Can Restricting Property Use Be Value Enhancing? Evidence from Short-Term Rental Regulation

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Abstract

Short-term rentals, private residences where tourists stay, have become ubiquitous over the past decade. Many communities are divided over the trade-offs between a property owner's rights and nuisance problems created by transient populations in residential neighborhoods. This paper empirically examines the effects of regulation restricting short-term rentals on property sales prices, using a unique data set and policy experiment from Anna Maria Island, Florida. We show that nonresident ownership of properties on the island decreased following the rental regulation and that the regulation decreased property values except in areas where the density of non-resident-owned properties in a neighborhood was quite high.

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 become an important issue in many municipalities around the world.[1] While short-term rentals have become a lucrative alternative to longer-term leasing to tenants for property owners, the influx of transient populations can cause nuisances that neighboring residents dislike. Presently, a

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[1] According to Sena, McNellis, and McDade (2015), the market for vacation rentals and alternative lodging is estimated to be roughly $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.

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fast-growing number of regulations purporting to balance the interests of resident and nonresident owners is being considered across numerous municipalities. However, the effect of such regulation on property values has received surprisingly little attention in the policy debate.

It appears that large city governments are lobbied by the hotel industry to restrict short-term rentals, but even small municipalities (such as the area we study in this paper) in which high-rise hotels or hotel chains are not present are forced to address this issue through zoning ordinances that set the terms and conditions for rental use. However, according to Coase (1960), whether the zoning law should protect residents by restricting short-term rentals crucially depends on whether restricting a property's use is efficiency enhancing. For instance, if the property's value decreases because of the regulation more than the (net) harm to residents, then municipalities would be better off by considering alternative policies such as a tax system rather than rental regulations.

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 on Anna Maria Island, Florida—a barrier island that is home to three relatively homogeneous cities where hotel chains and high-rise buildings are absent. As we detail below, in the 2000s, the island began to experience issues related to short-term rentals, and the regulatory framework took center stage in sharply divided town-hall meetings. The result was that one of the three cities revised district codes to require a minimum stay for short-term rentals while the other two cities' actions were preempted by last-minute state legislation.

Since the purpose of zoning laws is indeed to increase the value of property rights (Fischel 2000), the effects of rental regulation can be usefully summarized by the changes in property values after regulation. That is, if the decrease in the neighborhoods' externalities problem more than compensates for the lost rental income due to rental regulation, then the changes in equilibrium property prices will signal whether the regulation is efficiency enhancing.

We lay out a theoretical 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 more stringent regulation, the share of non-resident-owned (that is, potential rental) properties will decrease, property values will be more likely to decrease in low-density residential areas than in high-density areas, and property values will be more likely to increase in neighborhoods where the fraction of non-resident-owned properties is high. We then use property-tax records for all properties on the island and public records for arm's-length transactions between 1998 and 2015 for single-family housing to test our predictions using a difference-in-differences approach.

Our theoretical framework suggests that the mean effect of the regulation can be ambiguous because the density of zones and the density of potential rentals imply nonlinear, heterogeneous effects. Indeed, we find evidence that the rental regulation decreased property values in low-density zones—wherein the low den-

sity of housing may help mitigate rental externalities. Moreover, using a proxy for owner occupancy, tax benefits for which only owner-occupants are eligible (also known as a homestead exemption), we find that regulation increased property sales price in neighborhoods where the share of nonresident homes is high and decreased sales prices where the share is low. The estimated effects, however, suggest that property values were mostly negatively affected by the regulation. The price changes that resulted from the regulation are surprisingly large, on average a 15 percent decrease for properties located in a low-density residential zone compared with properties located in a high-density residential zone.

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. 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 (1978) separate the definition of a neighborhood into multiple dimensions and find that increases in non-single-family land uses in a town can also raise residential property values if suitably concentrated. Leung and Tsang (2012) find that the value of private housing in Hong Kong is negatively impacted by the share of public housing in the neighborhood. We follow this tradition by focusing on the effect of regulation that restricts the rental use of single-family housing.

The paper that is closest to ours in this literature is Wang et al. (1991), which finds that property sales prices are negatively associated with the share of rental properties among the five (or eight) adjacent properties. While our use of the density of investors (hereafter, investor density) in a neighborhood is the same, the difference is that we estimate the causal effect of rental regulation using the change in district codes while Wang et al. estimate the hedonic effect of traditional leasing on property prices. Thus, the underlying mechanisms are different—their hypotheses are based on the theories that owner-occupied units are better maintained than rental units and that renters' socioeconomic status might decrease the desirability of a neighborhood, while our study is motivated by the issue of restricting property-use rights and its interaction with investor densities.

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 (such as disputes over land use) in a world with no transaction costs. That is, if renters and residents can bargain costlessly, then a regulation would be unnecessary; however, if it is difficult in practice to control bad actors (such as monitoring neighbors who are renting their properties for a short time to excessively large groups without compensating their neighbors), then restricting property use through zoning laws may increase or decrease property values depending on the efficiency of the law, which is the issue at hand.

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, on the island we study, stringent land-development regulation has been in place at least since 1989 to maintain the community's quaint character, and nearly all parcels were developed before our sample period begins. Hence, our estimates of the effect of rental regulation come mostly through changes in property-use rights in a well-developed residential area rather than land-use rights that might result in windfall gains or the extensive margin of lot development per se.

The rest of the paper is organized as follows. Section 2 describes the zoning regulation that took place in Holmes Beach. Section 3 presents our theoretical framework. Section 4 describes our data set, and Section 5 empirically shows the changes in property values due to the regulation. Concluding remarks are in Section 6.

2. Regulatory Background

For our empirical exercise, we exploit a policy experiment on Anna Maria Island, a 7-mile island near Tampa Bay with about 8,000 permanent residents that is home to three cities: Bradenton Beach, Holmes Beach, and Anna Maria.[2] The island is known as a quaint vacation destination that provides mostly local amenities, 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, residents' complaints about tourists driving residents away intensified, 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' property-rental-use rights. During this struggle, Holmes Beach amended its land-development codes in 2007 (ordinance 07-04) to include a major revision of district codes governing short-term rentals.

