Airbnb Usage Across New York City Neighborhoods:
Geographic Patterns and Regulatory Implications[1]

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This paper offers new empirical evidence about actual Airbnb usage patterns and how they vary across neighborhoods in New York City. We combine unique, census-tract level data from Airbnb with neighborhood asking rent data from Zillow and administrative, census, and social media data on neighborhoods. We find that as usage has grown over time, Airbnb listings have become more geographically dispersed, although centrality remains an important predictor of listing location. Neighborhoods with more modest median household incomes have also grown in popularity, and disproportionately feature "private room" listings (compared to "entire home" listings). We find that compared to long-term rentals, short-term rentals do not appear to be as profitable as many assume, and they have become relatively less profitable over our time period. Additionally, short-term rentals appear most profitable relative to long-term rentals in outlying, middle-income neighborhoods. Our findings contribute to an ongoing regulatory conversation catalyzed by the rapid growth in the short-term rental market, and we conclude by bringing an economic lens to varying approaches proposed to target and address externalities that may arise in this market.

I. Introduction

Over the last few years, as Airbnb and competing platforms have grown in popularity, the short-term rental market has attracted considerable attention in cities around the world. A core feature of most platform-based activity is a blurring of lines between personal and commercial: housing that was exclusively residential in the past is now a new form of mixed-use real estate. The rapid scaling of short-term rental activity that used to be informal has challenged a variety of existing regulatory structures, from zoning laws to housing codes and tax policies. Proponents and critics offer anecdotes to support their positions, and local governments around the world are adopting a range of regulatory responses. Yet all this is happening without rigorous empirical evidence about the geography of usage patterns, their evolution over time, or the relative profitability of long- and short-term rentals.

We add clarity to this discussion by providing new empirical evidence about actual Airbnb usage patterns in New York City and how they vary across neighborhoods between 2011 and 2016. We combine unique census-tract level data obtained from Airbnb with neighborhood asking rent data from Zillow and administrative, census, and social media data on neighborhoods. We explore which neighborhoods are experiencing higher usage, and whether short-term rentals appear to be responding to a gap in the provision of hotel rooms. We also consider variation over time and space in the ratio of short-term to long-term rental prices, which offers insight into changing incentives and provides a signal of where the market is likely to grow moving forward.

Our findings reveal that as usage has grown over time, Airbnb listings have become more geographically dispersed, although centrality remains an important predictor of listing location. Controlling for centrality (as defined by proximity to Midtown Manhattan), lower-income districts have grown in popularity, and disproportionately feature "private room" listings (compared to "entire home" listings).

Saliently, short-term rental use is neither as extensive nor as profitable in New York City as many assume. Furthermore, the incentive for landlords to convert long-term to short-term rentals appears to have fallen over time as short-term rentals became less profitable relative to long-term rentals over our time period. That said, we find notable variation across neighborhoods in the ratio of short-term to long-term rents. While short-term rental prices decline with distance to the Empire State Building, the distance gradient for short-term rents is considerably flatter than that for long-term rents.[7] In other words, the short-term market does not seem to place as high a premium on proximity to the city center as the long-term market, perhaps because short-term renters are less sensitive to commute times and value more residential neighborhoods. In addition, short-term rentals are most profitable relative to long-term rentals in lower-rent and upper-middle-income neighborhoods.

In sum, our empirical results show that as usage has expanded, both the benefits and burdens of the short-term rental market have begun to shift to a growing number of non-central neighborhoods. This spread, which is likely happening to different degrees in other cities, has attracted renewed attention to the short-term market, and calls for regulating short-term rentals have intensified. City leaders around the world have adopted a wide range of approaches. We conclude by reviewing these alternative regulatory responses. We consider both citywide as well as neighborhood-specific responses, like those recently enacted in Portland, Maine or in New Orleans. A promising approach from an economic perspective is to impose fees that vary with intensity of usage. For instance, in Portland, Maine, short-term rental host fees increase with the number of units a given host seeks to register (Billings, 2017), and a recent bill from Representatives in the Commonwealth of Massachusetts (H.3454) propose taxes that vary with the intensity of usage of individual units.[8] Such varying fees may help discourage conversions of long-term rentals to short-term rentals and better internalize externalities that might rise with greater use. That said,

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[7] The Empire State Building is often used as a proxy for the business center of New York City
[8] For review of the bill see https://malegislature.gov/Bills/190/H3454

overly-customized approaches may be difficult to administer. Regulatory complexity itself should also be a criterion in choosing policy responses.

