_o) units of new (resp. old) housing is the rent \mathcal{R} (resp. R_o) paid by the housing renters. Subtracting the investment costs (4) from the gross income $\mathcal{R}h_n$ and $R_o h_o$, it follows that the representative landlord's net income from housing ownership is:

$$(\mathcal{R} - P_n)h_n - \frac{h_n^2}{2} + (R_o - P_o)h_o - \frac{h_o^2}{2} \quad (5)$$

The representative landlord chooses its portfolio (h_n, h_o) so as to maximize its income from housing ownership. Differentiating (5) with respect to h_n and h_o , the first-order conditions entail:

$$h_n = \mathcal{R} - P_n, \quad h_o = R_o - P_o, \quad (6)$$

⁹The results would not change were we to assume that the old dwellings initially were evenly distributed among the N households in the economy.

¹⁰See [Appendix A](#) for the formal proof.

¹¹Notice that since $c \in [0, 1]$, the supply of new housing is more elastic with respect to price than the supply of old housing, which coincides with immediate observations.

which represent the housing investments h_n and h_o of the representative landlord. The individual investment functions (6) state that, as expected, landlords buy more housing if their returns on investment \mathcal{R} and R_o are higher or their purchasing costs P_n and P_o are lower.

Since all m landlords are identical, the total investment in new and old housing is respectively:

$$I_n = m(\mathcal{R} - P_n), \quad I_o = m(R_o - P_o). \quad (7)$$

Housing investments (6) play a dual role due to the two-sided nature of the housing market. In the purchase market for raw housing described above, h_n and h_o are respectively demands which meets the supply provided by the firm constructing the new housing and the prime owners of old housing. In the rental housing market described hereafter, h_n and h_o are the supplies of housing services to renters.

3.3. Tenure choice

The rental market for new housing is constrained by a relevant rent ceiling \mathcal{R} , so the rental market for new housing is not in equilibrium. Demand is rationed and the equilibrium amount of new rental housing is determined by the supply side which is the investment in new housing by landlords I_n . This rationed equilibrium is depicted in Figure 1c. It follows that the number of renters of new housing can be written as:¹²

$$N_{rn}(\mathcal{R}) = I_n, \quad (\text{e.1})$$

where I_n is the investment function defined in (7). Condition (e.1) entails that the number of renters of new housing N_{rn} depends directly on the controlled rent \mathcal{R} , which is underlined by the notation $N_{rn}(\mathcal{R})$. This highlights the direct channel through which an increase in \mathcal{R} affects the model: a political measure raising the rent ceiling spurs more investment in the market for new rental housing which enables more households to become renters of new housing. This effect would be illustrated by an upward shift of the horizontal line in Figure 1c.

The homeowner's cost is equal to the cost incurred by a landlord, as defined in (4). To become homeowner of one unit of habitable new dwelling, an individual pays $c(1) = P_n + 1/2$. To encourage homeownership of new housing, government provides a subsidy $s > 0$ to purchasers of new housing. For convenience, we introduce the notation $\mathcal{S} \equiv s - 1/2$, so that the N_{hn} homeowners of new housing pay an ownership cost $P_n - \mathcal{S}$ where \mathcal{S} is the adjusted subsidy.

The household's disposable income after paying the cost of its housing unit is devoted to the consumption of a composite good. We denote the composite consumption of a homeowner of new housing as $C_{hn} = Y - (P_n - \mathcal{S})$ and the composite consumption of a renter of old housing as $C_{ro} = Y - R_o$, where Y is the raw individual income. Let α_n (resp. α_o) denote the marginal utility households derive from the consumption of their new (resp. old) housing unit. Assuming additive utility, the utility

¹²For ease of reference the main equilibrium conditions are denoted (e.i), $i = 1, \dots, .$

of a homeowner of new housing U_{hn} and the utility of a renter of old housing U_{ro} are:

$$U_{hn} = \alpha_n + Y - (P_n - \mathcal{S}), \quad U_{ro} = \alpha_o + Y - R_o, \quad (8)$$

Assuming that households differ only with respect to their attachment to tenure types and relying on the discrete choice approach introduced in [Mansoorian and Myers \(1993\)](#), we can show that:¹³

$$N_{hn} = \frac{N - N_{rn}(\mathcal{R})}{2} + \frac{\alpha}{2} + \frac{R_o - (P_n - \mathcal{S})}{2}, \quad N_{ro} = \frac{N - N_{rn}(\mathcal{R})}{2} - \frac{\alpha}{2} + \frac{(P_n - \mathcal{S}) - R_o}{2}, \quad (9)$$

which defines the number of homeowners of new housing and the number of renters of old housing. Parameter $\alpha \equiv \alpha_n - \alpha_o$ represents the household's relative preference for living in new rather than old housing. This can be positive or negative.¹⁴ This reflects not only individual preferences but also the economic, socio-demographic, historical and geographical characteristics of the economy. For example, if budgetary resources have been devoted to rehabilitating historic parts of the city center, α can be expected to be lower. Not surprisingly, (9) shows that an increase in α leads renters of old housing to opt for homeownership of new dwellings.

The expressions (9) are standard housing demand functions. An increase in the rent for old housing R_o reduces the number of renters of old housing but increases the number of homeowners of new dwellings. An increase in the price of new housing P_n has the opposite effects. In particular, the direct effect of extending the homeownership incentive, that is increasing the subsidy \mathcal{S} , is to allow renters of old dwellings to become homeowners of new housing.

The effect of extending the landlord incentive, that is raising the rent ceiling \mathcal{R} , on the tenure choice of households can also be described. As discussed below condition (e.1), the direct effect of increasing \mathcal{R} is to increase the number of renters of new housing N_{rn} . Expressions (9) indicate that these renters come from both of the other two tenures.

3.4. Equilibrium

The general equilibrium combines the constrained equilibrium of the rental market for new housing defined in (e.1) and drawn in [Figure 1c](#), and free equilibria of three markets: the rental market for old housing and the purchase markets for new and old housing.

Specifically, equilibrium of the purchase market for new housing, depicted in [Figure 1a](#), requires that the demand for new housing by both the landlords I_n and the homeowners N_{hn} is equal to the supply of new housing provided by the construction firm $H_n(P_n)$:

$$N_{hn} + I_n = H_n(P_n), \quad (e.2)$$

where $H_n(P_n)$, I_n and N_{hn} are respectively defined in (2), (7) and (9). Condition (e.2) could be interpreted as determining the equilibrium level of the new housing price P_n . Equilibrium of the

¹³See [Appendix B](#) for a detailed derivation.

¹⁴As expected, if $\alpha_n = \alpha_o$ and $P_n - \mathcal{S} = R_o$, households consider both markets identical, and therefore distribute themselves uniformly among both markets: $N_{hn} = N_{ro} = (N - N_{rn})/2$.

purchase market for old housing requires that the investment in old housing I_o is equal to the supply of old housing by its prime owners $H_o(P_o)$:¹⁵

$$I_o = H_o(P_o), \quad (10)$$

where $H_o(P_o)$ and I_o are respectively defined in (2) and (7). Condition (10) could be interpreted as determining the equilibrium level of the price P_o of old housing. Equilibrium of the rental market for old housing requires that the number of renters of old housing N_{ro} is equal to the amount of old housing supplied by the landlords I_o :¹⁶

$$N_{ro} = I_o, \quad (11)$$

where I_o and N_{ro} are respectively defined in (7) and (9). Condition (11) could be interpreted as determining the equilibrium level of the old housing rent R_o .

For ease of interpretation, let us use the equilibrium condition of the rental market for old housing (11) to rewrite the equilibrium condition of the purchase market for old housing (10) as follows:

$$N_{ro} = H_o(P_o) \quad (\text{e.3})$$

that is, the demand for old housing by renters is equal to the supply of old housing by its prime owners. This equilibrium is depicted in Figure 1b.