According to the new codes, a minimum stay of 30 days is required for rentals in low-density residential areas (zones R1 and R1AA), and a minimum stay of

[2] According to the Bradenton Area Convention and Visitors Bureau (2011), Anna Maria has 1,831 year-round residents, Holmes Beach has 5,119, and Bradenton Beach has 1,577. According to the 2000 US census, employment status and industry are more or less similar across the three cities (US Census Bureau, American Fact Finder, Profile of Selected Economic Characteristics: 2000, Census 2000 Summary File 3 [https://factfinder.census.gov/bkmk/table/1.0/en/DEC/00_SF3/DP3]). One apparent difference is that the median income is highest in Holmes Beach ($45,074), followed by Anna Maria ($40,341) and Bradenton Beach ($32,318).

7 days is required for rentals in higher-density residential areas (zones R2, R3, and R4). The regulation that was in place prior to 2007 was due to an ordinance passed in 1993 that intended to regulate "resort housing" in the R4 zone as part of the city's comprehensive plan (ordinance 93-1, sec. 2, February 2, 1993).[3] Thus, the 2007 ordinance was a major reform that imposed a length-of-stay regulation that applied to all residential zones, codifying a "prohibition against short-term occupancy" in each of the zoning district's codes.

The Holmes Beach city planner commented that "short-term rentals were hardly noticeable before 2005," which led to a lack of regulation in the primary residential zones prior to the 2007 ordinance, and the Holmes Beach city clerk added that the ordinance was proposed because of residents' complaints and passed with some moderation by city commissioners.[4] As we show below, Holmes Beach neighborhoods had lower shares of non-resident-owned homes prior to the legislation than the other two cities. This suggests that Holmes Beach had more at risk given the growth in vacation rentals; hence, it was the first to pass the regulation.[5]

After Holmes Beach passed the ordinance, Anna Maria and Bradenton Beach considered adopting similar zoning codes, as the share of nonresident properties started increasing, but the struggle between the opposing parties, property owners and managers on one side and residents on the other, led to continual postponements of a conclusive outcome. Such proposals might have been defeated or delayed in these other two cities because of interests that represented the nonresident owners. Meanwhile, 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 because of 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 inter-

[3] The goal of the plan was to "[e]nsure 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" (ordinance 08-05, goal 1, February 24, 2009).

[4] Bill Brisson, Holmes Beach city planner, e-mail to the authors, February 25, 2016; Stacey Johnston, Holmes Beach city clerk, e-mail to the authors, December 17, 2015. The city clerk adds, "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" (Stacey Johnston, e-mail to the authors, December 17, 2015).

[5] On the other hand, this raises the possibility that the other two cities were more likely to suffer if vacation rentals had no regulation and thus are not perfect control groups for Holmes Beach. However, if this is the case, our estimated net effect of rental regulation would be a lower bound. Further, our main prediction and specification include heterogeneous treatment effects by taking into account the density of non-resident-owned homes in a small neighborhood.

viewed 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 a minimum-stay requirement.[6]

Given that city officials admit that attempting to balance complaints from residents with property owners' rights was difficult, we believe that the resultant variation in policy created by the 2007 Holmes Beach ordinance provides a useful identification of the effects of rental-use rights on property values. The island is a relatively homogeneous locality where many tourists and residents walk on the same streets, and except for the differences caused by the ordinance, the towns have 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 demonstrated to date.

3. Theoretical Prediction

We present a price-theoretic model that highlights heterogeneous effects of rental regulation and rental 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. A nonresident may purchase a property exclusively for private use, for rental profit, or both. Thus, if a nonresident underutilizes his property (such as leaving it vacant for several months), then it must be that the utility from occasional private use is at least equal to the forgone income from renting out the property. However, there was a surge of short-term rentals in the locality we study. Accordingly, we consider 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 long-term from the resident's standpoint. Instead, we focus on a no-arbitrage condition in the housing asset market. That is, absent any transaction costs, property values are determined by the equality of the present values associated with housing services and rental income. While property transaction costs are certainly important, as long as they can be periodized and incorporated into the present-value stream, they will not substantially distort the no-arbitrage condition, 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. Con-

[6] 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 guests' stays. In response, Anna Maria proposed and passed a limited vacation-rental ordinance that sets limits on the number of guests staying at a property at any given time. However, the ordinance took effect April 1, 2016, after our sample period.

sider a property in a frictionless market, holding constant all other 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.

Our argument is that the present value of housing services is nonlinear in the proportion of properties offered as short-term rentals in the neighborhood, because visitors can exert both positive and negative externalities. Let us denote by m the share of homes in a property's neighborhood that can potentially be rented out on a short-term basis. As suggested at town-hall meetings on the island, short-term visitors can stimulate the local economy and facilitate the availability of local infrastructure; however, they can also cause a variety of nuisance problems including noise, parking, privacy, and security issues. Thus, under such conditions as diminishing marginal utility of amenities and increasing rental problems, the positive externalities will dominate in a low-m neighborhood, while the negative externalities will dominate in a high-m neighborhood.

On the other hand, investors, as nonresidents, are unlikely to be substantially affected by these externalities (for example, 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 of supply and demand for vacation rentals in a neighborhood. Holding constant the demand for rentals in any given time period, an increase in m would decrease rental income because it expands the supply. Another technical assumption we make is that for a sufficiently low-m neighborhood, income from vacation rentals strictly dominates the shadow price of housing services, while the reverse holds for a sufficiently high-m neighborhood. This guarantees the existence of a no-arbitrage equilibrium share of investors in a neighborhood, denoted m^*.

To summarize, residents' housing valuation curve, $H(m)$, is inverse-U shaped because too few tourists may depress local amenities while too many can cause nuisance problems. Because tourists typically do not pay for the problems and investors do not directly benefit from the amenities as much as residents do, 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 $m > 0$. On the other hand, investors' property valuation curve, $B(m)$, reflects the relationship of demand and supply in a market for short-term rentals. Given a standard upward-sloping supply of rental homes and a downward-sloping demand by renters, it is straightforward to observe that an increase in investor-owned homes will decrease rental income in equilibrium. Thus, the $B(m)$ curve is downward sloping in m.