II. Background on Short-Term Rental Externalities

As the short-term rental market has grown, so has discussion about its benefits and costs. Nevertheless, rigorous research is limited. On the one hand, short-term rentals create clear value for travelers and hosts, with median earnings from a typical Airbnb listing in New York City being \$5,367 over the year prior to June 2017.[9] Since short-term rentals are more geographically dispersed than hotels, the benefits of tourism (which include the earnings of Airbnb hosts and increased economic activity for local businesses) are spreading to a greater number of largely residential neighborhoods where hotels are often not permitted.[10]

On the other hand, widespread short-term rental use of residential real estate may impose negative externalities on the surrounding neighborhood. Basic zoning laws, which separate personal and commercial uses, are predicated on the existence of such neighborhood-level externalities. There is considerable evidence that the condition and uses of individual buildings have spillover effects on other properties on the block or neighborhood (Campbell, Giglio, and Pathak 2011; Ellen et al, 2013; Schuetz et al, 2008). While having a neighbor rent their home on a short-term basis is hardly comparable to having a slaughterhouse or even a foreclosed home next door, it might have a modest spillover on nearby properties. Some newspaper articles have quoted nearby neighbors complaining about noise from short-term rentals (Guttentag, 2015), but there is no rigorous research evidence showing that short-term renters are any noisier than long-term tenants. In fact, based on first principles, it is not clear whether increased short-term rental presence would decrease or increase property values.[11]

Another potential externality stems from short-term rentals increasing the number of unfamiliar faces in a building or neighborhood and simultaneously reducing the presence of long-term residents with a stake in the community, which can undermine the social fabric of residential neighborhoods. A recent review of concerns about short-term rentals submitted to the New South Wales Parliament in Sydney, Australia finds some residents expressing general unease about the increasing presence of visitors in their neighborhoods (Gurran and Phibbs, 2017). Some research suggests that a lack of neighborhood cohesion can potentially heighten crime, as residents are less able (or less willing) to monitor their blocks and communities. For example, Sampson, Raudenbush, and Earls (1997) demonstrate a link between a neighborhood's crime level and its level of "collective efficacy," defined as willingness to intervene on behalf of social good, which is driven by social cohesion and trust.

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[9] Available at https://new-york-city.airbnbcitizen.com/june-update-on-one-host-one-home-new-york-city/
[10] See high-level statistics on Airbnb-generated spending here: https://www.airbnb.com/economic-impact
[11] Airbnb hosting income may reduce the likelihood of mortgage defaults and increase owners' incentives to maintain their properties.

These externalities share a characteristic in common: their geographic scope is fairly limited. Airbnb guests in an apartment building impose minimal "unfamiliar faces" costs on residents in other neighborhoods. Similarly, noisy tourists staying in Greenwich Village short-term rentals will not disturb residents of other New York City neighborhoods. This localized effect of the externality suggests localized regulation may be socially efficient. For example, Cohen and Sundararajan (2015) highlight the potential regulatory role of "the increasingly ubiquitous co-op associations, condominium boards, and homeowners associations," arguing that these actors should play a role (and perhaps the central role) in mitigating the effects of such localized externalities, as "the guest-noise and strangers-in-the-building externalities are typically local." Filippas and Horton (2017) go further and argue that noise and stranger externalities exist at the level of the building and thus short-term rental rules should be set and administered by individual buildings. However while noise and stranger externalities are likely to be local, they likely extend beyond buildings, to blocks and even neighborhoods, at least when usage reaches a certain level.

Perhaps the most commonly voiced concern about Airbnb and other short-term rental activity is that such activity may lead landlords to convert long-term rentals into short-term rentals, thereby reducing long-term housing supply in cities that are grappling with housing affordability (Benner, 2017). This concern appears particularly prevalent in supply-constrained cities like New York and San Francisco, where increases in housing prices and rents have been outstripping gains in income. Unlike most of the externalities mentioned so far, this "pecuniary" externality may extend further, perhaps even to the entire local housing market.[12]

Robust evidence about the impact of Airbnb activity on long-term rents is limited. Many cities experiencing significant increases in long-term rental prices have also experienced population growth rates that far exceed their housing stock growth, which is often severely restricted due to regulatory barriers (Elsen, 2015; Glaeser and Gyourko, 2017; Gyourko and Molloy, 2015). Rent control and rent stabilization laws may amplify the effects that unanticipated population growth has on the long-term rental rates of housing stock not subject to these laws. These confounding factors make it particularly challenging to isolate the effect of short-term rentals.

