Property Rights and Neighborhood Externalities: Evidence from Short-Term Rental Regulation

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Abstract

Short-term rentals, where transient occupants such as tourists stay at residences, have become ubiquitous over the past several years. Many communities are divided over the tradeoffs between a property owner's rights and nuisance problems created by transient populations in residential neighborhoods. This paper empirically examines the effect of regulation restricting short-term rentals on property values (sales prices and appraisals) using a unique dataset and policy experiment from Anna Maria Island, Florida. We show that the rental-restricting regulation increased (decreased) property values in areas where the density of nonresident-owned homes is high (low). Across neighborhoods, sales prices were mostly negatively affected by the rental-restricting regulation, while the effect on appraisal values is distributed around zero.

Keywords: Property rights, zoning laws, housing market, sharing economy

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1 Introduction

With the advent of online platforms such as Airbnb and HomeAway, vacation rentals—renting privately-owned, furnished homes, apartments, or rooms on a short-term basis—have taken center stage in many municipalities around the world.[1] The hotel industry in particular has lobbied extensively against short-term rentals in large cities, often proposing severe restrictions, and presently a fast-growing number of regulations is being considered across numerous municipalities. The underlying issue centers around identifying the proper balance between a property owner's rights and neighborhood externalities from short-term rentals.

That is, while short-term rentals have become a lucrative alternative to traditional leasing between landlords and tenants, the influx of transient populations can cause a host of nuisance problems for neighboring residents. Often, municipalities are forced to handle this issue through zoning ordinances that set the terms and conditions for rental use. While some communities have attempted to regulate or outright ban short-term rentals, the effect of such regulation on property values has received surprisingly little attention in the policy debate.

The purpose of this paper is to provide such evidence in a price-theoretic framework, where it is assumed that there is no arbitrage between residential value and rental income. We do so by drawing on a unique policy experiment that took place in Anna Maria Island, Florida—a barrier island that is home to three cities comprising relatively homogeneous localities, and where hotel chains and condo high rises are absent. As we detail below, in the late 2000s, the Island began to experience issues related to short-term rentals, and the regulatory issue took center stage in sharply divided town-hall meetings.

The City of Holmes Beach, one of the three cities on the Island, updated its land development code in 2007 (Ordinance No. 07-04) which included a revision of district codes that require a minimum stay of 30 consecutive days for rentals in low-density residential areas and a minimum stay of seven days for rentals in other (higher-density) residential areas. Since the purpose of zoning laws is to increase the value of property rights (Fischel 2000), the effects of rental regulation may be usefully summarized by the changes in property values post regulation. While the margin affected by rental regulation is relatively small in comparison to property values, it

[1] According to Evercore ISI (2015), the market for vacation rentals and alternative lodging is estimated at around $100 billion annually, with about two thirds of vacation rentals being directly managed by property owners ("For Rent By Owner"); and the remaining one third being managed by property management companies.

can play an important role in determining the efficiency of an owner's property utilization.

To evaluate the effect of rental regulation on property values, we first lay out a price-theoretic framework that postulates the positive and negative externalities associated with short-term rentals and the determination of equilibrium property values. Our model highlights that following the regulation, (i) property values are more likely to decrease in low-density residential areas than in high-density areas; and (ii) property values are more likely to increase in neighborhoods where the fraction of nonresident-owned (i.e., potential rental) properties is high. We then use tax records (containing market-value estimates) and public records (arm's-length transactions) between 1998 and 2015 for all single-family housing to test our predictions using a difference-in-difference approach.

Our theoretical framework suggests that the mean effect of the regulation can be ambiguous because the density of zones and the degree of externalities imply potentially nonlinear, heterogeneous effects. Indeed, we find evidence that the rental regulation decreased property values in low-density areas — wherein the low density of housing may help mitigate rental problems. Moreover, using a measurement of owner occupancy (a taxable benefit for which only owner-occupants are eligible, known as a homestead exemption), we also find that the regulation increased (decreased) property values in neighborhoods where the share of nonresident homes is high (low). The overall distribution of estimated effects suggests that property values are mostly negatively affected in terms of sales prices, while the effect on appraisal values is symmetrically distributed around zero.

This paper contributes to the literature on the relationship between property values and land-use controls. In particular, the literature that takes into account neighborhood externalities, where the objective of municipal zoning ordinances primarily lies in the protection of property values. For instance, Stull (1975) shows that the median value of owner-occupied single-family homes is significantly affected by the proportion of neighboring land that is occupied by single-family homes. Lafferty and Frech III (1978) separate the definition of a neighborhood into multiple dimensions and find that increases in nonsingle-family land uses in a town can also raise residential property values if suitably concentrated. We thus follow this tradition by focusing on the margin effect created by short-term rentals.

The paper that is closest to ours in this literautre is Wang, Grissom, Webb, and Spellman

(1991), who find that sales prices are negatively associated with the number (or percentage) of rental properties among the adjacent five (or eight) properties. The difference is that we study short-term vacation rentals rather than the traditional (long-term) leasing for residential purpose. Accordingly, the underlying mechanisms of existing works are different — their hypotheses are based on the theories that owner-occupied units are better maintained than rental units and renters' socioeconomic statuses might decrease the overall neighborhood living environment. In contrast, our study is motivated by an owner's additional property rights vis-à-vis the nuisance problems caused by vacation rentals in a neighborhood.

This paper also contributes to the broader literature on property rights especially as they pertain to housing markets. As in the famous example of conflicts between wheat farmers and cattle ranchers in Coase (1960), homeowners in a neighborhood would be able to efficiently negotiate and settle nuisance problems (i.e., disputes over land use) in a world with no transaction costs. That is, if renters and resident neighbors can bargain costlessly, then a regulation may weaken property rights; however, if it is practically difficult to control bad actors (e.g., monitoring neighbors who are renting their properties for a short term to excessively large groups, causing nuisance problems such as noise and lack of parking), then voluntarily restricting land use through zoning laws can increase property values. Hence, the question is an empirical one.

Finally, there is a large literature on urbanization and land-use controls. Most of this literature focuses on the supply side of housing and the effect of land use on rising housing prices in large cities (Glaeser, Gyourko, and Saks 2005, Cunningham 2007, Akee 2009, Glaeser and Ward 2009, Turner, Haughwout, and van der Klaauw 2014). While this is an important issue, in the Island we study, stringent land-development regulation has been in place at least since 1989 to maintain the quaint community, and nearly all parcels had been developed before our sample period begins. Hence, our estimates on the effect of rental regulation would come mostly through changes in the additional property rights rather than windfall gains (income effect) or the extensive margin of parcel development per se.

The rest of the paper is organized as follows. Section 2 describes the zoning regulations that took place in Holmes Beach. Section 3 presents our theoretical framework. Section 4 describes our dataset. Section 5 empirically shows the changes in property values before and after the 2007 ordinance. Concluding remarks are in Section 6.