The equilibrium property value p^* is jointly determined with an equilibrium density of investor-owned homes m^*, such that $H(m^*) = B(m^*)$. On the basis of

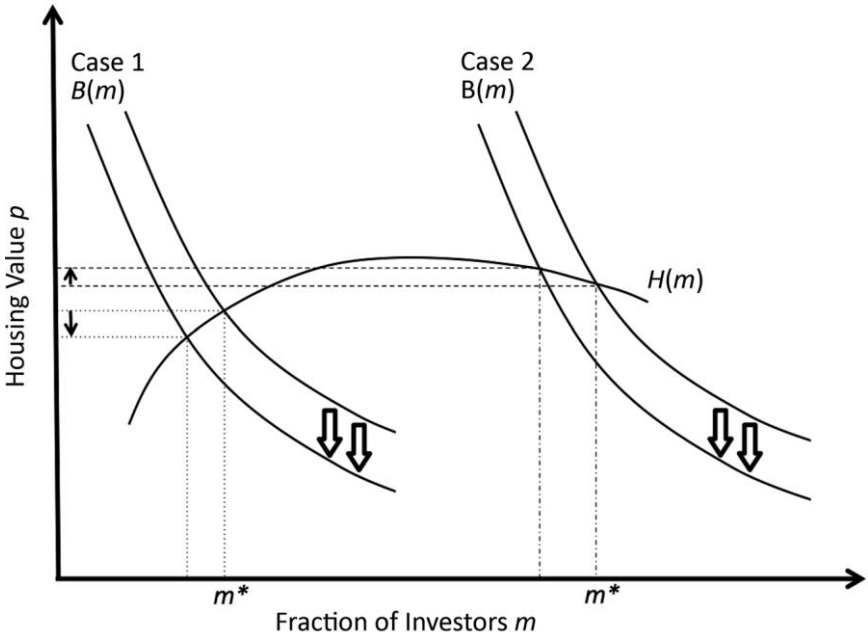

Figure 1. Effect of rental regulation on property value

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 rental restrictions will force investors to utilize the housing for their private use more than they would prefer or will simply increase the time the property is vacant. In either case, the rental rate of properties will decrease. 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 no income effect (that is, if residents do not intend to sell their homes to realize capital gains).

Formally, consider a small increase in the opportunity cost (that is, forgone income) due to a marginal reduction in the rental rate of properties. With a slight abuse of notation, let us refer to the inverse H and B curves as $H(p)$ and $B(p)$, where p is the property's price. Denoting the change in the opportunity cost that investors incur as c, the new equilibrium property price, now denoted $p(c)$, is determined from

$$H[p(c)] = B[p(c) + c]. \tag{1}$$

Differentiating equation (1) with respect to c, we obtain

$$\frac{dH}{dp}\frac{dp}{dc} = \frac{dB}{dp}\frac{d[p(c)+c]}{dc} = \frac{dB}{dp}\left(\frac{dp}{dc} + 1\right).$$

Rearranging the equation indicates how the regulation affects the equilibrium property price:

$$\frac{dp}{dc} = \frac{dB}{dp} \Big/ \left(\frac{dH}{dp} - \frac{dB}{dp} \right),$$

which can be expressed in terms of elasticities:

$$\frac{dp}{dc} = \frac{dB}{dp}\frac{p}{m} \Big/ \left(\frac{dH}{dp}\frac{p}{m} - \frac{dB}{dp}\frac{p}{m} \right) = \frac{\varepsilon}{\eta - \varepsilon}, \tag{2}$$

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. There are two cases given a marginal increase in c.

Proposition 1.
i) If $\eta > 0$ is satisfied, then $dp/dc < 0$.
ii) If $\eta < 0$ is satisfied, then $dp/dc > 0$.

Proof. Since the B curve is downward sloping, $\varepsilon < 0$ 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 $\eta - \varepsilon > 0$. Therefore, $dp/dc = \varepsilon/(\eta - \varepsilon) < 0$. In the second case, a downward-sloping H curve entails that $\eta < 0$ holds (and $\eta < 0$ implies a downward-sloping H curve). Given $|\eta| > |\varepsilon|$, which necessarily holds for $H(p)$ and $B(p)$ to intersect and an equilibrium to exist, whereby $\eta - \varepsilon < 0$, it follows that $dp/dc = \varepsilon/(\eta - \varepsilon) > 0$. Q.E.D.

Intuitively, an equilibrium is obtained when, over the relevant range of investors' shares, property values are more negatively affected for investors than for 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 on the basis of the availability of the rental supply. If, in the existing equilibrium, because of a large number of investors, residents' home values also decrease following the entry of investors, then a marginal increase in rental restrictions should lead to higher property values in equilibrium. If, on the other hand, there are few investors in a community in the current equilibrium, and residents' home values would, on net, increase following investors' entry, then the rental restriction 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. In particular, a low-density residential zone such as R1 has development standards that would result in fewer than 5.8 dwelling units per acre, whereas other zones (R2, R3, and R4) require fewer than 10 dwelling units per acre. Given their relative proximities to neighboring units, residents living in low-density (high-density) zones are less (more) likely to be affected by the nuisance problems caused by vacation rentals. Holding other factors constant, we see that the H curve is likely to be skewed to

the left in low-density zones and to the right in high-density zones, so the resultant prediction is that property values are on average more likely to decrease (increase) because of the rental regulation in low-density (high-density) zones.

Finally, our theory implies that regardless of whether it is in a high- or low-m neighborhood, rental regulation will lead to a lower share of investors in a neighborhood, holding other factors constant. Therefore, we summarize our theoretical predictions regarding the effect of rental regulation as follows:

Hypothesis 1. The number of investor-owned properties will decrease.

Hypothesis 2. Property values are more likely to decrease in low-density than in high-density areas.

Hypothesis 3. The change in property values will increase in the fraction of investor-owned properties in a neighborhood.

4. Description of the Data

We merge data from a few sources. First, we began by collecting all parcel identification numbers (IDs) for parcels on Anna Maria Island that are classified as single-family residential by using Manatee County's geographic information system (GIS). The parcel IDs are public records that include other time-invariant characteristics of the parcel such as address, city, subdivision, lot size, residential zoning, and flood zoning.[7] The latitude and longitude are also available (in a six-digit format) in GIS; however, these data do are not automatically included with each property record, so we manually collected the coordinates at the center of the building in each parcel ID using the GIS interactive map.

Second, we collected all public records and information about 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 sellers' names). The public records include sales date and amount, buyer's and seller's names, and a real-estate transfer qualification code. The building characteristics include year built, living area (square feet), 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 data sets.

One potential concern 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 lots were developed and units were built. Remodeling

[7] We use an indicator for Federal Emergency Management Agency (FEMA) flood zone V (coastal area in Table 1). According to FEMA, zone V indicates beachfront or waterfront properties: "The most hazardous flood zones are V (usually first-row, beach-front properties)." The geographic information system readily verifies that zone V traces the contours of the island. The rest of the island is zone A, "[t]he next most volatile of the Special Flood Hazard Areas" (Federal Alliance for Safe Homes, Floods: Flood Zone—Which One Are You In [http://flash.org/peril_inside.php?id=58]).

and flipping after purchase can still potentially affect the observable characteristics, but there seem to be a limited number of such cases.[8] Our interviews with local real-estate agents also reveal that most property owners were renting out homes rather than flipping for a quick profit.