Prior analyses from both Airbnb (Lackner et al., 2015) and from city regulators (Brousseau et al., 2015) to assess the relative importance of Airbnb hosting as a factor in housing costs have often focused on a central metric: if a host takes a long-term rental unit off the market and dedicates it to short-term rental activity, how many nights would they need to host to break even? Our essay contributes to this discussion and sheds light on the matter in New York

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[12] As Filippas and Horton (2017) point out, since any impact the short-term rental market might have on home values and long-term rents is a pecuniary externality, it may not necessitate government intervention because, rather than affecting market efficiency, it simply represents a transfer from one group to another. However, governments sometimes intervene in markets for reasons other than efficiency, and pecuniary externalities can have important distributional consequences. In the case of short-term rentals, pecuniary externalities may represent a transfer from long-term renters to short-term renters and property owners.

City by providing a comprehensive analysis of the distribution and evolution of this ratio of short-term rental to long-term rental rates. Our findings for New York City suggest that the effect Airbnb hosting might have on changes in long-term rental prices through long-term housing stock being repurposed as short-term stock is likely to be minimal. Nevertheless, more comprehensive analyses are needed to fully understand the nature and magnitude of this pecuniary externality, as well as appropriate regulatory responses to this and the non-pecuniary externalities highlighted earlier.

III. Data

We have combined data from Airbnb, the American Community Survey, Zillow,[13] and TripAdvisor,[14] allowing us to extract unique insights about the relationship between short-term rentals, long-term rentals, hotels, and the characteristics of the neighborhoods in which these types of lodging are located. We use census tracts, which typically include about 4,000 people (living in 1,000 to 2,000 housing units), to capture neighborhoods.

Airbnb has provided census-tract level panel data ranging from 2011 to 2016, for "entire home," "private/shared room,"[15] and all listings, on booked listing counts, the median of average nightly earnings,[16] bedroom composition (percent studio, percent one-bedroom, etc.), and heavy-use (rented over 180 days/year) listing counts. We have data only for tracts with six or more Airbnb listings. Further, separate data on entire home listings and individual room listings was only provided if there were six or more listings of each type.

Some researchers use Inside Airbnb[17] data or other third party sources to analyze Airbnb usage and price patterns (Gurran and Phibbs 2017; Gutiérrez et al, 2016; Kakar, Franco, Voelz, & Wu, 2016). Others crawl the web and collect consumer-facing Airbnb data by themselves (Quattrone et al. 2016; Zervas, Proserpio, and Byers 2017). Both data sources have critical limitations. First, these approaches rely on Airbnb advertised listings rather than booked listings, which means they are not capable of determining whether an advertised listing was booked or not and are likely to overestimate bookings. For example, some advertised listings are outdated or accidentally created and have

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[13] Zillow is an online real estate database company that was founded in 2006

[14] TripAdvisor provides hotels booking as well as reviews of travel-related content

[15] We group "private room" and "shared room" Airbnb listings, and use the term "individual room" interchangeably with "private/shared room" for brevity. Shared rooms are a tiny fraction of Airbnb listings.

[16] In order to properly compare short-term to long-term rental rates within census tracts, we must account for differing bedroom composition of Airbnb vs Zillow listings. To do this, we reweight the Airbnb rent estimates using the bedroom composition of Zillow rental listings. That is, we calculate the median rent for Airbnb listings of each bedroom type by census tract, and then weight these Airbnb bedroom-specific median rents using the borough-year bedroom composition of Zillow rental listings. We restricted our data to stays lasting fewer than 30 nights on Airbnb to construct the bedroom-specific short-term rent estimates.