2 Regulatory Background

For our empirical exercise, we exploit a policy experiment in Anna Maria Island, a seven-mile Island near Tampa Bay with about 8,000 permanent residents, that is home to three cities: the City of Bradenton Beach, the City of Holmes Beach, and the City of Anna Maria.[2] The Island is known as a quaint vacation destination that provides mostly local offerings, with no high-rise condominiums or name-brand hotels, which led many nonresident (absentee) owners to buy second homes on the Island. Thus, temporary visitors who wish to stay overnight either have to book a room in one of the few low-rise motels, or, as has been primarily the case over the past decade, reserve a stay at a vacation-rental property.

Over time, conflicting interests gave rise to increasing tensions between residents and absentee owners. While county tourism offices initiated marketing activities to attract more tourists, resident complaints intensified about tourists driving residents away, arguing that the Island offered a higher quality of life when it had a strong residential base. Residents, on the one side, and property managers and absentee owners on the other, pressured City Commissioners to respectively regulate and protect owners' rental-use rights. During this struggle, the City of Holmes Beach amended its land development codes in 2007 (Ordinance No. 07-04) which included a major revision of land-use regulations.

According to the new codes, a minimum stay of one month is required for rentals in the low-density residential areas (Zones R1 and R1AA); and a minimum stay of seven days is required for rentals in higher-density residential areas (Zones R2, R3 and R4). The preceding regulation that was in place prior to 2007 was due to an ordinance passed in 1993 which intended to regulate "resort housing" located in the R4 zone as part of the City's comprehensive plan.[3] Thus, the 2007 ordinance was a major reform that imposed a length-of-stay regulation, which applied to all residential zones, codifying "prohibition against short-term occupancy" in each of the zoning district's codes.

In our interviews, the Holmes Beach City Planner commented that "short-term rentals were hardly noticeable before 2005" leading to a lack of regulation in the primary residential zones

[2]According to the Bradenton Area Convention and Visitor's Bureau (2011), the City of Anna Maria has 1,831 year-round residents, the City of Holmes Beach has 5,119, and the City of Bradenton Beach has about 1,577.

[3]The goal of the plan was to "Ensure that the residential/family character of the City of Holmes Beach is maintained and protected while recognizing the potential for economic benefit resulting from tourist trade."

prior to the 2007 ordinance; and the Holmes Beach City Clerk added that the ordinance was proposed due to resident complaints and passed with some moderation by City Commissioners.[4] As we show below, the data supports this view, as well as suggesting that the reason for the passage of the regulation in Holmes Beach had to do with its slightly less-than-majority share of nonresident owners. Importantly, the regulation does not seem to be motivated by any concerns over falling property values or sales prices.

After the City of Holmes Beach passed the ordinance, the other two cities (Anna Maria and Bradenton Beach) had also considered adopting similar zoning codes, but the struggle between the opposing parties, property owners and managers on one side and residents on the other, led to heated debates in town-hall meetings with continual postponements of a conclusive outcome. As we show below, such revisions seem to have been defeated or delayed in the other two cities because of their more-than-majority share of nonresident owners. Meanwhile, the attempts by the two townships to regulate short-term rentals were preempted by a unique state law that was passed at the end of a legislative session.

In 2011, in part due to lobbying by rental and real-estate business interests, the Florida Legislature passed a bill, with almost no time for city governments to respond, that prohibited local governments from regulating the duration or frequency of vacation-rental occupancies *unless* they already had such regulations in place. The passage of the bill was unexpected as well — Island officials we interviewed indicated 'shock' at the ability of local municipalities to govern short-term rentals being largely stripped away. As a result of this state law, the 2007 ordinance in Holmes Beach was grandfathered and remains valid, but Anna Maria and Bradenton Beach do not have any minimum-stay requirement.[5]

Given that city officials admit that it was a difficult situation — attempting to balance

[4]In a written correspondence, the City Clerk states, "It is my understanding the change was prompted based on the City Commission receiving complaints from the residents. The solution agreed upon at that time resulted in the Commission passing the Ordinance [...] The Commission approved allowing for weekly rentals except in R1 and R1AA — even though the Planning Commission recommended 30-day rentals for those areas. It is my understanding our Planner also agreed with the Planning Commission, and had presented the Planning Commission's recommendation to the City Commission."

[5]Florida municipalities attempted to repeal the state law, and in 2014 the Legislature softened the law by giving local governments limited control over rentals — but not the regulatory power to control the duration or frequency of guest stays. In response, the City of Anna Maria proposed a limited vacation-rental ordinance that sets limits on the *number* of guests staying at a property at any given time, allowing existing rentals to come into compliance by 2021. However, the ordinance took effect on April 1, 2016, which does not overlap with our sample period.

complaints from residents with property owners' rights — we believe that the resultant policy variation created by the 2007 Holmes Beach ordinance provides a useful identification for the effects of rental use rights on property values. The Island is a relatively homogeneous locality whereby many tourists walk on the same streets, and except for the differences caused by the ordinance, the towns share similar social and economic environments. While property owners and residents argue that rental regulations would affect their property values in exactly opposite directions, no empirical evidence has been suggested to this day.

3 Theoretical Framework

We lay out a theoretical framework that highlights heterogeneous effects of rental regulation and neighborhood externalities on property values. Assume that there are two types of property owners — a resident who dwells on the premises, and a nonresident who purchases a property for investment. To be clear, a nonresident may purchase a property exclusively for private use, for rental profit, or both. However, there has been a surge of short-term rentals over the past decade facilitated by online platforms. Thus, if a nonresident underutilizes his property (e.g., leaves it vacant for several months), then it must be that the utility from occasional private use is at least equal to the foregone income from renting out the property. Accordingly, we think of nonresident owners in our theoretical framework mostly as 'investors' who generate income from rentals.

We denote by H and B the present-discounted values of housing services for residents and rental income for investors, respectively. Notice that we depart from the literature on housing tenure choice (Henderson and Ioannides 1983), where the issue is whether to own or rent a house from the long-term resident's standpoint. Instead, we focus on a no-arbitrage condition in the housing asset market. That is, absent any transactions costs, property values are determined from the equality of the present values associated with housing services and rental income. While transaction costs are certainly important, as long as they can be periodized and incorporated into the respective present-value stream, they would not conflict with the no-arbitrage assumption, particularly over multiple years.

The value of housing services for a resident is naturally affected by the externalities associated

with a transient population, while rental income for investors is influenced mostly by the supply and demand of vacation rentals. To be precise, consider a property in a frictionless market, holding constant all observable factors. In the housing tenure choice problem, the (long-term) rental price must equal the shadow price of housing services. This is because, from a property owner's standpoint, long-term leasing is implicitly the only alternative to either selling the property to a potential buyer or residing in it. However, with the introduction of short-term rentals, the property owner's rental income no longer needs to be equal to the value of housing services or income from long-term leasing.