There were 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 family members or between property owners and property-management companies. We use the transfer qualification code to systematically identify and keep only those records that qualify as arm's-length transactions, dropping all disqualifying sales.[9] This resulted in a final sample of 3,032 sales in our cross-sectional data set, with 1,794 unique parcel IDs. This means that some properties have multiple qualifying sales since 1998.

Our data-selection process also implies that our data do not include any "[d]eeds to or from financial institutions; deeds stating 'In Lieu of Foreclosure' (including private lenders)" because they are a subcategory of the disqualifying sales (Florida Department of Revenue 2010). Florida was hit hard by the subprime mortgage crisis; however, the number of disqualifying transactions due to foreclosure is relatively small. There are only 162 records with this code from 2009 to 2015 (the system did not have subcategory codes before 2009). It is still possible that the financial crisis affected arm's-length transactions in the three townships differently. Our results, however, are robust when we exclude all transactions, say, from 2008 to 2009.

Third, we collected the property-appraisal data from the Manatee County Tax Collector database. The database contains all yearly tax bills associated with the parcel IDs since 1998. We collected market value, assessed value, a list of tax exemptions associated with each property, and the owner's name and address. In short, the market value is the just value as estimated by property appraisers, and the assessed value is the base value used by tax collectors to determine property taxes.[10] As we discuss below, the difference between the market value and the

[8] Since 2009, the qualification code system has included a code 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)" (Florida Department of Revenue 2010). There are only 13 records with this code from 2009 to 2015, and they have no effect on our results. Before 2009, the system did not have subcategory codes.

[9] 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" and 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" (Florida Department of Revenue 2010).

[10] "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. 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" (Manatee County Property Appraiser's office, telephone conversation with the authors, February 4, 2016; see also Manatee County Property Appraiser, FAQs, Property Assessment [http://www.manateepao.com/dnn/FAQs/Property-Assessment]).

assessed value is created by various tax exemptions for residents (for example, homestead and other personal exemptions such as those for seniors, widows and widowers, and people with disabilities).

It is important that the tax exemptions apply only to the homeowners who reside in properties that are their primary residences (homestead), and the formal processes for obtaining these exemptions are closely monitored.[11] Once the exemptions have been granted, they remain associated with the property and its owner without requiring reapplication each year. Therefore, we believe that the presence of tax exemptions in the annual tax bill is a fairly accurate proxy for owner-occupied (that is, resident-owned) properties in our data. Our proxy for investor-owned properties is simply the absence of resident-based tax exemptions. This means that non-resident-owned properties are only potential rentals, and we have no means to verify that these properties were all rented out on a short-term basis or to discover how often they were used for vacation rentals.

However, there are significant reasons to believe that vacation rentals were prevalent, instead of homeowners renting out only occasionally to supplement their income. This is because under Florida statute homeowners have a duty to notify the property-tax appraiser's office that their homes no longer qualify for homestead exemptions if they rent out their properties.[12] Failure to do so results in significant monetary penalties going back 10 years, plus interest and potential criminal penalties. Thus, it would not make much sense for residents to rent out occasionally while forfeiting the right to claim homestead exemptions. Further, local newspaper articles state that tourism has skyrocketed in the past decade, and many island properties were part of the vacation-rental market (see, for example, Levey-Baker 2016). Hence, it seems plausible that a nontrivial portion of investor-owned homes were in fact rented out.

The last step in constructing our data set was to count the total number of properties located in a neighborhood (excluding the property at the center) and the subset of properties that are investor owned. We characterize a neighborhood by drawing a circle with a radius of .1 or .05 of a mile around each property based on our geolocation-coded data. This calculation is repeated for each year, so these count measures can be time varying. We then take the ratio of the two count measures to derive what we call the investor density in the neighborhood surrounding a property. The density is between 0 and 1 and is symmetrically distributed in our panel data. Finally, we identify and record the geographic coordinates

[11] "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 license or identification card number; Evidence of giving up driver 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 your last IRS return; Dependent children's school location(s); Bank statement and checking account mailing address; Proof of payment of utilities at homestead address" (Florida Department of Revenue, Property Tax Exemption for Homestead Property [http://floridarevenue.com/dor/property/brochures/pt113.pdf]).

[12] "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 " (Fla. Stat., sec. 196.061).