[17] InsideAirbnb.com is a non-commercial source of data derived from publicly available information on Airbnb's website. It provides point-in-time information about Airbnb listings, and is not associated with Airbnb.

zero Airbnb booking activity. Scrapers that track updates to host calendars cannot distinguish real bookings from dates host block for other reasons. Second, and related, they fail to collect accurate occupancy rates. For example, Inside Airbnb combines a number of assumptions to estimate these, using the number of reviews, review rate, minimum stay length, and average stay length.[18] Third, these sources collect Airbnb asking prices rather than transaction prices. Some asking prices are far above the market price, resulting in no booking activity, and in other cases guests receive lower rates via negotiations with the host or longer-term stay (e.g. 7+ days) discounts. Using asking prices overestimates Airbnb prices and profitability, and consequently, measures of short-term rental rates.

To capture census tract level rents, we use Zillow Rent Index data, which has been provided for each month in our study period. This dataset is constructed using Zillow's Rent Zestimates, which are generated via a hedonic model trained with public property data and rental listing info.[19] Zillow also provided data on the bedroom composition of rental listings (# of studio, # of one-bedroom, # of two-bedroom, and # of three-bedroom) at the census tract level from 2011 to 2016.[20] We combine the Airbnb and Zillow data with American Community Survey 2011–2015 five-year average census tract estimates of the number of housing units, the percent of the population over 25 years of age with at least a bachelor's degree, and median household income. Additionally, we have collected location and review data of 578 New York City hotels from TripAdvisor in 2016.

To construct the ratio of short-term to long-term rents, we divide the weighted median Airbnb entire home average earnings per night by the Zillow Rent Index rent per night in each tract. This gives us an estimate of the short-term to long-term rental ratio for 534 tracts in 2016 (the tracts for which both Airbnb and Zillow Rent Index data exist), or roughly one quarter of the 2,167 New York City census tracts in our data. These contain 28,540 entire home listings with a booking in 2016, representing 88% of the city's booked entire home listings that year. Of these tracts, 198 are in Manhattan, 254 are in Brooklyn, and 80 are in Queens.[21]

IV. Usage Intensity

In this section, we examine how the intensity of Airbnb usage differs across the city's census tracts and how usage patterns have changed between 2011 and 2016.

[18] See the Inside Airbnb "San Francisco Model" at http://insideairbnb.com/about.html
[19] See https://www.zillow.com/research/a-peek-inside-our-newest-zestimate-the-rent-zestimate-1076/.
[20] Zillow rent estimates are based on listings that may not be representative of the entire rental stock, particularly in the earlier years of our sample. Zillow estimates are based on listed prices, which may be higher than transacted rents. Granular transacted-price rent data are difficult to obtain, but we believe the Zillow rent dataset to be one of the most comprehensive and accurate available.
[21] The tracts for which we have rental ratio data are, on average, more central, higher income, and higher rent, relative to New York City overall. In this subset of tracts, the median across tracts of median household income (based on 2011-2015 ACS estimates) is $59,397, compared to $54,563 citywide, the median Zillow Rent Index in 2016 is $2,816, compared to $2,267 citywide, and the median distance to the Empire State Building is 6.8 km, compared to 12.9 km citywide.
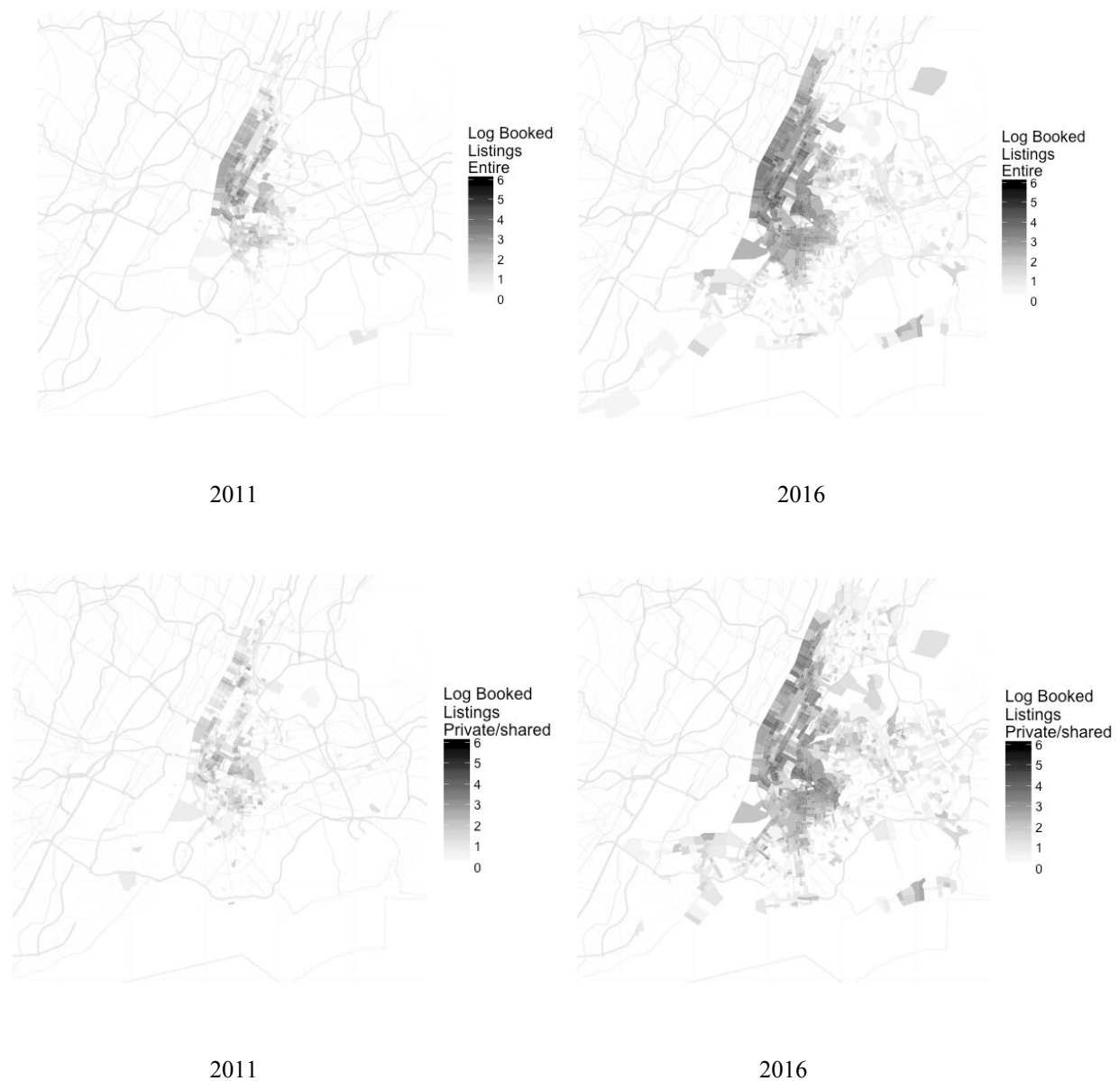
2011   2016