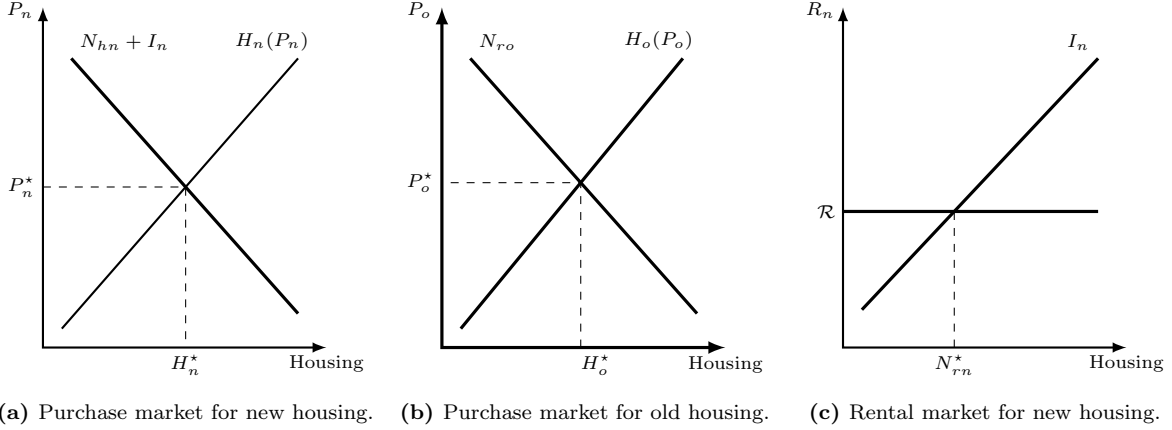


Figure 1. The market equilibria.

Notice that Figure 1b depicts the number of renters of old housing N_{ro} as a decreasing function of its price P_o . However, the expression (9) states that N_{ro} is decreasing with respect to the rent R_o but this does not explicitly include the housing price P_o . To see why representing the number of renters N_{ro} as a decreasing function of the price P_o is equivalently legitimate, we insert the explicit expressions of $H_o(P_o)$ (3) and I_o (7) into the equilibrium condition (10) and rearrange the terms. We obtain:

$$R_o = \left(1 + \frac{1}{m}\right) P_o \quad (12)$$

¹⁵Recall that the number of homeowner is assumed to be zero, $N_{ho} = 0$ (subsection 3.1). Except for this slight difference, (10) is similar to (e.2).

¹⁶Condition (11) echoes condition (e.1).

which indicates that the rent R_o is proportional to the price P_o , so that N_{ro} is indeed decreasing with respect to P_o . Condition (12) states that the rent R_o received by investors is equal to the price P_o to which the markup $1/m$ is applied. This markup decreases with the number of competing investors m . In the limit case where $m \rightarrow \infty$, investors no longer make a profit and the standard no-arbitrage condition $R_o = P_o$ applies.¹⁷

In sum, the general equilibrium of the economy can be reduced to three equilibrium conditions (e.1), (e.2) and (e.3) —depicted in Figure 1— which allow us to determine the equilibrium levels of the three variables N_{rn} , P_n and P_o as a function of the ownership incentive parameters \mathcal{S} and \mathcal{R} . Subsequently, the equilibrium levels of the other endogenous variables of the model, N_{hn} , N_{ro} and R_o can be computed directly from their expressions in (9), (12). The equilibrium level of the average housing price \bar{P} can also be computed directly from:

$$\bar{P} \equiv \frac{N_{hn} + N_{rn}}{N} P_n + \frac{N_{ro}}{N} P_o \quad (13)$$

Appendix C derives the explicit reduced forms of all the equilibrium variables.

3.5. Effect of the ownership incentives

Full characterization of the general equilibrium in which the rental and purchase markets for new and old housing are in equilibrium as established in subsection 3.4 allows us to assess the effects of policy interventions on the economy. Specifically, we are interested in political measures to help households get access to housing property. Subsection 3.5.1 considers the effect of an increase in the subsidy \mathcal{S} which encourages households to become homeowners of new housing. Subsection 3.5.2 describes the effect of an increase in the rent ceiling \mathcal{R} which represents an increase in the profitability of the rental investment and promotes landlords' investment in new housing. Subsection 3.5.3 summarizes the main results.

3.5.1. Effect of the homeownership incentive

Let us assume first that government increases the homeownership incentive by increasing the subsidy \mathcal{S} . The effect of this policy is depicted in Figure 2 and is described below. It can be shown that the following general equilibrium responses occur:¹⁸

$$\frac{\partial N_{hn}}{\partial \mathcal{S}} > 0, \quad (14a) \quad \frac{\partial N_{ro}}{\partial \mathcal{S}} < 0, \quad (14b)$$

which states that an increase in the homeowner subsidy spurs renters of old housing to become homeowners. This results directly from the increase in \mathcal{S} which represents a reduction in the net price of new housing $P_n - \mathcal{S}$ relative to the price of the rent for old housing R_o . These effects are represented in Figures 2a and 2b by horizontal shifts in the demand curves.

¹⁷Notice that this limit case would eliminate the rental market for old housing since no landlord would be interested in investing in this market, as shown by plugging $R_o = P_o$ into (7).

¹⁸See the detailed derivation of these conditions (A.15) and (A.21) in Appendix C.

These demand changes result in price changes which can be assessed by differentiating the equilibrium prices with respect to \mathcal{S} :¹⁹

$$\frac{\partial P_n}{\partial \mathcal{S}} > 0, \quad (15a) \quad \frac{\partial P_o}{\partial \mathcal{S}} < 0, \quad (15b)$$

which states that the demand pressure exerted by the new homeowners on the market for new housing exerts an upward pressure on prices, while desertion of the old housing market by renters reduces the rent and the price of old housing as illustrated in [Figures 2a and 2b](#).

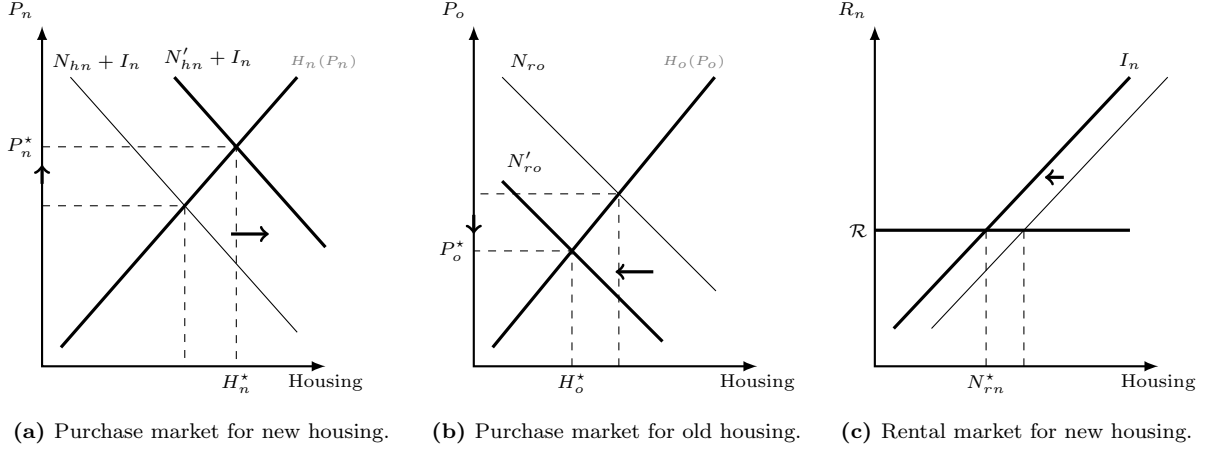


Figure 2. Main effects of the homeownership incentive: increase in \mathcal{S} .

Additionally, notice that the increase in P_n reduces the profitability of investment in new housing (see the definition of I_n in (7)) so that investors supply less new rental housing and we have:²⁰

$$\frac{\partial N_{rn}}{\partial \mathcal{S}} < 0,$$

which is represented by the leftward shift in the supply curve in [Figure 2c](#). This indirect effect generalizes the findings in (14) since we now know that the additional homeowners of new housing resulting from the policy, were previously renters in both the new and old housing markets.

Conditions (14a) and (15a) highlight the traditional trade-off faced by government when trying to increase access to housing property: the number of homeowners of new housing is higher but the price of this new housing is also higher. Of course, homeowners will pay a lower net price $P_n - \mathcal{S}$ than before the subsidy increase. However, what matters from a social welfare viewpoint is the raw price P_n which is paid either directly by private agents or indirectly through taxes or debt required to finance the price subsidy. Moreover, standard tax incidence theory shows that the price increase resulting from a subsidy increase entails a deadweight loss to the economy.