Figure 2. Resident and nonresident units in Anna Maria, 2006

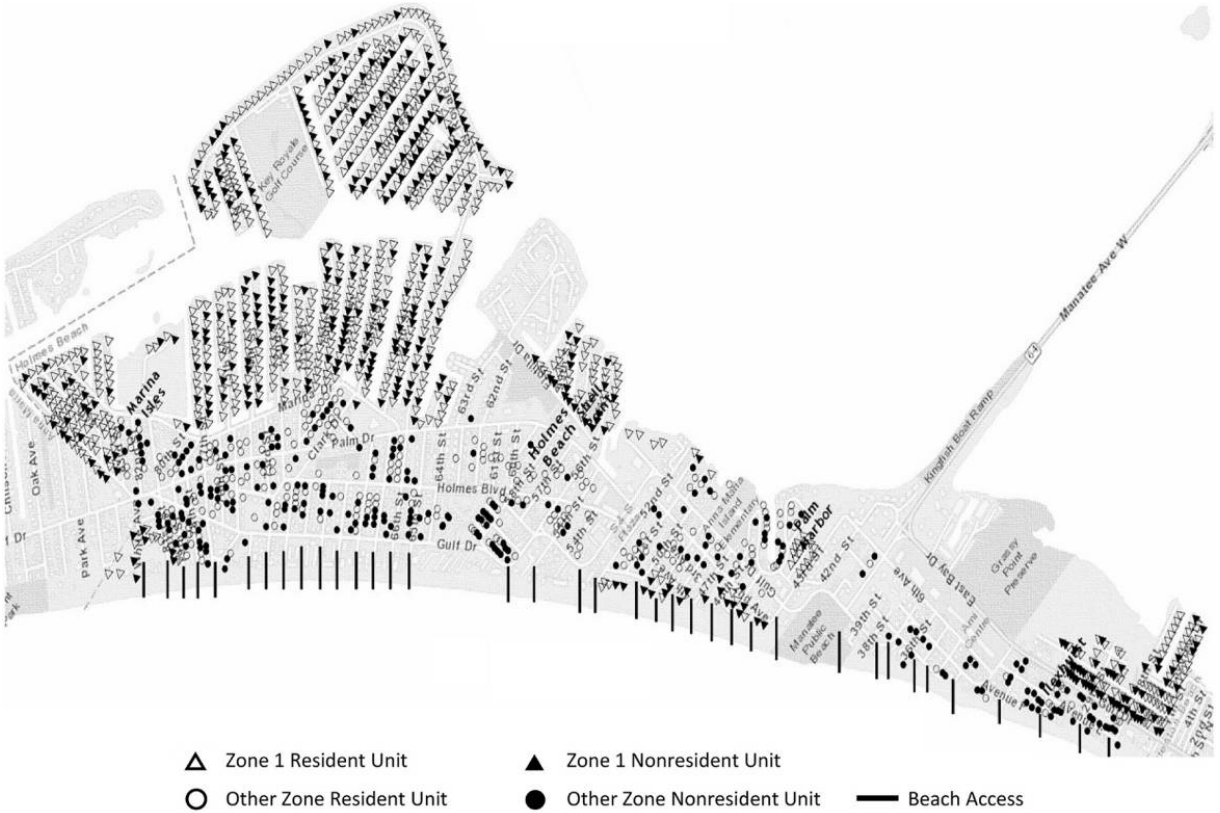

Figure 3. Resident and nonresident units in Holmes Beach, 2006

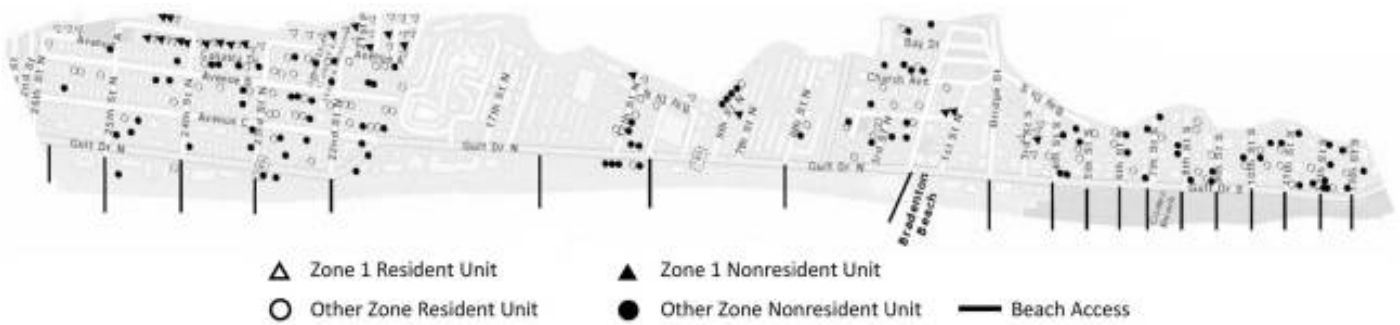

Figure 4. Resident and nonresident units in Bradenton Beach, 2006

Table 1
Summary Statistics

	Mean	SD	*N*
Building characteristics:			
Sales amount ($)	535,415	369,306	3,032
House age	30.86	20.93	3,032
Living area (square feet)	1,932	801.9	3,032
Bedrooms	2.927	.932	3,030
Bathrooms	2.355	.891	3,032
Lot size (acres)	.201	.100	3,032
Nonresident unit	.595	.491	2,934
Coastal area (flood zone V)	.078	.269	3,032
Low-density area (zones R1 and R1AA)	.673	.469	3,032
Distance to beach (km)	.507	.437	3,032
Tax appraisal and density characteristics:			
Market value ($)	440,702	291,831	51,456
Assessed value ($)	360,422	260,948	51,456
Cap differential ($millions)	.080280	.152373	51,456
Tax exemption (resident unit)	.517	.500	51,458
Neighbors in .1-mile radius	36.96	13.51	52,902
Residents in .1-mile radius	19.19	8.54	52,902
Neighbors in .05-mile radius	10.57	4.11	52,902
Residents in .05-mile radius	5.45	2.86	52,902

Note. The panel contains 2,939 (properties) × 18 (years) = 52,902 or fewer (that is, unbalanced) parcel-year observations.

of all access points to the beach, which face the Gulf of Mexico (see Figures 2–4), and calculate the distance from each property to the nearest access point. We use this as a control variable since beach access is an important amenity.

Table 1 presents descriptive statistics for our data sets. The public records contain all arm's-length transactions from 1998 to 2015, with which building and parcel characteristics are merged. There is a slight majority of resident-owned homes in each case. This implies that the supply of potential vacation rentals was indeed very large, an observation that is consistent with local newspapers describing a extensive amount of conversion to vacation rentals (Neff 2009; Anderson 2017; Copeland 2009).

We show the share of nonresident homes by year and city in Figure 5. Before 2007, Holmes Beach had a stable share of nonresident homes of just over 40 percent, while Bradenton Beach and Anna Maria had more than 50 percent shares of nonresident homes. Thus, as previously argued, it is possible that the Holmes Beach community had more to lose from the growth in vacation rentals. With a downward trajectory in the first half of the 2000s, Bradenton Beach and Anna Maria could have adopted similar rental restrictions; however, the share of nonresident homes began to increase starting in the mid-2000s perhaps because of the growing popularity of online platforms such as Airbnb and HomeAway. Rental regulations, except for those grandfathered townships, were then pre-

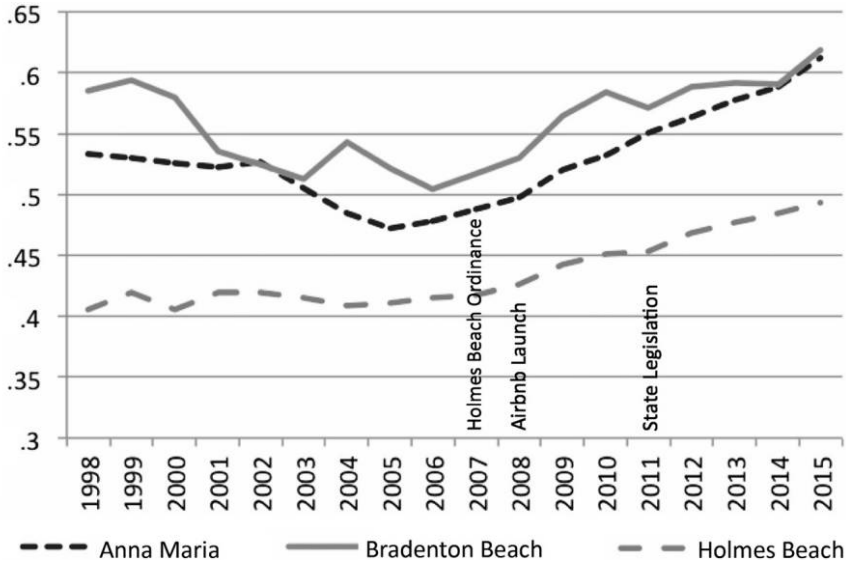

Figure 5. Shares of nonresident homes

empted by the 2011 Florida state law, and the shares of nonresident homes have been increasing in all three cities.[13]