More specifically, our argument is that the present value of housing-services utility is nonlinear in the proportion of properties offered for rent in the neighborhood, because visitors can exert both positive and negative externalities through their transiency. Let us denote by m the share of homes in a property's neighborhood that can be potentially rented out on a short-term basis. As suggested by town-hall meetings on the Island, short-term visitors can stimulate the local economy and facilitate the availability of local public goods; however, they can also cause a variety of nuisance problems including noise, parking, privacy, and security issues. Thus, under rather natural conditions (such as diminishing marginal utility of public goods), the positive externalities would dominate in a low-m neighborhood, while the negative externalities dominate in a high-m neighborhood.

On the other hand, investors, as nonresidents, are unlikely to be substantially affected by these externalities (e.g., unlike residents, investors do not necessarily benefit from a sense of quiet in a neighborhood), except through changes in vacation-rental income. We assume that rental income is determined from the standard interaction between supply and demand for vacation rentals in a neighborhood. That is, holding constant the demand for rentals in any given time period, an increase in m would decrease rental income due to expanded supply. Another technical assumption we make is that for sufficiently low m, income from vacation rentals strictly dominates the shadow price of housing services, while for sufficiently high m, the reverse holds. Together, these guarantee the existence of a no-arbitrage equilibrium share of investors, denoted by m^*.

To summarize, residents' housing valuation curve, $H(m)$, is inverse-U shaped because too many (too little) tourists may require excessive (insufficient) provision of local public goods; and because visitors typically do not pay for these public goods and services and investors do not

benefit from them to the same extent as residents, vacation rentals can give rise to neighborhood externalities. This inverse-U shape, given $H'' \leq 0$, holds when $H'(0) > 0$ and $H'(m) < 0$ for some $m > 0$. In contrast, investors' property valuation curve, $B(m)$, reflects the demand and supply relationship in a market for short-term rentals. Given standard upward-sloping supply of rental homes and downward-sloping demand by renters, it is straightforward to observe that an increase in investor-owned homes would decrease investors' income in equilibrium.

The equilibrium property value p^* is jointly determined with an equilibrium density of investor-owned homes m^*, such that $H(m^*) = B(m^*)$. Based on our assumptions, $H'(m^*)$ can be either positive or negative, whereas $B'(m^*) < 0$ always holds (see Figure 1). The effects of rental regulation can then be examined by an across-the-board decrease in $B(m)$. That is, imposing the rental restrictions would have a direct impact on investors as they would lose the visitors who would have booked for a shorter term, and their rental schedules are now harder to fill without lull periods. On the other hand, residents are not directly affected by the regulation except through changes in m^* (hence in neighborhood externalities) in the new equilibrium as long as there is little to no income effect (i.e., if residents do not sell their homes to realize capital gains).

Formally, the shift in the $B(m)$ curve can be thought of as a tax liability imposed on investors. That is, given that rental use represents one property rights margin, it makes sense to consider a small increase in a per-investor flat tax t (e.g., this tax increase can represent the cost of complying with the rental regulation). With a slight abuse of notation, let us refer to the "inverse" H and B curves as $H(p)$ and $B(p)$. Then, given a tax t, the equilibrium property value, denoted by $p(t)$, is determined from

$$H(p(t)) = B(p(t) + t). \tag{1}$$

Differentiating (1) with respect to t, we obtain

$$\frac{dH}{dp}\frac{dp}{dt} = \frac{dB}{dp}\frac{d(p(t)+t)}{dt} = \frac{dB}{dp}\left(\frac{dp}{dt} + 1\right).$$

Rearranging indicates how the tax on investors changes the equilibrium housing value:

$$\frac{dp}{dt} = \frac{\frac{dB}{dp}}{\frac{dH}{dp} - \frac{dB}{dp}}.$$

The above can be expressed in terms of elasticities:

$$\frac{dp}{dt} = \frac{\frac{dB}{dp}\frac{p}{m}}{\frac{dH}{dp}\frac{p}{m} - \frac{dB}{dp}\frac{p}{m}} = \frac{\epsilon}{\eta - \epsilon}, \tag{2}$$

where ϵ and η denote the price elasticities of investors and residents, respectively, with respect to the size of the investor population m in a neighborhood. Given (2), it is straightforward to see that following a marginal increase in the tax on investors, the change in property value increases in ϵ and decreases in η, that is, $\frac{d(dp/dt)}{d\eta} < 0$ and $\frac{d(dp/dt)}{d\epsilon} > 0$.

There are then two cases given a marginal increase in t:

Proposition 1. *(i) If $\eta > 0$ is satisfied, then $\frac{dp}{dt} < 0$. (ii) If $\eta < 0$ is satisfied, then $\frac{dp}{dt} > 0$.*

Proof. Since the B curve is downward sloping, $\epsilon < 0$ holds throughout. In the first case, an upward-sloping H curve entails that $\eta > 0$ holds (and $\eta > 0$ implies an upward-sloping H curve), whereby $\eta - \epsilon > 0$. Therefore, $\frac{dp}{dt} = \frac{\epsilon}{\eta - \epsilon} < 0$. In the second case, a downward-sloping H curve entails that $\eta < 0$ holds (and $\eta < 0$ implies a downward-sloping H curve). Given $|\eta| > |\epsilon|$, which necessarily holds in order for $H(p)$ and $B(p)$ to intersect and an equilibrium to exist, whereby $\eta - \epsilon < 0$, it follows that $\frac{dp}{dt} = \frac{\epsilon}{\eta - \epsilon} > 0$. □

Intuitively, an equilibrium is obtained when, over the relevant range of investor shares, property values of investors are more negatively affected than those of residents by the entry of additional investors into a community. This condition can be motivated by a large competitive effect among investors, with rental rates significantly fluctuating based on the availability of rental supply. If, in the existing equilibrium, due to a large number of investors, residents' home values also decrease following entry by investors, then a marginal increase in the tax on investors should lead to higher home values in equilibrium. If, on the other hand, there are few investors in a community in the current equilibrium, and residents' home values would, in net, increase following investor entry, then a marginal increase in the tax on investors should lead to lower property values in equilibrium (see Figure 1).

Another direction to extend our theoretical framework is to consider the extent to which different residential zones are exposed to the externalities. More specifically, a low-density residential zone such as R1 has development standards that would result in less than 5.8 dwelling

units per acre on the Island, whereas other zones (R2, R3 and R4) require less than 10 dwelling units per acre. Given their relative proximities to neighboring units, residents living in low (high) density zones are less (more) likely to be affected by the nuisance problems caused by vacation rentals. This means that, holding other factors constant, the H curve is likely to be skewed to the left in low-density residential zones and to the right in high-density zones, so that the resultant prediction is that property values are on average more likely to decrease (increase) due to the rental-restricting regulation in low (high) density zones.