Most existing studies highlight the above inflationary effect of ownership incentive policies (see [section 2](#)). However, conditions (14b) and (15b) indicate that this pernicious effect \mathcal{S} could be mitigated

¹⁹See the detailed derivation of the condition (A.13) in [Appendix C](#).

²⁰See the detailed derivation of condition (A.17) in [Appendix C](#).

as a more comprehensive perspective shows. The stronger demand pressure on the purchase market for new housing results from a spillover from the old housing rental market. Thus, normative judgment requires to balance the increase in the new housing price P_n with the reduction in the old housing price P_o . This can be achieved by analyzing the effect of the subsidy increase on the average housing price \bar{P} defined in (13). Differentiation allows us to derive the fundamental condition:²¹

$$\frac{\partial \bar{P}}{\partial \mathcal{S}} \underset{\leq}{\geq} 0 \iff \alpha \underset{\leq}{\geq} \hat{\alpha}, \quad (16)$$

where $\hat{\alpha}$ is a threshold expressed explicitly in equation (A.24) of Appendix C. This result shows that intensifying the homeownership incentive does not necessarily raise the average price of housing. This ambiguity comes directly from (15). Since the average price \bar{P} (13) is a weighted mean of the new housing price P_n which decreases with \mathcal{S} and the old housing price P_o which decreases with \mathcal{S} , \bar{P} is expected to increase if the proportion of new housing $(N_{hn} + N_{rn})/N$ is relatively high, and to decrease otherwise. This is precisely what condition (16) states: the average housing price increases in response to the homeownership incentive if and only if the relative societal preference for new housing α is sufficiently strong. If α is close to the threshold $\hat{\alpha}$, the ownership incentive has no significant effect on the housing prices. It might also be the case that the societal preference for new housing is sufficiently low ($\alpha < \hat{\alpha}$) that the average housing price will decrease.

3.5.2. Effect of the landlord incentive

The main result of subsection 3.5.1 can be summarized as follows: due to residential spillovers across markets, it is possible to encourage homeownership without necessarily causing the price of housing to increase. The present subsection shows that this original finding extends to incentives targeting ownership for investment motives even though in this case the residential spillovers are slightly different. Formally, assume that the government intensifies the landlord incentive by raising the rent ceiling \mathcal{R} . The effect of this policy is depicted in Figure 3 and described below.

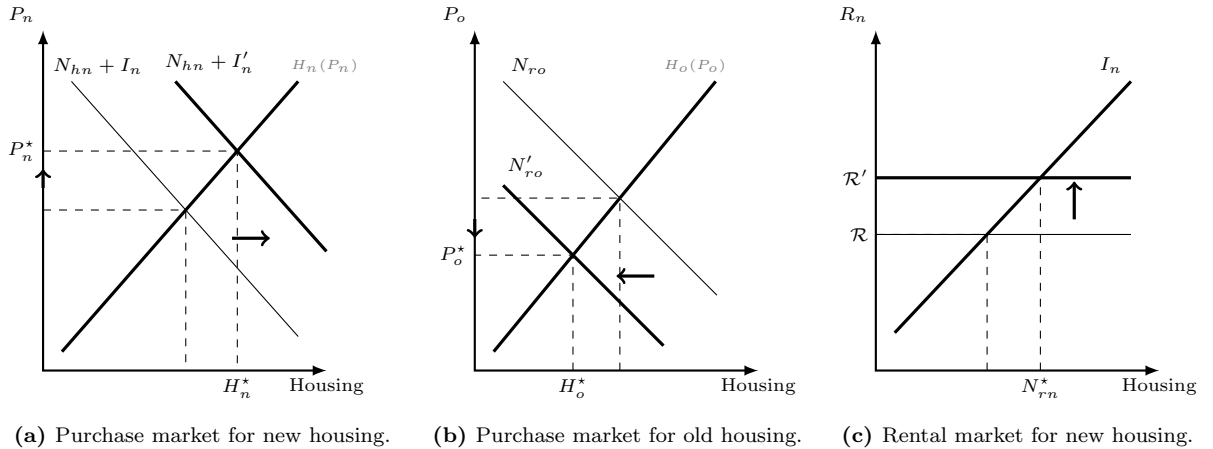


Figure 3. Main effects of the landlord incentive: increase in \mathcal{S} .

²¹See the detailed derivation of condition (A.26) in Appendix C.

It can be showed that the following general equilibrium responses occur:²²

$$\frac{\partial N_{rn}}{\partial \mathcal{R}} > 0, \quad \frac{\partial N_{ro}}{\partial \mathcal{R}} < 0, \quad \frac{\partial N_{hn}}{\partial \mathcal{R}} < 0, \quad (17)$$

which states that the landlords' incentive increases the level of investment in new housing which allows more households to become renters of new dwellings (Figure 3c). Conditions (17) state also that these new renters were previously either renters in the old housing market (Figure 3b) or homeowners of new housing. The population constraint (1) and condition (17) imply also that $\partial(N_{hn} + N_{rn})/\partial \mathcal{R} > 0$ or equivalently that:

$$\frac{\partial N_{hn} + I_n}{\partial \mathcal{R}} > 0,$$

Thus, as expected stimulation of investment in new housing entails an increase in the total demand for new housing despite the crowding out of homeowners. This is represented by the rightward shift in the demand curve in Figure 3a. In sum, similar to the homeownership incentive, the landlord incentive increases the demand new housing for sale and reduces demand for old housing for rent. The following price changes can be derived:²³

$$\frac{\partial P_n}{\partial \mathcal{R}} > 0, \quad (18a) \quad \frac{\partial P_o}{\partial \mathcal{R}} < 0, \quad (18b) \quad \frac{\partial \bar{P}}{\partial \mathcal{R}} \begin{matrix} \geq \\ \leq \end{matrix} 0 \iff \alpha \begin{matrix} \geq \\ \leq \end{matrix} \hat{\alpha}, \quad (18c)$$

which are identical to (15) and (16), and are interpreted similarly. In particular, condition (18c) confirms that the average housing price increases in response to ownership incentives only if households' preference for new housing is sufficiently high. In this case, the share of new housing in the economy is sufficiently high for the increase in the price of new housing to outweigh the decrease in the price of old housing.

The inflationary or deflationary effect of ownership incentive measures could be driven also by the current levels of the housing policy instruments. It can be shown that:²⁴

$$\frac{\partial^2 \bar{P}}{\partial \mathcal{R}^2} > 0, \quad \frac{\partial^2 \bar{P}}{\partial S^2} > 0, \quad \frac{\partial^2 \bar{P}}{\partial S \partial \mathcal{R}} > 0, \quad (19)$$

which states that the marginal effect of each policy instrument is amplified by the initial level of both policy instruments. Combined with conditions (16) and (18c), conditions (19) indicate that ownership incentive policies are expected to entail an overall price increase if these ownership incentive instruments are already well developed. On the contrary, deflationary effects could be expected in societies where these type of instruments are rare so that few people have access to new dwellings which are often expensive. In this case, the share of old housing in the economy is high and the decrease in the old housing price outweigh the increase in the new housing price.

3.5.3. Summary

The analysis in this section allows several general statements about ownership incentive policies. We have shown that:

²²See the detailed derivation of conditions (A.15), (A.17) and (A.21) in Appendix C.

²³See the detailed derivation of condition (A.13) in Appendix C.

²⁴See the detailed derivation of conditions (A.27) in Appendix C.