In terms of the property market, however, there is no clear sign that suggests that the Holmes Beach regulation was endogenous to the trends in property prices. Figure 6 shows the mean sales prices (logged) by year and city, which are the dependent variables in our sales regressions. The trends appear to be common across the cities both before and after 2007. In the market overall, there is a cubic time trend that is likely due to the financial crisis, which appears to have hit the townships similarly. Figures 2–4 show the location of the single-family properties in the data, their ownership status, and their residential zone as of 2006. The resident and nonresident units are reasonably dispersed rather than clustered in any predictable way. Hence, at least for our analysis, it seems reasonable to assume that investor density in a neighborhood is exogenous.

5. Empirical Evidence

5.1. Effects on Property Ownership

The theoretical framework presented in Section 3 predicts that the density of investor-owned homes m^* in a neighborhood always decreases in equilibrium

[13] Our proxy for rental homes seems to agree with the city's working definition of rental homes. For instance, in a 2015 newspaper article, the mayor of Anna Maria stated that "residents are outnumbered because 60 percent of the homes in the city are vacation rentals" (Mascareñas 2015), a figure that is in line with the share of nonresident-owned homes shown in Figure 5.

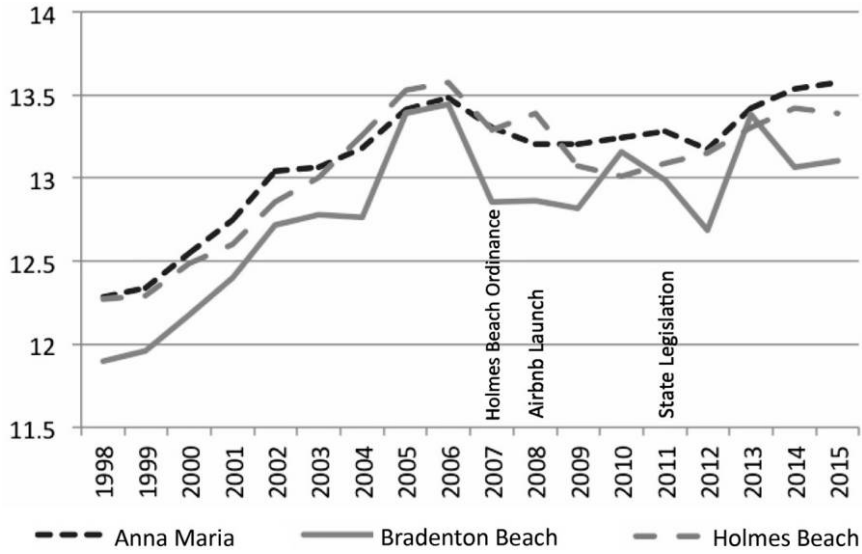

Figure 6. Mean property log of sales price

following the regulation, regardless of the existing level of investor-owned homes (see Figure 1). Hence, our first test is to determine whether this prediction is supported by the data. As mentioned in Section 4, our measure of ownership status is the presence of resident-based tax exemptions (such as homestead exemptions), which are determined as of January 1 in each year. Since property-tax bills are generated for all property owners, we make use of our property-tax panel data for our analysis.

One issue for our test is how to measure the empirical counterpart of m^*, which is the investor density in a neighborhood. For our dependent variable, the share of investor-owned homes within a certain radius is not a good measure because the boundaries overlap, and hence the same residency decision appears multiple times in calculating the investor-owned share of homes around each property. Instead, m^* has to be measured by the share of investor-owned homes in a non-overlapping neighborhood or simply by the ownership status for each property. For the former, we decided to collapse the panel data by subdivision to obtain the share of investor-owned homes in each subdivision.[14]

Since this is an annual panel data set, controls that are not absorbed by the subdivision or property fixed effects need to be time varying. We include two control variables that are important for residents' housing-tenure decision, namely, the gap between the market value and the assessed value (henceforth, the cap differential) and its portability. In Florida, the 1992 Save Our Homes Act prevents the

[14] To be precise, we collapse the panel data by subdivision and city, because a few subdivisions are shared between two cities. For simplicity, we refer to (unique) subdivision-city pairs as subdivisions.

assessed value of homestead property from increasing more than 3 percent per year or the percentage change in the Consumer Price Index, whichever is lower. Consequently, the tax savings from the Save Our Homes cap and homestead exemption represent a significant tax benefit to residents.

A large cap differential tended to discourage Florida residents from moving to a new home because they would lose the accumulated cap differential, which would trigger large tax hikes (Ihlanfeldt 2011). However, in 2008, Florida voters passed a constitutional amendment to allow for portability of capped values up to $500,000 when homesteaded owners move from one Florida home to another.[15] Therefore, more residents can now move and retain their cap differentials, which implies that a homestead property is more likely to have a positive cap differential since 2008. Similarly, this also implies that a subdivision with a larger share of homestead properties would have a larger cap differential on average after 2008.

Using the property-tax panel, we estimate the following fixed-effects specification:

$$\begin{aligned}\text{Investor}_{it} = {} & \alpha + \beta \text{HB Ordinance}_{it} + \delta_1 \text{Cap Differential}_{it} \\ & + \delta_2 \text{Cap Differential} \times \text{Post}_{it} + \text{Property}_i + \text{Year}_t + \varepsilon_{it},\end{aligned} \tag{3}$$

where the dependent variable is zero when property i is granted homestead and/or other tax exemptions in year t (as of January 1) and one otherwise. The treatment variable HB Ordinance is an indicator for Holmes Beach properties from 2008 onward, since the ordinance went into effect in early 2007. The term Cap Differential$_{it}$ is the cap differential for property i in year t, and Cap Differential $\times$ Post$_{it}$ is the interaction between the cap differential and an indicator for 2009 and later, since the constitutional amendment (portability) went into effect in early 2008. The terms Property$_i$ and Year$_t$ are standard fixed effects.