We summarize our predictions as follows:

Hypothesis 1: *Property values are more likely to decrease in low-density residential areas than in high-density areas.*

Hypothesis 2: *Property values are more likely to increase in neighborhoods where the fraction of investor-owned properties is high.*

4 Data Description

We merge data from a few sources. First, we began with collecting all parcel IDs on Anna Maria Island that are classified as Single-Family Residential by using Manatee County's Geographic Information Systems (GIS). The parcel IDs come with other time-invariant parcel characteristics such as the address, city, subdivision, lot size, residential zoning, flood zoning, and current owner's name. The latitude and longitude information is also available (in a six-digit demical format) on GIS; however, this data does not come with each property automatically, so we manually collected the coordinates at the center of the building unit located in each parcel ID using the GIS Interactive Map.

Second, we collected all public records and residential building characteristics associated with the 2,939 unique parcel IDs, from Manatee County's Property Database. The public records include all property transfer records dating back to 1931 (when most of the records do not have data on sellers' names). The public records include sales date, sales amount, buyer's and seller's names, and real-estate transfer Qualification Code. The building characteristics include year built, living area, number of bedrooms, and number of bathrooms. The building characteristics reflect the information associated with the most recent public record and thus they are time-

invariant in our datasets.

One potential concern here is that the static characteristics might have changed over time. While we do not have time-varying data on parcel and building characteristics, we ameliorate this issue by focusing on public records since 1998, dropping all pre-1998 records. That is, we exclude the earlier periods (1970s and 1980s) when the vast majority of land lots were developed and units were built. Remodels and flipping after purchase can still potentially affect the observable characteristics, but there seem to be a limited number of such cases.[6] Our interviews with local real estate agents reveal that most property owners are renting out homes rather than flipping for a quick profit.

There are initially a total of 15,357 public records associated with the parcel IDs in our data; however, many of them are not arm's length transactions. For instance, the majority of the records have a nominal sales amount of $1 or $10 and represent transfers between, e.g., family members or property owners and property management companies. We use the transfer Qualification Code to systematically keep only those records that qualify as arm's length transactions, dropping all disqualifying sales.[7] This led to the final sample of 3,032 sales in our cross-sectional dataset which contains 1,794 unique parcel IDs. This means that some properties have multiple qualifying sales since 1998.

Third, we collected property appraisal data from Manatee County's Tax Collector Database. The database contains all yearly tax bills associated with the parcel IDs since 1998. We collected market value, assessed value, and a list of tax exemptions associated with a property, as well as the owner's name and address. In short, market value is how much the property is estimated to be worth in the current market environment. The Manatee County Property Appraiser's Office stated to us: "Appraisals are conducted for all properties each year. They are conducted either by a person remotely, by an in-person inspection, or almost entirely by a computer algorithm.

[6]Since 2009, the Qualification Code system included a class for "transfer included property characteristics not present at time of transfer (examples: parcel split, parcel combination, new construction, deletion, disaster, improvements not substantially complete, sales price includes improvements not yet built)." There are only 13 records in this category since 2009, and they have no effect on our results. Before 2009, the system did not have this category.

[7]Florida's Department of Revenue maintains the property transfer Qualification Code system which is used by Property Appraisers. The system contains a code for transfers "qualified as arm's length as a result of examination of the deed or other instrument transferring ownership of real property" as well as a number of codes for transfers "disqualified as a result of examination of the deed" or "disqualified as a result of credible, verifiable, and documented evidence."

Recent sales play the biggest role in determining appraisals, but appraisers also look at home sales in the broader area, whether properties touch water, and whether they have a good view or other amenities."

Although a property's market value can be higher or lower than the would-be sales price, it is a reasonable guide for the property's listing price. Further, for a property for which there are no recent sales records, the market value provides a readily-available estimate of the property's value. Thus, we use the market value as another dependent variable of interest in our analysis. Notice that assessed values (which are used to determine property taxes) are often lower than their corresponding market values — note that we do *not* use assessed values in our analysis. Indeed, the wedge between market value and assessed value is created by tax exemptions (e.g., homestead exemptions and other personal exemptions such as seniors, widows/widowers, and service-related disabilities) that reduce the assessed value of the property and also put a cap on its annual increases.

It is important that such tax exemptions only apply to the owners who reside in properties that are their primary residences, and the formal processes for obtaining these exemptions are closely monitored, with significant monetary penalties for noncompliance.[8] Therefore, we identify owner-occupied (i.e., resident-owned) properties in our panel data with the presence of tax exemptions in the annual tax bill. We believe that this is a reliable indicator because, once the exemption has been granted, it will remain on the property without requiring re-application each year, while strong penalties — going back as far as ten years, plus 50% penalties and 15% interest — are imposed on those who do not instruct the Property Appraiser to remove exemptions for which they no longer qualify. Furthermore, if a resident chooses to rent out his property, then he forfeits the right to claim exemptions.[9]

The last step in constructing our dataset is to count the total number of properties located in a close 'neighborhood' of each property (while excluding the property at the center), as well

[8]Specifically, Florida's Department of Revenue states: "Your property appraiser may ask for any of the following items to prove your residency: Proof of previous residency outside Florida and date ended • Florida driver's license or identification card number • Evidence of giving up driver's license from another state • Florida vehicle license plate number • Florida voter registration number (if US citizen) • Declaration of domicile and residency date • Name of current employer • Address listed on last filed IRS return • Dependent children's school location(s) • Bank statement and checking account mailing address • Proof of payment of utilities at homestead address."

[9]Florida Statute (196.061) states: "The rental of all or substantially all of a dwelling previously claimed to be a homestead for tax purposes shall constitute the abandonment of such dwelling as a homestead, and the abandonment continues until the dwelling is physically occupied by the owner."

as the subset of properties that are marked as nonresident-owned properties. We characterize a neighborhood by drawing a circle of radius 0.1 or 0.05 miles around each property based on our geo-coordinate data. This calculation is repeated for each year, so these count measures are time-varying. We then take the ratio of these two count measures to derive what we call the neighborhood density of nonresident-(or 'investor')-owned homes for a given property. The resultant proxy for investor density is widely and symmetrically distributed in our panel data. The distributions across residential zones (e.g., R1 versus others) are also similar-looking (although we do not show them here).

Table 1 presents descriptive statistics of our datasets. We separately merge building and parcel characteristics into the cross-sectional sales data, and into the property appraisal panel from 1998 to 2015. The bottom four rows indicate that there are, on average, 37 homes within a 0.1-mile radius and 10.6 homes within a 0.05-mile radius, where there is a slight majority of resident-owned (i.e., tax-exemption applied) homes in each case. This implies that the short-term rental regulation is a highly contested issue in the local communities. In fact, local newspaper articles regularly described an incredible amount of conversion to vacation rentals — those can be observed by the signs posted at residences that advertise property-management companies.