Proposition 1 *Ownership incentive policies targeting new housing, although they encourage access to property from new owners, have an inflationary effect on the price of new housing.*

This is a traditional capitalization result: ownership incentives increase the demand for new dwellings and therefore increase their price. It highlights the social trade-off between providing access to property and low housing prices. We showed also that:

Proposition 2 *Due to residential spillovers from the old housing market towards the new housing market ownership incentive policies targeting new housing have a deflationary effect on the price of old housing.*

This reveals that undermining the emphasis on the market not targeted by the ownership incentives reverses the traditional capitalization argument in [Proposition 1](#). This is important when considering the social welfare effects of ownership incentive policies. [Proposition 2](#) sheds light on an overlooked benefit of these policies: they are expected to make old housing more affordable. This is particularly important since most people live in old housing. This argument is completed by the following result:

Proposition 3 *Ownership incentive policies targeting new housing have a priori, an ambiguous effect on the average housing price. An inflationary [deflationary] effect is expected if households' preferences for new housing are strong [weak] or if housing policies favoring the new housing market are [are not] well developed.*

This originally highlights that the price effects of housing policy measures should be assessed for the housing directly targeted by the policy, and also should account for global market variables such as the average housing price. This provides a better picture of the overall welfare implications of the policy. Specifically, and in contrast to the literature ([section 2](#)), [Proposition 3](#) shows that policy that tries to increase access to property may not necessarily result in an overall increase in housing prices. In particular, if the non-targeted market (here, the old housing market) is sufficiently large, the overall housing price might even decrease resulting in a “win-win” situation for policy makers in which more households have access to property and the average housing is more affordable.

In the rest of the paper we empirically test the predictions in [Propositions 1](#) to [3](#) to establish whether it is inevitable that ownership incentive policies will be accompanied by pernicious inflation.

4. Institutional setting

4.1. Housing ownership incentives

The Pinel reform is part of a long-standing public policy aimed at promoting the construction of new housing by encouraging private agents to buy new housing. New housing construction is a major issue in France because housing shortages contribute to substantial increases in the price of housing: real estate prices increased by 153% between 1999 and 2018 whereas minimum income grew by only 42% in that period. The 1999 Besson program, the 2003 Robien program and the 2008 Scellier Act

contributed to creating the public policy context for the Pinel reform. The two main components of this context are the interest-free loan policy (or PTZ for *prêt à taux zéro*) and the support for rental investment (SRI).

The PTZ was implemented to help individuals to become homeowners (Gobillon and Le Blanc, 2008). Eligible individuals pay no interest on the first 40% of the new dwelling price up to a certain threshold. However, there are certain conditions attached to eligibility for the PTZ. First, the dwelling being purchased must be new housing; the PTZ is not available for the purchase of old housing.²⁵ Also, the PTZ is not available to individuals who were homeowners in the previous two years, or individuals with incomes above a certain income threshold. Finally, the housing must remain in the ownership of the PTZ beneficiary for a minimum period of time.²⁶

The SRI targets the rental market for new housing. Again, there are several conditions attached to benefiting from a tax reduction. Similar to the PTZ, the housing purchased by the landlord must be new housing.²⁷ Also, to be eligible for a tax reduction the landlord must rent the housing to renters with moderate incomes and at a moderate rent. Finally, the landlord must rent the dwelling for a predetermined period of time –6, 9 or 12 years– before it can be sold. The longer the time guaranteed for inclusion in the rental market, the higher the tax reduction.

The French municipalities are split across three zones: zone A includes municipalities where the real estate market is tightest, zone B includes intermediate markets, and zone C includes less restricted real estate markets.²⁸ This categorization identifies areas with the most severe housing shortages, and determines the conditions for access to the PTZ and the SRI: the tighter the housing market, the less restrictive the conditions.

4.2. The Pinel reform

The Pinel reform consisted mainly of an updating to the municipality zoning according to changes in the housing market. Some zones in the metropolitan areas of the largest French cities (e.g. Lyon, Marseille, Lille and Montpellier) were regraded from B to A, while other areas suffering less severe housing shortages were regraded from B to C. The changes were effective from October 1, 2014.

This paper focuses on the metropolitan area of Lyon (called the Greater Lyon) which is the 2nd

²⁵New housing is defined as housing not previously occupied. There are some exceptions to eligibility for the PTZ such as if an old housing that is being purchased is subject to major renovations or conversion from an existing premises into housing (e.g. conversion of a commercial space into housing).

²⁶It must be the principal residence of the beneficiary of the PTZ for a minimum period of 6 years from the date of payment of the loan (although in exceptional cases this condition could be relaxed). After this 6 year period, it can be rented. Also, occupation of the housing must be no later than 1 year after completion of the construction work, or 1 year after purchase of the housing if this is later than the construction completion data.

²⁷New housing is defined as not previously occupied or housing that is still under construction. Some non-new housing is eligible if it is subject to major renovation to bring it up to decent standards, or if it related to some other type of property that has been converted to housing.

²⁸Zones A and B are subdivided in respectively zones A bis/A and B1/B2. For simplicity, we refer to a change from B1 to A, a change from B to A.

most populated French urban area. Before the reform, all the cities in Greater Lyon were B zones. The reform changed the status of two (Lyon and Villeurbanne) which were regraded from B to A. The remaining B zone cities can be considered the control group. This setting allows to evaluate the effect on housing prices of a switch from zone B to zone A which allows us to assess the effect of the extension of the two instruments –PTZ and SRI– supporting the purchase of new housing.

Specifically, the PTZ is affected by the zone ranking as follows. First, the income ceiling allowing the individual to benefit from the PTZ varies with the zone: a higher grading increases the income ceiling. For example, in 2015, the income threshold for a single person was €26,000 in zone B and €36,000 in zone A. Second, the maximum price of the housing on which the zero rate loan applies is higher when the grade is high: €135,000 for a single person in zone B and €150,000 in zone A.

Since our analysis does not distinguish among types of households and housing, the changes in the PTZ entailed by the reform can be understood as an increase in the average subsidy received by the average homeowner of average new housing. This corresponds to our theoretical modeling of the homeowner incentive in [subsection 3.1](#).

Eligibility for the SRI was also affected in two ways by the change in the zone grading. The rent ceiling increases from €10 per square meter in zone B to €11.9 in zone A. Also, the maximum income for eligibility for the SRI increased: the income ceiling for a single tenant increased from €31,000 in zone B to around €38,000 in zone A.

Again, since our analysis does not distinguish among different types of households, the change in the RSI entailed by the reform can be understood as an increase in the rent ceiling for new housing and an increase in the average subsidy (i.e. tax rebate) received by the average landlord supplying average new housing. This corresponds to our theoretical modeling of the landlord incentive in [subsection 3.1](#).

5. Empirical strategy

To assess the effect of the October 1, 2014 Pinel reform we use a difference-in-difference approach. We compare the growth rates of prices in the treated and the control areas after the reform. Our monthly data span from January 2014 to December 2016. This includes 9 months from January 2014 to September 2014 that were prior to the reform, and 23 months from October 2014 to December 2016 that were after the reform was implemented.

We estimate the effect of the policy on the price Y_{ijt} of housing sale i in housing block j at month $t = Jan2014, \dots, Dec2016$. T_i is a binary variable which takes the value 1 if the sale occurred in a treated zone and 0 if the sale occurred in a control zone. The variable DD_{it} takes the value 1 for sales in a treated zone which occurred after the reform (i.e. $t \geq Oct2014$) and 0 otherwise.

The baseline difference-in-difference model that we fit takes the form:

$$Y_{ijt} = \alpha T_i + \delta DD_{it} + \eta \mathbf{X}_{it} + \zeta \mathbf{G}_{it} \cdot t + \phi_t + \mu_j + \epsilon_{ijt} \quad (20)$$

in which the coefficient of interest is the difference-in-difference estimator δ which estimates the effect

of the reform on the selling price.

ϕ_t are time fixed effects meant to capture macroeconomics factors that are invariant across the treatment and control groups. μ_j are housing block fixed effects which capture time-invariant differences in prices among housing blocks. We made a spatial partition of Greater Lyon into 4km square meter blocks. Robustness checks are provided for various block sizes.

\mathbf{X}_{it} is a vector of hedonic characteristics of the housing unit. The number of rooms is computed as a categorical variable to capture non linearity such as the floor level and energy labeling (see [section 6](#)). The other control variables are dummy variables which capture presence of a dedicated parking space and presence of more than one bathroom. The only continuous control variable is average space per room.