2011   2016

Figure 1: Booked Entire Home and Private/Shared Room Airbnb Listings in NYC Census Tracts

Our first finding is that *as Airbnb usage has grown, listings have become more geographically dispersed over time.* The number of census tracts with at least one booked listing rose from 723 (33 percent of NYC census tracts) in 2011 to 1,744 (87 percent of NYC census tracts) in 2016,[22] and the percentage of booked listings that were located in Manhattan decreased from 66 percent in 2011 to 54 percent in 2016. The average distance to the Empire State Building increased from 4.8 km in 2011 to 6 km in 2016.

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[22] The number of census tracts with at least six booked Airbnb listings (the restricted sample for which we have price data) rose from 371 (17% of NYC census tracts) in 2011 to 937 (43% of NYC census tracts) in 2016.
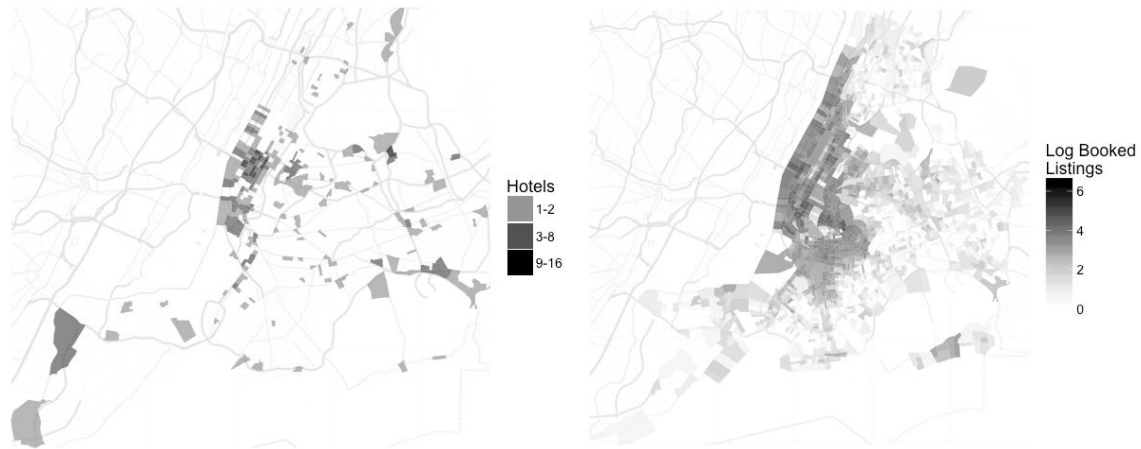
Figure 2: Hotels and Airbnb Listings in NYC Census Tracts, 2016