We show the share of nonresident homes by year and city in Figure 2. Before 2007, Holmes Beach had a stable share of nonresident homes of just over 40 percent, while Bradenton Beach and Anna Maria often had above a 50 percent share of nonresident homes prior to 2007. Thus, as previously argued, it is possible that Holmes Beach Commissioners were able to gather support and acceptance of a rental regulation while still taking into account rental business interests (see footnote 4). With a continuing downward trajectory, Bradenton Beach and Anna Maria could have adopted similar rental restrictions; however, the townships were preempted by the 2011 Florida state law while nonresident shares went back up since 2007.[10]

In terms of the local housing market, there is no clear sign that suggests that the Holmes Beach regulation was endogenous to property values. Figures 3(a) and 3(b) show the mean sale prices (logged) and the mean market values (logged) by year and city, which are the dependent variables in our analysis. The pre-trends appear to be common across the cities either before or

[10]Our proxy for rental homes seems on par with the City's working definition of rental homes. For instance, in a 2015 newspaper article, the City of Anna Maria mayor stated "residents are outnumbered because 60 percent of the homes in the city are vacation rentals," a figure that is in line with the share of nonresident-owned homes shown in Figure 2.

after 2007, when the market was affected by the financial crisis. In the next section, we present our empirical results by both including and excluding a cubic time trend for each city to ensure that our results are not sensitive to this. That our results are robust suggests that the exogeneity assumption on the timing of the 2007 ordinance is reasonable.

5 Empirical Evidence

We use a difference-in-difference approach to test how the rental-restricting regulation (imposing a minimum length of stay) affects property values. We start by using a repeated cross section of arm's-length transactions records from 1998 to 2015. This cross section covers 1794 properties (including some with multiple transactions) out of 2939 total single-family residential properties on the Island. Thus, the results from using this cross-sectional dataset can tell us about the realized gain or loss of property value due to the regulation. We then examine the robustness of our findings by utilizing the panel dataset of market-value estimates for all single-family residential units, which tells us about the ex-ante gain or loss.

There are key underlying assumptions for the difference-in-difference approach: First, the timing of the ordinance (treatment) is exogenous to the outcome variable. This, as we argued above, seems plausible given the preexisting trends of sales prices and market values as well as the vexed passage of the ordinance. Second, the 2007 ordinance was the first time that the one-month and seven-day minimum requirements on short-term rentals were codified in the district zoning codes for the R1/R1AA and R2-R4 zones in Holmes Beach. Third, previously noncompliant rentals would find it increasingly difficult to "fly under the radar" as local code enforcement ensured compliance with the minimum-stay requirement.

Our baseline specification is as follows:

$$\begin{aligned}\ln(Sales\ Price_{ijlt}) = \ & \alpha + \beta HB\_Ord + \mathbf{X}'\delta + \sum_{j=1}^{2} \lambda_j City_j \\ & + \sum_{l=1}^{129} \gamma_l Subdiv_l + \sum_{t=1}^{71} \phi_t Year\_Quarter_t + \varepsilon_{ijlt}.\end{aligned} \tag{3}$$

The dependent variable is the log of sales price of house i in city j and subdivision l at time t. The treatment variable HB_Ord is an indicator for Holmes Beach properties on or after the second quarter of 2007, because the ordinance took effect at the end of March 2007. The

parameter β thus identifies the impact of the ordinance on Holmes Beach properties compared to those in the other two cities. $City_j$ is a city dummy variable; $Subdiv_l$ is a subdivision dummy variable; and $Year\_Quarter_t$ is a dummy variable for each year and quarter combination.

Controls in $\mathbf{X}$ include the eight time-invariant property characteristics shown in Table 1: an indicator for low-density zones, an indicator for nonresident homes, lot size, house age, living area, number of bedrooms and bathrooms, and an indicator for coastal zones. We also include city-specific cubic time trends in some specifications to account for preexisting housing market trends. We test our hypotheses by using interactions of the treatment with low-density zones ($Zone$ 1) and with investor density within a 0.1-mile ($Density$ 10) and a 0.05-mile radius ($Density$ 05). Equation (3) is estimated using ordinary least squares; and standard errors are clustered at the city level.

Column (1) of Table 2 shows the baseline specification without city-specific time trends (coefficients for controls are not shown here as they are not the focus of this paper), which suggests an average of 9.69% decrease in sales price due to the rental-restricting regulation. The specification in column (2) includes city-specific cubic time trends to account for housing-market trends in each city. This specification suggests that the effect of regulation on sales price is no longer statistically significant. Note that indeed our theoretical framework predicts an ambiguous sign for the average treatment effect due to the offsetting positive and negative externalities. Thus, our preferred specification is the one with time trends.

Columns (3) and (4) show our tests of the first hypothesis — that negative externalities associated with the nuisance problems would be smaller in an area where the number of dwelling units per acre of land is more limited, because the opportunity for interaction between residents and transient visitors is more limited, holding fixed other factors. This means that the rental regulation would benefit the properties located in high-density areas relatively more. The coefficients on the interaction term suggests that the properties located in low-density areas of Holmes Beach sold for about 15% lower prices than if Holmes Beach had not adopted the rental-restricting ordinance; and this finding is robust to city-specific trends.

However, all units within the same residential zone need not be affected by the rental problems equally. This is because rental properties are unlikely to be uniformly distributed within the zone. Thus, we test our second hypothesis — that the negative externalities associated with the

nuisance problems would increase in the neighborhood density of investor-owned homes. Table 3 shows the results of our regressions when using the two measures of investor densities. All four columns suggest that the sales price decreased less (or increased) due to the regulation in a neighborhood where investor density is high. The results are robust across specifications and seem to support our predictions.

The above results on sales price leads to the question of how property values are affected by the regulation for those who continue to own the properties. To address this question, we now turn to analyzing the annual panel data.[11] The data cover all 2939 single-family residential properties on the Island from 1998 to 2015 (provided they have a tax bill). We estimate the following fixed-effects regression equation:

$$\ln(Market\ Value_{it}) = \alpha + \beta HB\_Ord + Property_i + Year_t + \varepsilon_{it}, \tag{4}$$

where the dependent variable is the log of (estimated) market value of house i in year t. The treatment variable HB_Ord is an indicator for Holmes Beach properties in 2007 and thereafter, and we use the same interaction terms as above to test our two main hypotheses. The specification includes property and year fixed effects as well as city-specific cubic time trends; and standard errors are clustered at the property level.

Table 4 shows the results of similar regressions as in Table 2 (notice that all time-invariant building and parcel characteristics are subsumed in the property fixed effects). As can be seen, controlling for unobservable property characteristics lessens the treatment effect in columns (1) and (2) relative to those in Table 2. This means that the unobservable factors correlated with a relative fall in property values might have led property owners to sell. This seems plausible if property owners prefer to sell in such a situation rather than hold given that property values had already appreciated in earlier years. That said, the results from columns (3) and (4) of Table 4 support our first hypothesis in a similar manner as described above for the OLS results.