\mathbf{G}_{it} is a vector of locational characteristics and is interacted with the transaction date. Locational characteristics are the distance between the housing unit and Lyon city center interacted with the orientation of the housing unit with respect to Lyon city center (North, South, East or West). The location specific time trends $\mathbf{G}_{it} \cdot t$ are intended to control for changes in the spatial structure of the city such as gentrification dynamics which might induce a difference in price variation between the treated and control groups. $\mathbf{G}_{it} \cdot t$ controls for spatial selection into the treatment.

Specification (20) allows us to estimate the average effect of the treatment over the two post-treatment years i.e. October 2014 to December 2016. To examine the variation in this effect over the post-period more precisely, we estimate the following more flexible specification:

$$Y_{ijt} = T_i + \sum_{\substack{a=-2 \\ a \neq 0}}^9 \delta^a DD_{it+a} + \eta \mathbf{X}_{it} + \zeta \mathbf{G}_{it} \cdot t + \phi_t + \mu_j + \epsilon_{ijt}, \quad (21)$$

The set of dummy variables DD_{it+a} denotes a transaction in a treated zone in quarter $t + a$. For example, DD_{it+2} equals 1 if the transaction is in a treated zone two quarters after the reform and 0 otherwise. The coefficients δ^a flexibly capture the evolution of the treatment group relative to the control group before and after the treatment. Considering quarter spanning from October to December 2014 as the period of reference, there are 2 pre-reform quarters and 9 post-reform quarters. For specification (20), we used quarters instead of months, as the unit for time effects, to keep a sufficient number of observations in each period so as not to reduce the power of each δ^a estimate too much.

6. Data and summary statistics

Our data cover 30,346 real estate transactions which took place in the Greater Lyon area between January 2014 and December 2016. The PERVAL database is constructed by notaries responsible for recording every housing sale along with detailed other information about each sale. Most of the sales made in Greater Lyon during this period are included in these data. However, the data cannot be considered fully exhaustive since it is an initiative of the national notary association and is not a

legal notarial obligation: among the approximately 12,000 sales recorded annually, the Greater Lyon administration estimates that at least 80% are included in these data.

Table 1. Contingency table of the number of dwellings in Greater Lyon area, 2014-2016

	New housings	Old housings	Total
Treated	568	3,181	3,749
Not treated	5,161	21,436	26,597
Total	5,729	24,617	30,346

The information describing the dwellings includes features such as number of rooms and living area.²⁹ It also includes information on floor level, date of construction, energy rating and specific services such as a designated parking space along with date and place of sale. The precise day of each sale and the location based on spatial coordinates are recorded for each sale. Also, the Greater Lyon administration provides information on whether the sale involved new or old housing.³⁰

The sample consists of 5,729 new housing transactions, and 24,617 old housing transactions as reported in Table 1. As expected, the latter are more numerous reflecting the fact that the majority of the total housing stock consists of old/existing housing. Observations are subdivided into 156 housing blocks of $4km^2$, resulting in an average of 194 transactions per housing block.

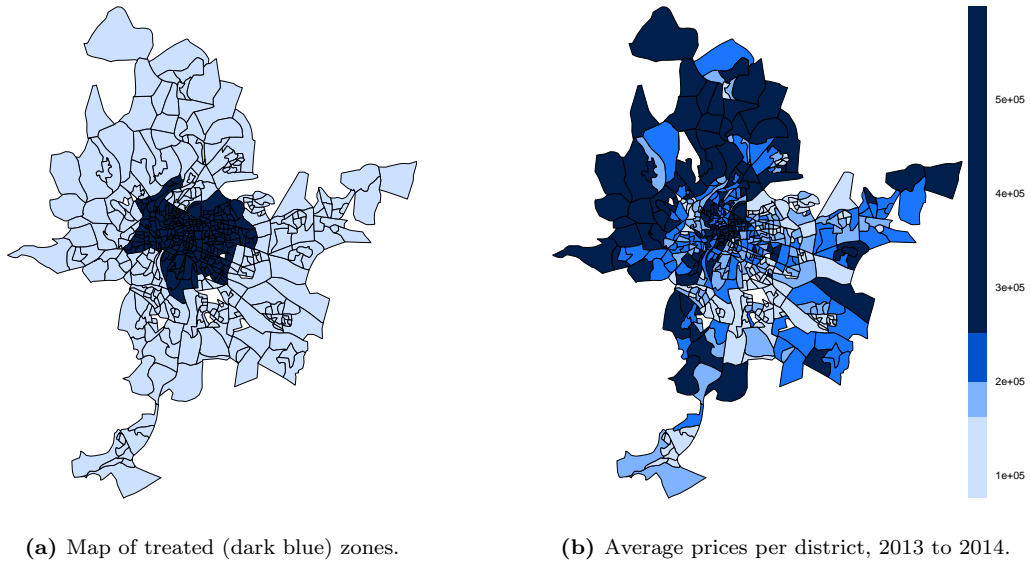


Figure 4. Maps of prices and treated areas in Greater Lyon.

²⁹See Table 2 for the list of housing characteristics used in our study.

³⁰A housing is considered as new if it is sold less than five years after its construction and if its sale is not exempted from VAT. This latter constraint excludes second-hand sales, since only housing sales between individuals are exempted from VAT. Thus, this definition of new housing is essentially the same as that of the Pinel reform (see subsection 4.1).

Figure 4a shows the geographical locations of the treated and control areas. It shows that the treated areas are concentrated in the center of Greater Lyon and the control areas are located in the periphery. However, Figure 4b suggests that treated zones are not correlated with higher priced areas which leads us to expect low selection bias. Moreover, the location specific time trends $\mathbf{G}_{it,t}$ in the regression equations (20) and (21) will control for spatial selection into treatment and different price dynamics depending on the location to the center.

Table 2. Descriptive statistics of housing sales

	(1)	(2)	(3)
	All housings	Old housings	New housings
Price in euro	213,294	217,969	193,208
Average surface of dwellings	72.842	75.920	59.617
Average number of rooms	3.250	3.364	2.762
Number of dwellings with more than one bathroom	11.7%	12.3%	9.3%
Number of dwellings with at least one parking place	63.9%	58.1%	88.9%
Share of dwellings of 2, 3 or 4 rooms	74.1%	71.5%	85.4%
Share of appartements	86.8%	84.8%	95.3%
Share of new dwellings	18.9%	00.0%	100.0%
Share of dwellings with EU grade higher than D*	13.3%	13.9%	10.6%
Share of sales that occurred in treated area	12.4%	12.9%	9.9%
Share of sales that occurred after the policy	75.2%	73.6%	81.7%
Share of sales that are treated by the policy	9.4%	9.7%	8.2%
Number of dwellings	30,346	24,617	5,729

NOTE— Descriptive statistics are for all sales included in the PERVAL database in Greater Lyon area during the period of 2014 to 2016. They cover the 59 municipalities in the Greater Lyon area.

Descriptive statistics are presented in Table 2; column 1 reports the mean value of each variable in the database for the entire subsample, and columns 2 and 3 provide the respective values of each variable for old and new dwellings. Column 1 shows that the average housing price is €213,294, and that the price of an old dwelling is slightly higher than the price of new housing. These figures are in line with the statistics on dwelling size: old housing tend to be bigger in size than new housing. They tend to have more and larger rooms compared to new housing. Overall, 74.1% of the housing sold in Greater Lyon area during the period 2014 to 2016 have 2, 3 or 4 rooms. Most were apartments, 84.8% of old housing and 95.3% of new housing; houses were a minority. Most housing has only one bathroom; and 63.9% have dedicated parking. On average, more new than old dwellings have at least one parking space. Dwellings with energy ratings higher than D are not common in the Greater Lyon area—they represent only 13.3% on average of all dwellings.³¹

³¹The EU energy labeling is a system that rates the energy performance of the dwelling: A is the best and G is the worst.

7. Results

Table 3 presents the results for specification (20) on the different type of housing transactions: new housing transactions in columns (1) and (2), old housing transactions in columns (3) and (4) and all transactions in columns (5) and (6). We only report the estimate of primary interest: the coefficient on treatment variable DD indicating the difference in the average variation in sale prices between the treatment and control group.