By 2016, booked Airbnb listings were considerably more geographically dispersed than hotels. In 2016, TripAdvisor data included information on 578 New York City hotels, which were located in 215 (or ten percent) of the city's census tracts. While TripAdvisor's coverage may be limited, hotels are clearly located in a much smaller set of census tracts than Airbnb bookings, which in 2016 reached nearly 90 percent of the city's census tracts. Hotels also appear to be more centralized, perhaps due to the zoning rules that constrain them to be located in commercially zoned neighborhoods. Nearly two thirds of hotels (and likely a larger percentage of hotel rooms) are located in Manhattan, as compared to 54 percent of Airbnb booked listings.

Despite the dispersion trend, centrality remains an important predictor of Airbnb listing location. In 2016, 28% of booked Airbnb listings were within 3km of the Empire State Building, 46% were within 5 km, and 87% were within 10 km. Usage is heaviest in central neighborhoods of Manhattan and Northern Brooklyn. Further, "booked entire home intensity," defined as the number of entire home listings booked at least once over the year-long time frame as a percentage of the housing stock, falls with distance from the center of Manhattan. Booked entire home intensity averages roughly 3–5% in neighborhoods that are within 3 km of the Empire State Building and drops to well under 1% in neighborhoods more than 10 km away.

Similarly, the share of housing units booked more than 180 nights in 2016 ranges from 0.3% to 0.5% of the housing stock in neighborhoods that are within 3km of the Empire State Building, and drops to well under 0.1% in neighborhoods more than 10 km away. Most tracts have between 1,000 and 2,000 housing units, meaning there are generally fewer than ten 'heavy-use' entire home listings in central tracts, and few to none in less central tracts. On average, roughly ten percent of booked Airbnb entire home listings are rented more than 180 nights per year.[23]

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[23] Note that Airbnb listings may include boutique hotels, accessory dwelling units, and other specialty listings that one might expect would be booked over 180 days per year. The dataset does not offer further detail on the nature of the listings, beyond what we describe in the Data section.
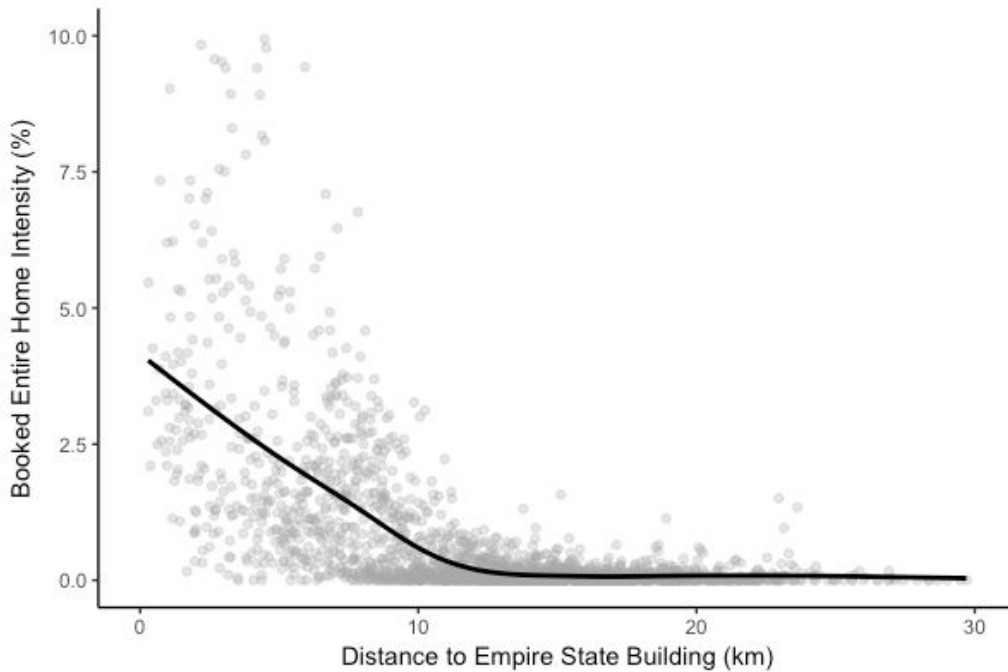
Figure 3: Airbnb Booked Entire Home Intensity vs Distance to Empire State Building, 2016: Black curve represents the fit of a generalized additive model.