Table 5 turns to examining the effect of regulation depending on the fraction of nonresident-owned homes in a neighborhood. The results in this table reveal that there is a clear pattern of

[11] While most of the literature focuses on transaction data, pooled sample analysis rests heavily on the assumption that cross sections are randomly sampled. On the other hand, property appraisal values can be different from the would-be transaction prices, so using market value estimates could induce a nonclassical measurement error. (e.g., the County's Tax Collector might neutralize year-over-year tax base for budgeting purposes)

an inverted-U shaped relationship between property values and investor density, as postulated by the theory, and the coefficients are quite precisely estimated in all specifications. Taken together, our findings suggest that the rental-use rights dominate in low investor-density neighborhoods while restrictions of those rights dominate in high investor-density neighborhoods. Column (2) in Table 4 suggests statistically insignificant average effect on property values following the regulation, but our analysis reveals that the rental regulation can have significant heterogeneous effects across neighborhoods.

To be more precise, we calculate the estimated changes of sales price and market value for Holmes Beach properties, taking into account the interaction effect with investor density across neighborhoods, and show the distribution of gains and losses due to the regulation, relative to the actual values, in Figures 4(a) and 4(b), respectively.[12] It is worth noting that the effect of regulation is mostly negative (ranging from -15% to 5%) for sales price while it is symmetrically distributed around zero (ranging from -5% to 5%) for market value estimates. This implies that the restriction of additional property rights were mostly viewed negatively in the housing market, while the effects were more evenly distibuted from an ex ante standpoint (i.e. before deciding to sell the property). That is, the city government might have expected more neutral effect from the regulation without factoring into the margin of property value change due to the regulation.

6 Conclusion

With the market for vacation rentals still growing, more and more local governments are making policy decisions on short-term rental regulation. In this paper, we have theoretically and empirically investigated the effect of restricting short-term rental on property values. While our theoretical framework suggests that the mean effect of the regulation may be ambiguous given the distribution of investors across neighborhoods, our empirical evidence supports the prediction that the additional property rights associated with short-term rentals are valued relatively more highly than nuisance problems in less populous areas or in lower investor-density neighborhoods,

[12] In the cross section, we take the estimates in specification (4) of Table 3 and calculate the would-be sales price in the absence of the regulation as $lnPrice + .2038246 * HB\_Ord - .3117961 * HB * Density$ 10. In the panel, we take the estimates in specification (4) of Table 5 and calculate the would-be market value in the absence of the regulation as $lnMV + .0818701 * HB\_Ord - .1841768 * HB * Density$ 10.

while the opposite is the case in more populous areas or higher investor-density neighborhoods. Further, the overall distribution of estimated effects from the regulation suggests that the rental-restricting regulation may hurt property sales prices; conversely, the ability to rent properties short-term with fewer restrictions may enhance property sales prices.

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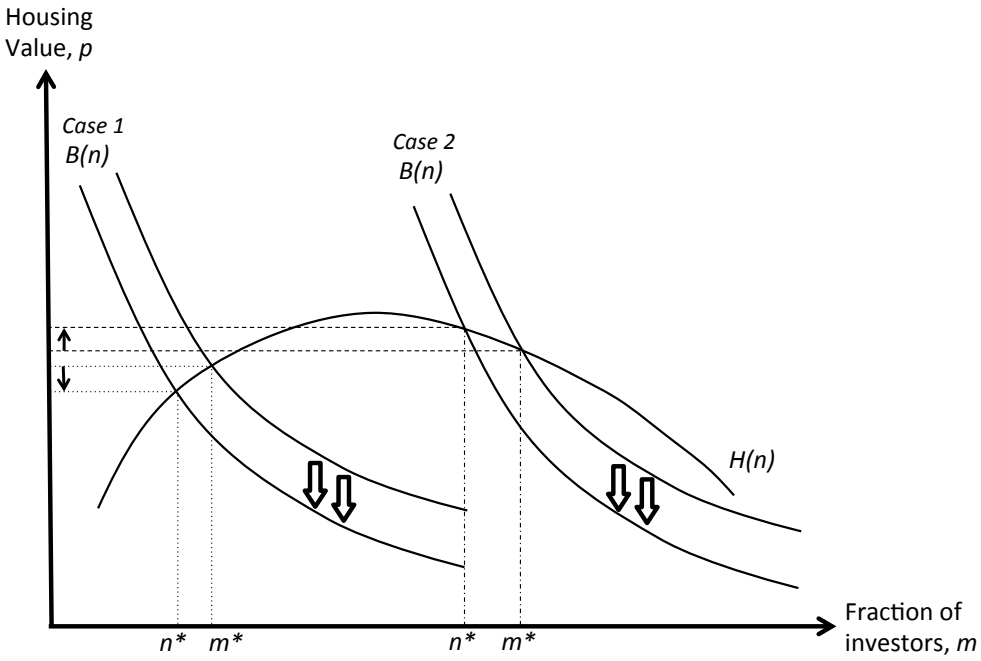