In some specifications, we also include city-specific, flexible (cubic) time trends, as the three cities seem to exhibit different trends for nonresident ownership shares (see Figure 5). In fact, our results can be intuitively explained by noting that the nonresident shares were clearly decreasing in the control cities (Anna Maria and Bradenton Beach) before the 2007 Holmes Beach legislation, while the nonresident share in Holmes Beach was nearly flat. Following the legislation, the nonresident ownership shares in the control cities increased faster than the rate experienced by Holmes Beach. This suggests that controlling for the city-specific time trend is important for our results. Finally, we bootstrap our standard errors (with 500 replications), as ownership status is unlikely to be independently distributed.

Table 2 shows the ordinary least squares (OLS) estimation results for specification (3). As expected, the cap differential is negatively correlated with nonres-

[15] The portability of the cap differential means raising the tax share of low-mobility households and lessening the tax share of high-mobility households because the latter group might move into a new jurisdiction with a large cap differential (Cheung and Cunningham 2011). While it is possible that the 2008 constitutional amendment affected the net migration across the three cities differently, we are unable to prove or disprove such possibilities because of a lack of data.

Table 2
Effect of Rental Regulation on Nonresident Status

	(1)	(2)	(3)	(4)
HB Ordinance	.0034	−.0176	.0091	−.0252*
	(.0137)	(.0116)	(.0136)	(.0114)
Cap Differential			−.9999**	−1.0079**
			(.0555)	(.0570)
Cap Differential × Post			−.3231**	−.3246**
			(.0326)	(.0383)
City × Time	No	Yes	No	Yes
City × Time^2	No	Yes	No	Yes
City × Time^3	No	Yes	No	Yes
Adjusted R^2	.5783	.5786	.6198	.6207
N	51,458	51,458	51,456	51,456

Note. Bootstrapped standard errors are in parentheses. The regressions include property and year fixed effects and 17 year dummies (because of collinearity with the constant term). Time is in an increment of 1 per year.

* $p < .05$.

** $p < .01$.

ident ownership status, and more so since 2009. The treatment effect estimate $\hat{\beta}$ is positive and imprecisely estimated when the city-level time trends are not included; however, its sign changes when we include the time trends. The coefficient $\hat{\beta}$ is also statistically significant when we control for the cap differential and its portability. Therefore, while it seems nontrivial to establish the negative net effect of the regulation on nonresident ownership, we believe that the specification in column 4 yields the most plausible support for our model's prediction.

To examine the robustness of this finding, we aggregate the panel data to the subdivision level, which is nonoverlapping, by calculating the nonresident ownership shares and the average cap differentials in each subdivision. The estimation equation is basically the same as equation (3), but the unit of observation is a subdivision, and thus the property fixed effects are replaced with subdivision fixed effects. Table 3 reports the OLS estimation results, where the dependent variable is the investor share in a subdivision, and shows that our previous results are robust in this regard. Therefore, we conclude that the Holmes Beach ordinance had a negative causal effect on nonresident ownership, in line with our first prediction.

5.2. Effects on Property Value

The main purpose of this paper is to uncover the net price effect of the rental regulation on property values, using the cross section of all arm's-length transactions involving single-family residential properties from 1998 to 2015. This data set covers 1,794 properties, a subset of the 2,939 single-family residential properties on the island that received a tax bill during the same time period.

Table 3
Effect of Rental Regulation on Nonresident Shares in a Subdivision

	(1)	(2)	(3)	(4)
HB Ordinance	.0076	−.0367+	.0201	−.0424*
	(.0235)	(.0205)	(.0224)	(.0206)
Cap Differential			−.4624**	−.4932**
			(.1025)	(.1165)
Cap Differential × Post			−.2294*	−.2435**
			(.0936)	(.0859)
City × Time	No	Yes	No	Yes
City × Time^2	No	Yes	No	Yes
City × Time^3	No	Yes	No	Yes
Adjusted R^2	.6981	.7000	.7164	.7205

Note. Bootstrapped standard errors are in parentheses. The regressions include subdivision and year fixed effects and 17 year dummies (because of collinearity with the constant term). Time is in an increment of 1 per year. $N = 2{,}345$.

+ $p < .10$.
* $p < .05$.
** $p < .01$.

Thus, more than half of the properties changed owners; however, there are close to 3,000 qualified transactions in the data set because some properties have more than one transaction during our sample period. Note that disqualified sales such as foreclosures are not included in our analysis.

Hence, with a plausible identification strategy, the results from using this repeated cross-sectional data set can tell us about the realized gains or losses of property value due to the rental regulation. Our difference-in-differences approach requires a few assumptions. First, the timing of the Holmes Beach ordinance is assumed to be exogenous to trends in the property market. This seems to be a plausible assumption given that there are no obvious city-specific differential time trends for the mean property sales price in Figure 6. This also implies that the inclusion or exclusion of the time trends will not matter as much in sales regressions as it did in the ownership regressions, which is what we find below.

Second, the 2007 ordinance was the first time that the 30-day and 7-day minimum-stay requirements for short-term rentals were codified in the district codes for the R1 and R1AA and the R2–R4 zones, respectively, 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 requirements. While we do not have direct evidence of how much time and how many resources were expended to enforce the rental regulation, local newspaper articles suggest that there has been some level of code enforcement given that the rental problem is recognized as one of the important issues on the island (Levey-Baker 2016; *Islander* 2012).

Using the transactions data, we estimate the following specification and its variants:

$$\ln(\text{Sales Price}_{ijlt}) = \alpha + \beta \text{HB Ordinance}_{it} + \boldsymbol{X}_i'\delta + \text{City}_j + \text{Subdivision}_l + \text{Year-Quarter}_t + \varepsilon_{ijlt}, \quad (4)$$

where the dependent variable is the log of sales price of property i in city j and subdivision l at time t. Each transaction in the data has a sales date, so we created 72 year-quarter dummies, denoted t, to control for the yearly and quarterly time trends in a flexible manner. The treatment variable HB Ordinance 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 regulation on Holmes Beach compared with the other two cities. There are 130 subdivisions that are not perfectly nested within the cities, so both fixed effects (City_j and Subdivision_l) are included; Year-Quarter_t is an indicator for the year and quarter combination. Given the small sample size, we cluster the standard errors by city.