Usage is concentrated in neighborhoods with incomes above the citywide median, but neighborhoods with somewhat lower incomes have grown in popularity. Table 1 illustrates neighborhood characteristics of the average Airbnb booked listing in 2011 and 2016 and shows that the average Airbnb booked listing in 2011 was in a census tract with a median household income of $82,000 in 2011, compared to $73,000 in 2016. In both years, these incomes were above the citywide household median income (which was $53,000 in the 2011-2015 ACS five-year estimates), but usage is clearly spreading to relatively lower income areas. Similarly, the share of college graduates in the neighborhood of the average Airbnb booked listing is high relative to the share of the city as a whole (which was 35.7% in the 2011-2015 ACS five-year estimates), but again, it is declining over time. Finally, the average Airbnb booked listing is located in neighborhoods with a relatively large share of young adults (the share of age 25-34 in the city was 17.6% in the 2011-2015 ACS five-year estimates), though this proportion is declining over time.

Table 1: Listing-Weighted Averages of Airbnb Tract Characteristics in 2011 and 2016[24]

Characteristic	2011	2016
Household Income	$82K	$73K
Distance from Empire State Building	4.8 km	6.0 km
Share College Graduates	62%	54%
Share Age 25–34	27.0%	25.6%

Individual room listings have grown in number more quickly than entire home listings. In 2011, booked entire homes represented 68% of all booked listings, compared to 53% in 2016. Both types of listings grew every year during our study period.

Lower income neighborhoods disproportionately feature individual room listings (compared to entire home listings). Figure 4 shows that a higher proportion of the listings in lower income neighborhoods are individual rooms rather than full homes. In tracts with median household income less than $40,000, close to 65 percent of booked listings are individual rooms. This percentage decreases linearly with a tract's median household income, with only a quarter of booked listings in the highest income tracts being individual rooms. In 2016, a full 50% of booked individual room listings in NYC were in tracts in the bottom half of the income distribution, compared to 27% of booked entire home listings.[25] This suggests that hosts in lower income areas may be more apt to share spare space in their primary residence.

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[24] Based on ACS 2011–2015 tract-level estimates.
[25] Based on 2011–2015 ACS tract-level median household income estimates, which exist for 97% of NYC census tracts. In 2011, 41% of booked individual room listings in NYC were in tracts in the bottom half of the income distribution, compared to 17% of booked entire home listings.
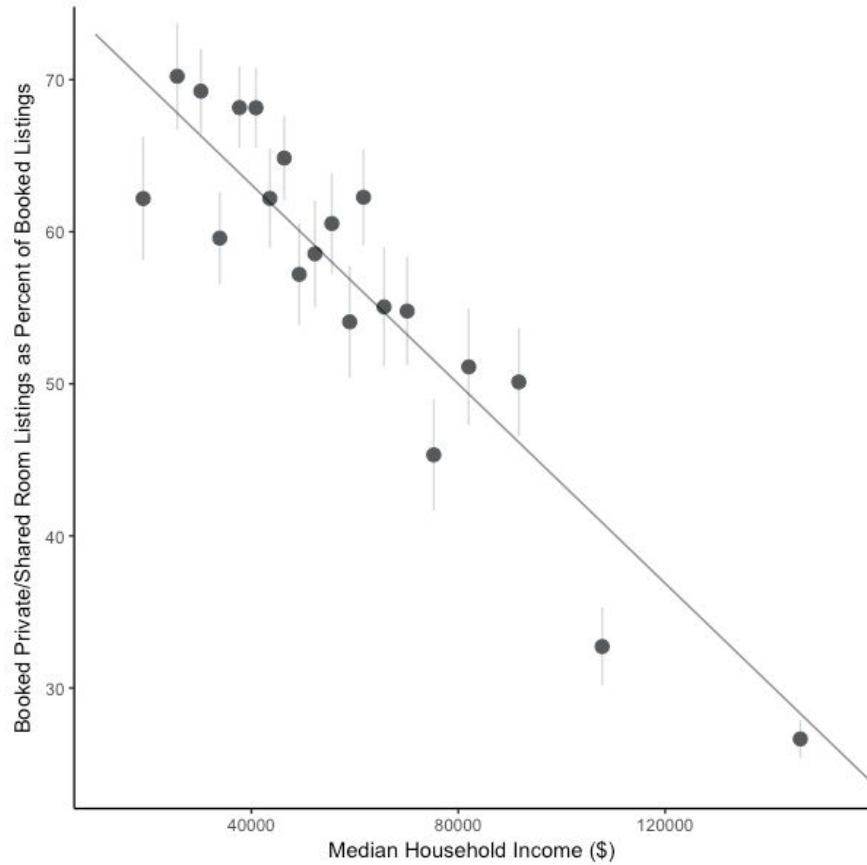
Figure 4: Median Household Income vs Private/Shared Room Percent in NYC Census Tracts, 2016:
We divided tracts into twenty equal-sized bins, ordered by income. The average income in each bin is plotted against the average percent of booked listings that are individual rooms, with bars representing one standard error. The line represents the least-squares fit based on the underlying data.