Figure 1: Effect of short-term rental regulation on property value

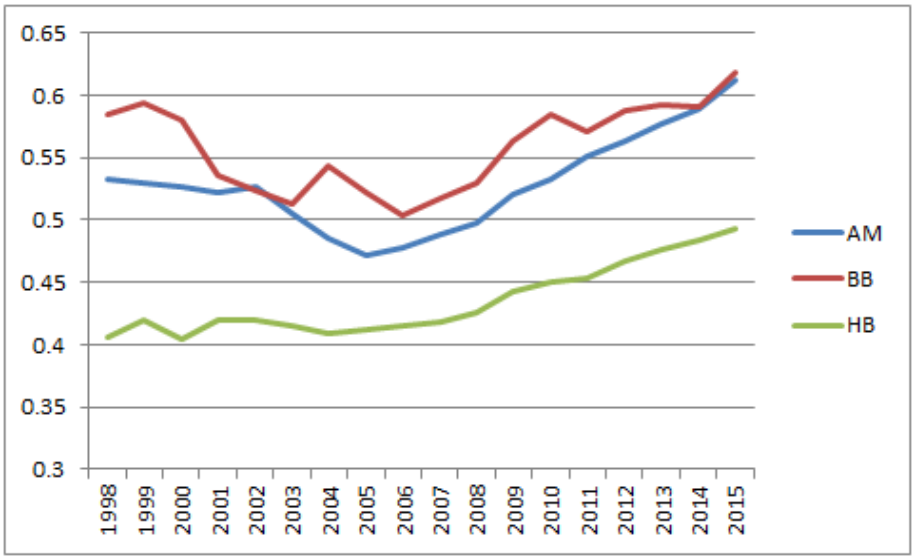
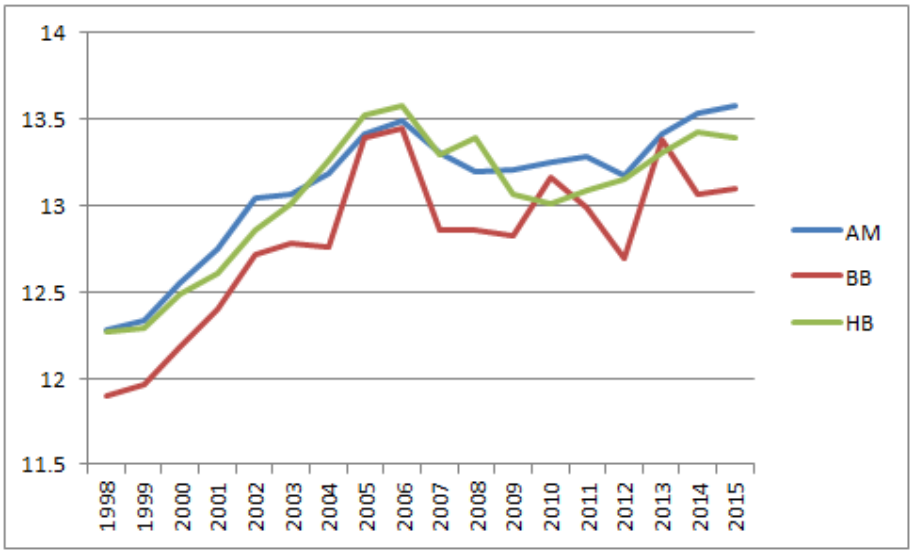
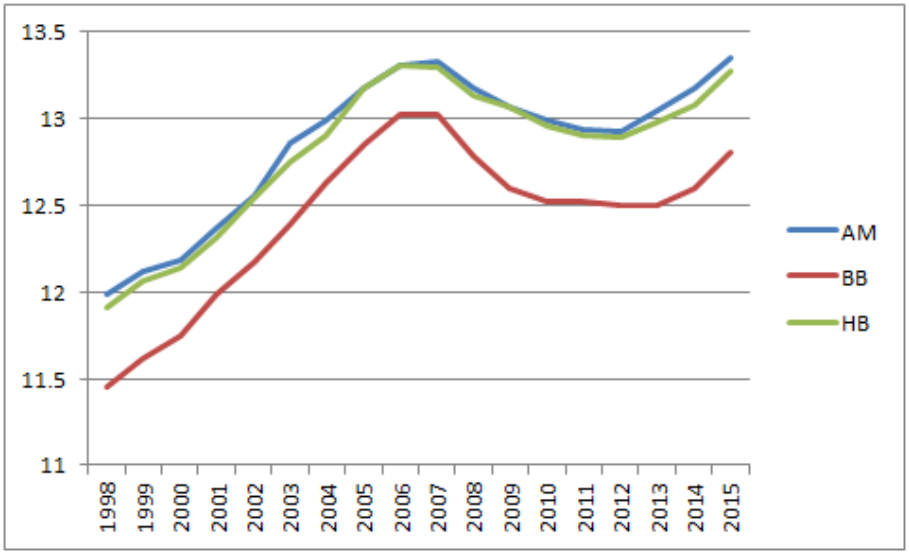


Figure 2: Shares of nonresident homes by year and city

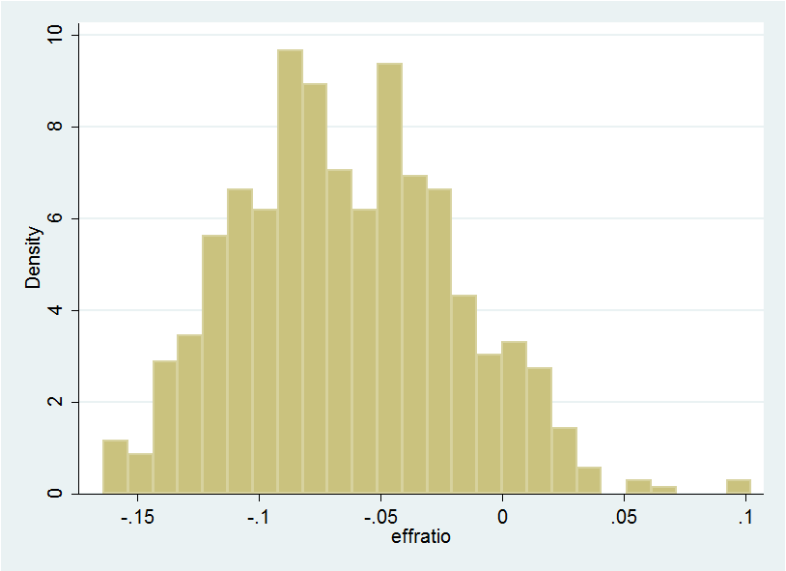


(a) Mean sales price (logged)

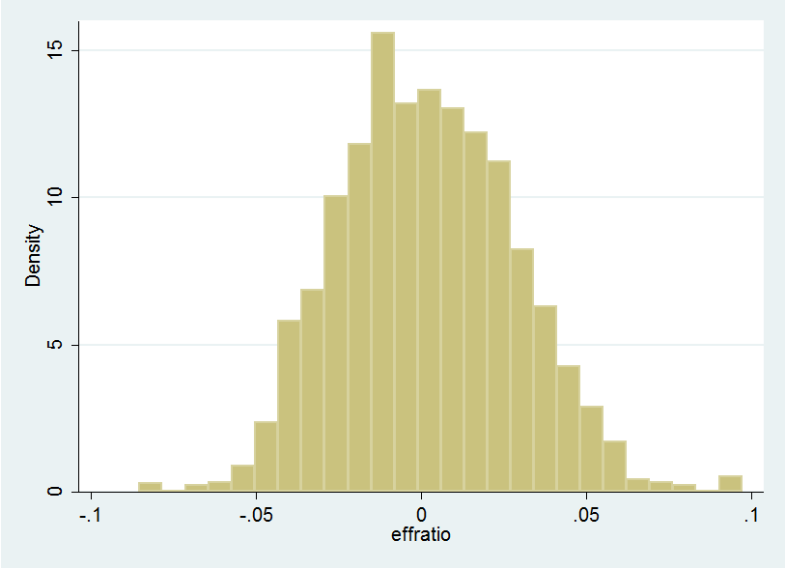


(b) Mean market value (logged)

Figure 3: Mean sales price/market value by year and city



(a) Sales price



(b) Market value

Figure 4: Distributions of estimated sales price/market value changes given investor density

Table 1: Summary Statistics

	Mean	Std. Dev.	N
Public Records:			
Sales Amount ($)	535,415	369,306	3,032
House Age	30.86	20.93	3,032
Living Area (Sq. Ft.)	1932	801.9	3,032
No. Bedrooms	2.927	0.932	3,030
No. Bathrooms	2.355	0.891	3,032
Lot Size (Acre)	0.201	0.100	3,032
Nonresident Unit	0.405	0.491	2,934
Coastal Area (Flood Zone VE)	0.078	0.269	3,032
Low-density Area (Zone R1/R1AA)	0.673	0.469	3,032
Appraisal Panel:			
Market Value ($)	440,702	291,831	51,456
Assessed Value ($)	360,422	260,948	51,456
Exemptions Present	0.517	0.500	51,458
No. of Neighbors (0.1 mile radius)	36.96	13.51	52,902
No. of Residents (0.1 mile radius)	19.19	8.54	52,902
No. of Neighbors (0.05 mile radius)	10.57	4.11	52,902
No. of Residents (0.05 mile radius)	5.45	2.86	52,902

[a] Notes: There are 1,794 properties having at lease one sales record; that is, public records contain multiple transactions for some properties. The total number of unique properties in the panel dataset is 2,939; hence, the panel contains $2939 \times 18 = 52902$ or less (i.e., unbalanced) parcel-year observations.