Table 3. Effect of the policy on housing prices

	<i>Dependent variable: log of housing prices</i>					
	New		Old		All	
	(1)	(2)	(3)	(4)	(5)	(6)
DD	0.040 (0.025)	0.150** (0.068)	-0.017* (0.010)	-0.015 (0.023)	-0.002 (0.014)	0.007 (0.021)
Hedonic controls	YES	YES	YES	YES	YES	YES
Year and month F.E.	YES	YES	YES	YES	YES	YES
Housing Block F.E.	YES	YES	YES	YES	YES	YES
Time varying-effects	NO	YES	NO	YES	NO	YES
Observations	5,729	5,729	24,617	24,617	30,346	30,346
R ²	0.788	0.844	0.778	0.798	0.756	0.790
Adjusted R ²	0.781	0.809	0.776	0.786	0.755	0.780

NOTE— * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. The statistical individuals are new individual sales. The dependent variable is the log of the housing price. Hedonic characteristics are: number of rooms, energy rating and floor level which are categorical variables, and presence of a dedicated parking space, presence of more than one bathroom and dwelling size. Time-varying controls are the interaction between the year and month effects and distance from the city center of Lyon and location of the transaction (East/West/South/North) with respect to the city center of Lyon. Standard errors are clustered at the housing block level.

The first result of note concerns the price of new housing which is eligible for subsidy. Our theoretical model shows that the new housing market should experience a price increase after the policy, as stated in Proposition 1. We tested this prediction empirically by estimating equation (20). The results are presented in Table 3 columns (1) and (2). We observe that accounting for different price dynamics between areas by interacting time with distance and location relative to the city center affects the results. This is as expected since the treated areas are concentrated mainly around the center of Lyon and consequently are likely to be affected by different price dynamics compared to untreated areas. When including all the controls we find a positive and significant effect of the reform on the price of new housing: the average effect of the reform after October 1, 2014 on new housing prices is 15%. This

result has the expected sign and confirms our theoretical predictions about the effect of the policy on the price of new housing. This inflationary effect is consistent also with studies such as [Baum-Snow and Marion \(2009\)](#) and [Chapelle et al. \(2018\)](#).

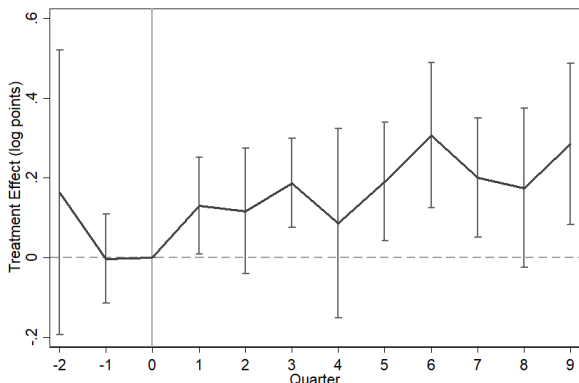


Figure 5. Effect on new housing prices. Error bars indicate confidence intervals at the 95% level. Figure shows the treatment effect defined in equation (21). Parametric equivalent is in [Table 3](#), column (2).

The 15% estimate is the average effect of the policy over two years but it is likely that the effect of the policy was heterogeneous over this period. To allow for heterogeneous effects over time, we study the effect of the policy on quarterly prices. This allows us to test the pre-trend assumption. We estimated equation (21) including the same control variables as in [Table 3](#) column (2). The results are graphically represented in [Figure 5](#). We found no evidence of trend differences between the two groups prior to the reform: the placebo treatment effects in the two quarters before the reform are not significant. The estimated coefficients of the post-treatment dummies show a progressive price increase over the two years. During the first year after the reform the increase in price is limited to about 10%. However, around 30 months after the reform, prices increased by almost 30% in the treated compared to the control areas.

We next examine the old housing market where our theoretical model predicts that the policy will decrease housing prices as per [Proposition 2](#). The results are reported in [Table 3](#) columns (3) and (4). Column (3) which does not include location specific time trends shows a slightly significant and negative effect of the policy on the price of old housing. However, when time-varying effects are included the average effect of the reform during 2015-2016 is negative and insignificant. As in the new housing case, we present the results of the more flexible specification (21) in [Figure 6](#). Pre-treatment variations again tend to support the common-trend assumption. We see that prices seem to decrease in the treatment group compared to the control group, from one year after the reform but that the decrease is only significant eight and nine quarters after the reform. The effect of the policy at the end of the observation period is a 7% decrease in the prices of old housing.

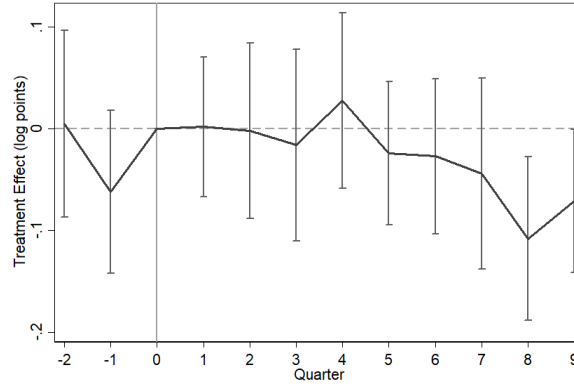


Figure 6. Effect on old housing prices. Error bars indicate confidence intervals at the 95% level. Figure shows the treatment effect defined in equation (21). Parametric equivalent is in Table 3, column (4).

These results suggest that the residential spillover identified in our theoretical analysis might be at work: as demand for new housing increases, demand for old housing decreases. The negative sign of the point estimates suggests that demand for old housing decreases in the treated areas compared to control areas after implementation of the policy. Further evidence of this spillover effect is provided below.

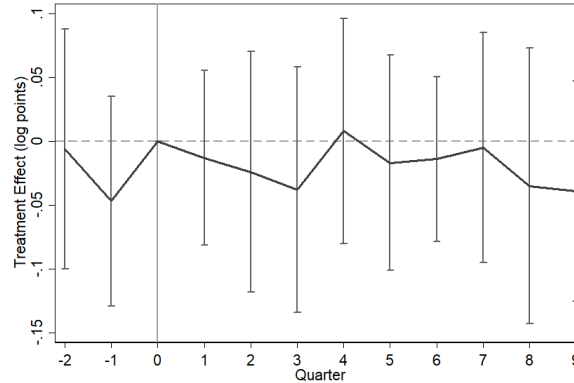


Figure 7. Effect on all housing prices. Error bars indicate confidence intervals at the 95% level. Figure shows the treatment effect defined in equation (21). Parametric equivalent is in Table 3, column (6).

Proposition 3 of our theoretical analysis states that due to its opposite effects on the prices of new and old housing, the reform should have an ambiguous effect on the overall market price. The housing market is constituted mainly of old housing related transactions. As a consequence, the overall effect should be driven mainly by the effect on this sub-market. Hence, we might observe a “win-win” situation in which intensification of the ownership incentives have been accompanied by a decrease in the average transaction price. However, the downward trend shown in Figure 7 leads to a decrease of about 4 percentage points two years after the reform, which is statistically insignificant. This suggests that the price increase in the new housing market has been offset by the price decrease in the

second-hand housing market.

We conducted two robustness checks. The first examines the sensitivity of the results to variations in the size of the housing blocks used to control for fixed effects. We consider two alternative sizes: a 1 square kilometer housing block, and an infra-communal administrative unit.³² The results are presented in [Table A.1](#) in [Appendix D](#). The results are similar to our main results. In particular, there is a significant increase in new housing prices whatever the size of the housing block fixed effects. The second robustness check varies the level of standard error clustering. We consider a 1 square kilometers housing block and a city level clustering. The 1 square kilometers housing block is a finer level that is more able to account for an eventual spatial structure of the error term but with potentially larger standard errors due to the reduced number of units in the block. Clustering standard errors at the city level is less flexible but should result in smaller standard errors. The results presented in [Table A.2](#) in [Appendix D](#) lead to the same conclusions as the main results. As expected, the result is less significant for the 1 square kilometer clustering level but the policy still significantly increases the price of new housing at the 10% level.