Controls in $\boldsymbol{X}$ include the nine property characteristics shown in Table 1: indicators for low-density residential zones; nonresident homes, lot size, house age, living area, and number of bedrooms and bathrooms; coastal zones (beachfront or waterfront); and the distance to the nearest access point to the beach (see Figures 2–4). We also include city-specific cubic time trends as in some earlier specifications to account for differential time trends for robustness checks. We test our hypotheses using interactions of the treatment with low-density zones (Zone 1) and with investor density within a .05-mile (Density 05) and a .1-mile radius (Density 10). In the latter two cases, the stand-alone density terms are controlled for. Equation (4) is then estimated using OLS regression.

Column 1 of Table 4 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 a 9.68 percent decrease in sales price due to the rental-restricting regulation. The specification in column 2 includes city-specific time trends to account for differential housing-market trends in each city and suggests that the effect of regulation on sales price is no longer statistically significant. Indeed, our theoretical framework predicts an ambiguous sign for the average treatment effect because of the offsetting positive and negative externalities. Thus, the imprecisely estimated effect in column 2 is not unexpected.

Columns 3 and 4 show our tests of the second hypothesis—that negative externalities from short-term rentals will be smaller in an area where there are fewer dwellings per acre of land and buildings are set back farther from streets, because privacy is more readily preserved and interactions between residents and visitors are more limited, other things being equal. This means that the rental regulation will offer more benefit when properties are located in high-density residential areas. The coefficients on the interaction term suggests that the properties located in low-density areas of Holmes Beach sold for prices about 15 percent lower than

Table 4
Effect of Rental Regulation on Sales Price

	(1)	(2)	(3)	(4)
HB Ordinance	−.0968*	−.1030	.0053	.0051
	(.0136)	(.0652)	(.0254)	(.0769)
HB Ordinance × Zone 1			−.1504*	−.1489*
			(.0189)	(.0190)
City × Time	No	Yes	No	Yes
City × Time^2	No	Yes	No	Yes
City × Time^3	No	Yes	No	Yes
R^2	.7325	.7337	.7341	.7352

Note. Standard errors, clustered by city, are in parentheses. The regressions include two city dummies, 129 subdivision dummies, and 71 year-quarter combination dummies (because of collinearity with the constant term); unreported controls (zone 1, nonresident unit, lot size, house age, living area, bedrooms, bathrooms, coastal area, and distance to beach); and city, subdivision, and year-quarter fixed effects. Time is in an increment of 1 per year. $N = 2{,}932$.

* $p < .05$.

if Holmes Beach had not adopted the rental-restricting ordinance, and this finding is robust to the inclusion of time trends.

However, all units in the same residential zone need not be affected by rental problems, and hence the rental regulation, equally. This is because rental properties are unlikely to be uniformly scattered within a particular zone. Thus, we test our third hypothesis—that the negative externalities associated with rental problems will increase with a neighborhood's density of investor-owned homes. Table 5 shows the results of our regressions when we interact the treatment variable with the two measures of investor densities in a neighborhood. All four columns suggest that the interaction effect is statistically significant and positive, which gives strong support to our prediction.

Taking into account the fact that the density varies from 0 to 1, we find that our estimates in Table 5 can be used to calculate the heterogeneous effect for neighborhoods with different investor densities. Although we omit graphs, our measure of investor densities is bell shaped, symmetric, and distributed mostly between .2 and .8 in the panel data. Thus, most of the properties experienced a decline in value because of the regulation. In particular, for the .05-mile radius in column 2, it would require an investor density of .89 or higher for a property's price to increase. For the .1-mile radius in column 4, it would require an investor density of .66 or higher, which represents some 12 percent of all properties, for a property's price to increase.

Some caveats must be kept in mind when interpreting our findings. Although our cross-sectional data set excludes "sales disqualified as a result of examination of the deed," which include deeds to or from financial institutions and deeds stating "'In Lieu of Foreclosure' (including private lenders)" (Florida Department of Revenue 2010), the effect of the subprime mortgage crisis can be subtler, as Flor-

Table 5
Effect of Rental Regualtion by Neighborhood's Nonresident Density

	(1)	(2)	(3)	(4)
HB Ordinance	−.1720**	−.1521	−.2296**	−.2036+
	(.0149)	(.0637)	(.0229)	(.0523)
HB Ordinance × Density 05	.1653*	.1724*		
	(.0317)	(.0288)		
Density 05	.0858*	.0822+		
	(.0196)	(.0192)		
HB Ordinance × Density 10			.2956*	.3117*
			(.0630)	(.0542)
Density 10			.1258**	.1189*
			(.0067)	(.0149)
City × Time	No	Yes	No	Yes
City × Time^2	No	Yes	No	Yes
City × Time^3	No	Yes	No	Yes
R^2	.7340	.7352	.7337	.7349
N	2,927	2,927	2,932	2,932

Note. Standard errors, clustered by city, are in parentheses. The regressions include two city dummies, 129 subdivision dummies, and 71 year-quarter combination dummies (because of collinearity with the constant term); unreported controls (zone 1, nonresident unit, lot size, house age, living area, bedrooms, bathrooms, coastal area, and distance to beach); and city, subdivision, and year-quarter fixed effects.. Time is in an increment of 1 per year.

+ $p < .10$.
* $p < .05$.
** $p < .01$.

ida was one of the states that were hit hard by the financial crisis. For instance, owners of second homes may have chosen to rent out their vacation homes more, which can increase rental problems in a neighborhood. If some parts of town were more suitable for second homes than others, then those areas would experience a decline in property values not caused by the rental regulation.

Another caveat is that the island we study is relatively small, which means that a sense of community can be island-wide rather than town specific, so the regulating town may lose property value but continue to suffer some of the nuisance problems. Further, vacation rentals in the three towns can be viewed as substitutes from the standpoint of a tourist. If so, then demand for rentals in control towns may increase while demand for rentals in the regulated town (Holmes Beach) may decrease. While we are unable to address these issues with our data, caution should be exercised, as our estimates of the treatment effect may well be an upper bound if one seeks to extrapolate these effects to a citywide regulation.

6. Conclusion

With the market for vacation rentals still growing, a number of local governments either have been, are, or will be considering short-term rental regulations. In this paper, we theoretically and empirically investigated the effect of restricting

short-term rentals on property values. While our theoretical framework suggests that the mean effect of the regulation may be ambiguous, our empirical analysis supports the prediction that the owner's property rights associated with rental use are likely to be valued more highly than the neighborhood externalities caused by renters, especially in low-density residential areas and in neighborhoods with low or medium densities of potential rental homes. Thus, on the basis of these findings, zoning laws that restrict vacation rentals seem to be inefficient policy. We believe that further studies based on different geographies would be helpful in fine-tuning this policy implication.

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