Table 2: Effect of Rental Regulation on Sales Price

	(1)	(2)	(3)	(4)
HB Ordinance	-0.0969**	-0.1020	0.0054	0.0062
	(0.0140)	(0.0635)	(0.0255)	(0.0744)
HB Ordinance			-0.1507**	-0.1492**
× Zone 1			(0.0182)	(0.0181)
Controls	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes
Subdivision FE	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes
City × Time	No	Yes	No	Yes
City × Time^2	No	Yes	No	Yes
City × Time^3	No	Yes	No	Yes
$Adj.R^2$	0.7117	0.7123	0.7134	0.7139
N	2932	2932	2932	2932

[a] Notes: Standard errors are clustered by city and reported in parentheses. There are two city dummies, 129 subdivision dummies, 71 year-quarter combination dummies. Time is in an increment of 1 per year. Controls not reported here include Zone 1, Nonresident Unit, Lot Size, House Age, Living Area, Bed, Bath, and Coastal Area. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

Table 3: Effect by Neighborhood Investor Density

	(1)	(2)	(3)	(4)
HB Ordinance	-0.1720***	-0.1520	-0.2296**	-0.2038*
	(0.0152)	(0.0613)	(0.0236)	(0.0502)
HB Ordinance	0.1651**	0.1723**		
× Density 05	(0.0345)	(0.0314)		
Density 05	0.0867*	0.0827*		
	(0.0273)	(0.0261)		
HB Ordinance			0.2956**	0.3118**
× Density 10			(0.0656)	(0.0564)
Density 10			0.1252**	0.1171**
			(0.0246)	(0.0181)
Controls	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes
Subdivision FE	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes
City × Time	No	Yes	No	Yes
City × Time^2	No	Yes	No	Yes
City × Time^3	No	Yes	No	Yes
$Adj.R^2$	0.7131	0.7138	0.7128	0.7134
N	2927	2927	2932	2932

[a] Notes: Standard errors are clustered by city and reported in parentheses. There are two city dummies, 129 subdivision dummies, 71 year-quarter combination dummies. Time is in an increment of 1 per year. Controls not reported here include Zone 1, Nonresident Unit, Lot Size, House Age, Living Area, Bed, Bath, and Coastal Area. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

Table 4: Effect of Rental Regulation on Market Value

	(1)	(2)	(3)	(4)
HB Ordinance	0.0140*	-0.0050	0.0990***	0.0796***
	(0.0075)	(0.0049)	(0.0125)	(0.0100)
HB Ordinance			-0.1246***	-0.1246***
× Zone 1			(0.0120)	(0.0120)
Property FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
City × Time	No	Yes	No	Yes
City × Time^2	No	Yes	No	Yes
City × Time^3	No	Yes	No	Yes
$Adj.R^2$	0.9249	0.9259	0.9260	0.9271
N	51456	51456	51456	51456

[a] Notes: Standard errors are clustered by property and reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

Table 5: Effect by Neighborhood Investor Density

	(1)	(2)	(3)	(4)
HB Ordinance	-0.0282**	-0.0455***	-0.0614***	-0.0819***
	(0.0137)	(0.0137)	(0.0199)	(0.0200)
HB Ordinance	0.0910***	0.0983***		
× Density 05	(0.0303)	(0.0306)		
Density 05	-0.0090	-0.0130		
	(0.0158)	(0.0159)		
HB Ordinance			0.1657***	0.1842***
× Density 10			(0.0457)	(0.0466)
Density 10			-0.0291	-0.0472*
			(0.0278)	(0.0281)
Property FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
City × Time	No	Yes	No	Yes
City × Time^2	No	Yes	No	Yes
City × Time^3	No	Yes	No	Yes
$Adj.R^2$	0.9249	0.9260	0.9251	0.9262
N	51324	51324	51456	51456

[a] Notes: Standard errors are clustered by property and reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

Appendix

In the paper, we focused on how rental regulation changed property values. However, the theoretical framework laid out in Section 3 contains an additional prediction about the density of investor-owned homes: a neighborhood's density of investor-owned homes, m^*, always decreases in equilibrium following the regulation. This is a prediction, if validated, that would further support our theoretical framework.

We test whether m^* in fact decreased after the 2007 regulation by using our proxy for the neighborhood density (within 0.05- and 0.1-mile radius) of investor-owned homes as the dependent variable. Here, it seems natural to examine the overall changes in investor density across the whole region, not just those around transacted properties. Thus, we focus on the panel sample and estimate the following equation:

$$Investor\ Share_{it} = \alpha + \beta HB\_Ord + Property_i + Year_t + \varepsilon_{it}. \tag{5}$$

Note that the dependent variable is constructed in a circle of radius *excluding* the property i at the center. This means that the property i fixed effect is more properly interpreted in this context as the neighborhood fixed effect that surrounds property i. In some specifications, we also include property value as a control variable, although the expected sign of the coefficient is ambiguous given the nonlinear relationship.

Table 6 reports the estimation results where the dependent variable is the investor density in a 0.05-mile radius in columns (1) and (2) and in a 0.1-mile radius in columns (3) and (4), respectively. In all specifications, the coefficient on HB_Ord is negative and significant, implying that the rental regulation decreased the equilibrium density of nonresident-owned homes, in line with our predictions.

Table 6: Effect of Rental Regulation on Investor Density

	0.05-mile radius		0.1-mile radius	
	(1)	(2)	(3)	(4)
HB Ordinance	-0.0135***	-0.0145***	-0.0109***	-0.0110***
	(0.0040)	(0.0041)	(0.0021)	(0.0021)
ln(Market Value)		0.0055		-0.0014
		(0.0064)		(0.0035)
Property FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
City × Time	Yes	Yes	Yes	Yes
City × Time^2	Yes	Yes	Yes	Yes
City × Time^3	Yes	Yes	Yes	Yes
$Adj.R^2$	0.6937	0.6995	0.8226	0.8240
N	52757	51324	52901	51456

[a] Notes: Standard errors are clustered by property and reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.