Table 4. Effect of the policy on the share of new housing transactions

	<i>Dependent variable:</i> <i>share of new housing transactions</i>	
	(1)	(2)
<i>DD</i>	0.024 (0.040)	0.060*** (0.011)
Hedonic controls	YES	YES
Year and month F.E.	YES	YES
Housing Block F.E.	YES	YES
Dummies for blocks with 0% and 100% new housing	YES	YES
Time varying-effects	NO	YES
Observations	3,574	3,574
R ²	0.719	0.800
Adjusted R ²	0.703	0.710

NOTE— *p<0.1; **p<0.05; ***p<0.01. The statistical individuals are housing blocks. The dependent variable is the share of new housing transactions. Hedonic characteristics are: number of rooms, energy rating and floor level which are categorical variables, and presence of a dedicated parking space, presence of more than one bathroom, dwelling size and a dummy variable indicating housing blocks with 0% of new housing. Time-varying controls are the interaction between the year and month effects and the distance to Lyon city center and the location of the transaction (East/West/South/North) with respect to center of Lyon. Standard errors are clustered at the housing block level.

³²The infra-communal administrative unit is called IRIS.

[Propositions 1](#) and [2](#) explain the increase in the price of new housing and the decrease in the price of old housing by a shift in demand between the two markets. We test this spillover effect by examining the effect of the reform on the share of new housing transactions. We collapse our data to year-month-housing block units and compute the share of new housing transactions in the total number of transactions. We replicate our estimates of [Table 3](#) using the share of new-housing transactions as the dependent variables. The results are reported in [Table 4](#). The regressions now include dummy variables indicating respectively housing blocks with 0% and 100% of new housing. These extreme cases correspond to corners solutions in which the volume of transactions is expected to be less responsive to policy changes. For instance, construction of new housing is unlikely in the center of the city of Lyon which comprises old traditional buildings.

The results presented in [Table 4](#) show that the reform increased the share of new housing transactions by 6 percentage points. [Table 1](#) reports that the pre-reform share of new housing transactions was 23% so that the reform increased this share by roughly 25%. This tends to confirm a demand spillover between the two markets: in the treated areas the number of transactions related to new-housing units compared to the number of transactions related to old housing units increased over time.

8. Conclusion

This paper investigated the traditional trade-off faced by governments between providing better access to housing ownership and keeping housing affordable. Based on an original theoretical model in which homeowners, landlords and renters interact, we show that this trade-off is limited to new housing targeted by ownership incentive policies. Considering the entire housing market reveals that residential spillovers from the old housing market to the new housing market reduce the price of old housing. In theory, this reduction could outweigh the increase in the price of new housing and eventually could lead to a decrease in the average market price of housing.

These theoretical findings are empirically assessed using a 2014 French reform which increased the ownership incentives for homeowners and landlords in the metropolitan area of Lyon. Our empirical findings indicate, as a result of residential spillovers, that the increase in the price of new housing induced by the reform was fully offset by the reduction in the price of old housing .

Our results offer a more positive picture of the effect of ownership incentive policies compared to previous studies: the decrease in the price of old housing increases the affordability of used housing which is the most numerous. In addition, the inflationary effect identified for the new housing market in the short run may be less important in the medium and long runs where the elasticity of supply is greater.

The results of the paper could be interpreted as encouragement to further development and calibration of ownership incentive policies. Depending on the composition of the overall housing market these policies might reduce, leave unchanged or improve housing affordability. Our findings call for more research to investigate the special case of metropolitan areas where the market for old houses

is well-developed due to historical and political preferences for instance. Further research could shed light on empirical examples of "win-win" games where policy manages to both encourage access to property and increase the affordability of housing.

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Appendix

A. Supply of old housing

The exogenous stock of old housing in the economy is composed of a continuum of H_0 dwellings indexed by $\eta \in [0, H_0]$. Each dwelling η requires its prime owner to incur an idiosyncratic fixed cost $f(\eta)$ to sell it. This idiosyncratic cost is not observed for a specific housing so that we represent it by the random variable f which is assumed to be uniformly distributed between 0 and H_0 , $f \sim \mathcal{U}([0, H_0])$, so that the fraction of old housing among the total stock H_0 is:

$$Pr(f < P_o) = \int_0^{P_o} \frac{1}{H_0} dz = \frac{P_o}{H_0}$$

where P_o is the price of an old housing. It follows that the supply of old housing is:

$$H_o(P_o) = \frac{P_o}{H_0} H_0 = P_o \tag{A.1}$$

which proves the expression of the supply function (3).

B. Tenure choice

To model the discrete choice of tenure, we rely on the attachment-to-home modeling in [Mansoorian and Myers \(1993\)](#). The N households in the economy differ only with respect to their attachment to one or other tenure type. Assume that among the $N - N_{rn}(\mathcal{R})$ households who do not rent new housing, there is one household of each type, denoted x , and that x varies between 0 and $N - N_{rn}(\mathcal{R})$. We assume also that the preferences of household x are given by:

$$V(x) = \begin{cases} U_{hn} + (N - N_{rn}(\mathcal{R}) - x) & \text{if } x \text{ is homeowner of a new dwelling,} \\ U_{ro} + x & \text{if } x \text{ is renter of an old dwelling,} \end{cases} \tag{A.2}$$

where x measures the idiosyncratic benefit that the individual derives from being homeowner of a new dwelling and $N - N_{rn}(\mathcal{R}) - x$ is the benefit derived from being a renter of an old dwelling. Households with relatively high x prefer new housing.

Households are free to choose their tenure, and choose the type that provides them with the highest utility. Hence, the tenure choice equilibrium is characterized by the marginal household identified by $x = N_{hn}$, being indifferent between tenure:

$$\begin{aligned} U_{hn} + (N - N_{rn} - N_{hn}) &= U_{ro} + N_{hn}, & \tag{A.3} \\ U_{hn} + (N - N_{rn} - x) &> U_{ro} + x, & \text{if } x < N_{hn}, \\ U_{hn} + (N - N_{rn} - x) &< U_{ro} + x, & \text{if } x > N_{hn}, \end{aligned}$$

where N_{hn} is also the number of homeowners of new housing. Households with x less than N_{hn} are homeowners of new housing and those with x greater than N_{hn} are renters of old housing. Solving (1)

and (A.3) for N_{hn} and N_{ro} , we obtain:

$$N_{hn} = \frac{N - N_{rn}(\mathcal{R})}{2} + \frac{U_{hn} - U_{ro}}{2}, \quad (\text{A.4})$$

$$N_{ro} = \frac{N - N_{rn}(\mathcal{R})}{2} + \frac{U_{ro} - U_{hn}}{2}, \quad (\text{A.5})$$

and replacing the utilities using (8), we obtain:

$$N_{hn} = \frac{N - N_{rn}(\mathcal{R})}{2} + \frac{\alpha}{2} + \frac{R_o - (P_n - \mathcal{S})}{2}, \quad (\text{A.6})$$

$$N_{ro} = \frac{N - N_{rn}(\mathcal{R})}{2} - \frac{\alpha}{2} + \frac{(P_n - \mathcal{S}) - R_o}{2}, \quad (\text{A.7})$$

where $\alpha \equiv \alpha_n - \alpha_o$ represents the household's relative preference for living in new rather than old housing. This proves expressions (9).

C. Equilibrium

This appendix derives the equilibrium reduced form of the key endogenous variables: P_n , P_o , \bar{P} , N_{rn} , N_{hn} and N_{ro} . It also derives the sign of the derivatives of these variables with respect to the policy instruments \mathcal{S} and \mathcal{R} .

C.1. Prices P_n and P_o

For convenience, let us restate the two main equilibrium conditions (e.2) and (e.3):

$$N_{hn} + I_n = H_n(P_n), \quad (\text{A.8})$$

$$N_{ro} = H_o(P_o). \quad (\text{A.9})$$

Plugging (2), (3), (7), (9) (12) into (A.8) and (A.9), we obtain:

$$\frac{N - m(\mathcal{R} - P_n)}{2} + \frac{\alpha}{2} + \frac{\frac{m+1}{m}P_o - (P_n - \mathcal{S})}{2} + m(\mathcal{R} - P_n) = \frac{P_n}{c}, \quad (\text{A.10})$$

$$\frac{N - m(\mathcal{R} - P_n)}{2} - \frac{\alpha}{2} + \frac{(P_n - \mathcal{S}) - \frac{m+1}{m}P_o}{2} + m(\mathcal{R} - P_n) = \frac{P_n}{c}, \quad (\text{A.11})$$

Solving (A.10) and (A.11) for P_n and P_o , and collecting terms, we obtain:

$$P_n = \frac{c(m(\alpha + m\mathcal{R} + 2N + \mathcal{S}) + N)}{D}, \quad P_o = \frac{N(D - 2m - 1) - m(\alpha + m\mathcal{R} + \mathcal{S})}{D}, \quad (\text{A.12})$$

where $D \equiv m[c(m+1) + 3] + 1 > 0$. It directly follows from (A.12) that:

$$\frac{\partial P_n}{\partial \mathcal{S}} > 0, \quad \frac{\partial P_n}{\partial \mathcal{R}} > 0, \quad \frac{\partial P_o}{\partial \mathcal{S}} < 0, \quad \frac{\partial P_o}{\partial \mathcal{R}} < 0. \quad (\text{A.13})$$

C.2. Residential populations N_{ro} , N_{rn} and N_{hn}

Let us start with N_{ro} . We know from (3), (10) and (11) that:

$$N_{ro} = I_o = H_o(P_o) = P_o.$$

Then, using (A.12), we obtain:

$$N_{ro} = \frac{N(D - 2m - 1) - m(\alpha + m\mathcal{R} + \mathcal{S})}{D} \quad (\text{A.14})$$

It directly follow from (A.14) that:

$$\frac{\partial N_{ro}}{\partial \mathcal{S}} < 0, \quad \frac{\partial N_{ro}}{\partial \mathcal{R}} < 0. \quad (\text{A.15})$$

Let us turn to N_{rn} . We know from (7) and (e.1) that:

$$N_{rn} = I_n = m(\mathcal{R} - P_n). \quad (\text{A.16})$$

Inserting (A.12) into (A.16), we obtain:

$$N_{rn} = m \left(\mathcal{R} - \frac{c(m(\alpha + m\mathcal{R} + 2N + \mathcal{S}) + N)}{D} \right). \quad (\text{A.17})$$

Differentiating (A.17) with respect to \mathcal{S} and \mathcal{R} , we obtain:

$$\frac{\partial N_{rn}}{\partial \mathcal{S}} < 0, \quad \frac{\partial N_{rn}}{\partial \mathcal{R}} = \frac{m((c+3)m+1)}{D} > 0. \quad (\text{A.18})$$

Let us turn to N_{hn} . We know from (e.2) that:

$$N_{hn} = H(P_n) - I_n = \frac{P_n}{c} - m(\mathcal{R} - P_n) = \frac{mc+1}{c}P_n - m\mathcal{R}. \quad (\text{A.19})$$

where the second equality uses (2) and (7). Inserting (A.12) into (A.19), we obtain:

$$N_{hn} = \frac{mc+1}{c} \frac{c(m(\alpha + m\mathcal{R} + 2N + \mathcal{S}) + N)}{D} - m\mathcal{R}. \quad (\text{A.20})$$

Differentiating (A.20) with respect to \mathcal{S} and \mathcal{R} , we obtain:

$$\frac{\partial N_{hn}}{\partial \mathcal{S}} > 0 \quad \frac{\partial N_{hn}}{\partial \mathcal{R}} = -\frac{m[(c+2)m+1]}{D} < 0. \quad (\text{A.21})$$

C.3. Average price \bar{P}

By definition of \bar{P} (13), we have:

$$\bar{P} = \frac{N_{hn} + N_{rn}}{N} P_n + \frac{N_{ro}}{N} P_o = \frac{H_n(P_n)}{N} P_n + \frac{H_o(P_o)}{N} P_o = \frac{P_n^2 + cP_o^2}{cN}.$$

where the second and third equalities used (2), (3), (e.1), (e.2), (11) and (10). Differentiating (C.3) with respect to \mathcal{S} and \mathcal{R} , we obtain:

$$\frac{\partial \bar{P}}{\partial \mathcal{S}} = \frac{1}{m} \frac{\partial \bar{P}}{\partial \mathcal{R}} = 2m \frac{(c+1)m(\alpha + m\mathcal{R} + \mathcal{S}) - N[c((m-1)m-1) + m]}{D^2 N}. \quad (\text{A.22})$$

which implies that:

$$\frac{\partial \bar{P}}{\partial \mathcal{S}} = 0 \iff \frac{\partial \bar{P}}{\partial \mathcal{R}} = 0 \iff \alpha = \hat{\alpha}, \quad (\text{A.23})$$

where $\hat{\alpha}$ is defined as:

$$\hat{\alpha} = \frac{N[c((m-1)m-1) + m]}{(c+1)m} - m\mathcal{R} - \mathcal{S} \quad (\text{A.24})$$

Condition (A.22) directly implies that:

$$\frac{\partial^2 \bar{P}}{\partial \alpha \partial \mathcal{S}} > 0, \quad (\text{A.25})$$

It follows from conditions (A.23) and (A.25) that:

$$\frac{\partial \bar{P}}{\partial \mathcal{S}} \underset{\leq}{\geq} 0 \iff \alpha \underset{\leq}{\geq} \hat{\alpha}, \quad (\text{A.26})$$

Condition (A.22) also directly implies that:

$$\frac{\partial^2 \bar{P}}{\partial \mathcal{R}^2} > 0, \quad \frac{\partial^2 \bar{P}}{\partial \mathcal{S}^2} > 0, \quad \frac{\partial^2 \bar{P}}{\partial \mathcal{S} \partial \mathcal{R}} > 0. \quad (\text{A.27})$$

which concludes this appendix.

D. Robustness checks

Table A.1. Robustness 1: Alternative housing block fixed effects

<i>Dependent variable: log of housing prices</i>						
	New		Old		All	
	Fixed-effects level					
	1km ²	Infra-com.	1km ²	Infra-com.	1km ²	Infra-com.
DD	0.205*** (0.056)	0.120*** (0.045)	-0.015 (0.021)	-0.011 (0.024)	-0.011 (0.023)	-0.008 (0.028)
Hedonic controls	YES	YES	YES	YES	YES	YES
Year and month F.E.	YES	YES	YES	YES	YES	YES
Housing Block F.E.	YES	YES	YES	YES	YES	YES
Time varying-effects	YES	YES	YES	YES	YES	YES
Observations	5,729	5,729	24,617	24,617	30,346	30,346
R ²	0.865	0.866	0.813	0.816	0.791	0.798
Adjusted R ²	0.828	0.828	0.800	0.802	0.780	0.786

NOTE— *p<0.1; **p<0.05; ***p<0.01. The statistical individuals are new individual sales. Dependent variable is log of housing prices. Hedonic characteristics are: number of rooms, energy label and floor as categorical variables, presence of a dedicated parking space, presence of more than one bathroom and dwelling size. Time-varying controls are interaction effects of year and month effects with distance to the inner city of Lyon and the localisation of the transaction (East/West/South/North) with respect to the inner city of Lyon. Standard errors are clustered at the housing-block level.

Table A.2. Robustness 2: Alternative clustering levels

	<i>Dependent variable: log of housing prices</i>					
	New		Old		All	
	Clustering level					
	$1km^2$	City	$1km^2$	City	$1km^2$	City
DD	0.150*	0.150***	-0.015	-0.015	-0.004	-0.004
	(0.081)	(0.041)	(0.017)	(0.024)	(0.023)	(0.017)
Hedonic controls	YES	YES	YES	YES	YES	YES
Year and month F.E.	YES	YES	YES	YES	YES	YES
Housing Block F.E.	YES	YES	YES	YES	YES	YES
Time varying-effects	YES	YES	YES	YES	YES	YES
Observations	5,729	5,729	24,617	24,617	30,346	30,346
R ²	0.844	0.844	0.798	0.798	0.777	0.777
Adjusted R ²	0.809	0.809	0.786	0.786	0.767	0.767

NOTE— *p<0.1; **p<0.05; ***p<0.01. The statistical individuals are new individual sales. Dependent variable is log of housing prices. Hedonic characteristics are: number of rooms, energy label and floor as categorical variables, presence of a dedicated parking space, presence of more than one bathroom and dwelling size. Time-varying controls are interaction effects of year and month effects with distance to the inner city of Lyon and the localisation of the transaction (East/West/South/North) with respect to the inner city of Lyon.