The patterns described above hold up in a regression of listing intensity on neighborhood location and income. For each additional kilometer from the Empire State Building, the Airbnb listing intensity in a census tract drops around 0.2 percentage points. Airbnb listing intensity is significantly higher in Manhattan and Brooklyn. Compared to individual room listings, entire home listings are more concentrated in Manhattan. Controlling for centrality, usage intensity tends to be higher in neighborhoods that are higher income, though usage falls off for the very highest income neighborhoods, perhaps because households in those neighborhoods place relatively low value on the added income they can earn through the short-term market.

Table 2: Regression Results for Airbnb Listing Intensity (%) in 2016

	All Listings (1)	Entire Home (2)	Private Room (3)
Distance to Empire State Building (km)	-0.214***	-0.110***	-0.104***
	(0.0124)	(0.00507)	(0.00957)
Median Income ($1,000)	0.0415***	0.0306***	0.0109**
	(0.00579)	(0.00236)	(0.00446)
Median Income Square	-0.000230***	-0.000142***	-8.71e-05***
	(3.43e-05)	(1.40e-05)	(2.64e-05)
MN	0.999***	0.764***	0.236
	(0.252)	(0.103)	(0.194)
BK	0.590***	0.206***	0.384***
	(0.163)	(0.0665)	(0.125)
QN	-0.498***	-0.362***	-0.135
	(0.166)	(0.0677)	(0.128)
Constant	2.472***	0.812***	1.659***
	(0.277)	(0.113)	(0.213)
Observations	2,101	2,101	2,101
R-squared	0.264	0.429	0.106

Note: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

V. Rents: Short-term versus Long-term

Some housing advocates worry that short-term rentals are displacing long-term rentals. However, we find that overall, *short-term rentals do not appear to be as profitable, relative to long-term rentals, as many assume.* In 2016, the listing-weighted average ratio of median short-term nightly rents for entire homes to estimated nightly earnings from long-term rents across the city's neighborhoods was roughly 1.7. This suggests that to match long-term rental revenue, hosts would have to have their homes booked over 216 days a year, the "break-even" number of short-term rental nights. Placed in context, as of June 2017, the median number of nights booked for a typical entire home listing in New York City was 46.[26] In fact, this revenue-based calculation may be conservative, since it assumes zero transaction costs when short-term rental hosts must manage guest reservations and clean their homes between booking—generating costs that likely exceed those of long-term rental landlords.[27] The remainder of the section explores this relative profitability of short to long-term rentals over time and across neighborhoods.

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[26] See https://new-york-city.airbnbcitizen.com/june-update-on-one-host-one-home-new-york-city/

[27] According to a calculator offered by Handy.com, a marketplace for short-term rental management services, cleaning costs for a one, two, or three bedroom unit in Manhattan are $57, $84, and $111 respectively. See https://www.handy.com/quotes/new?service=52 for details.
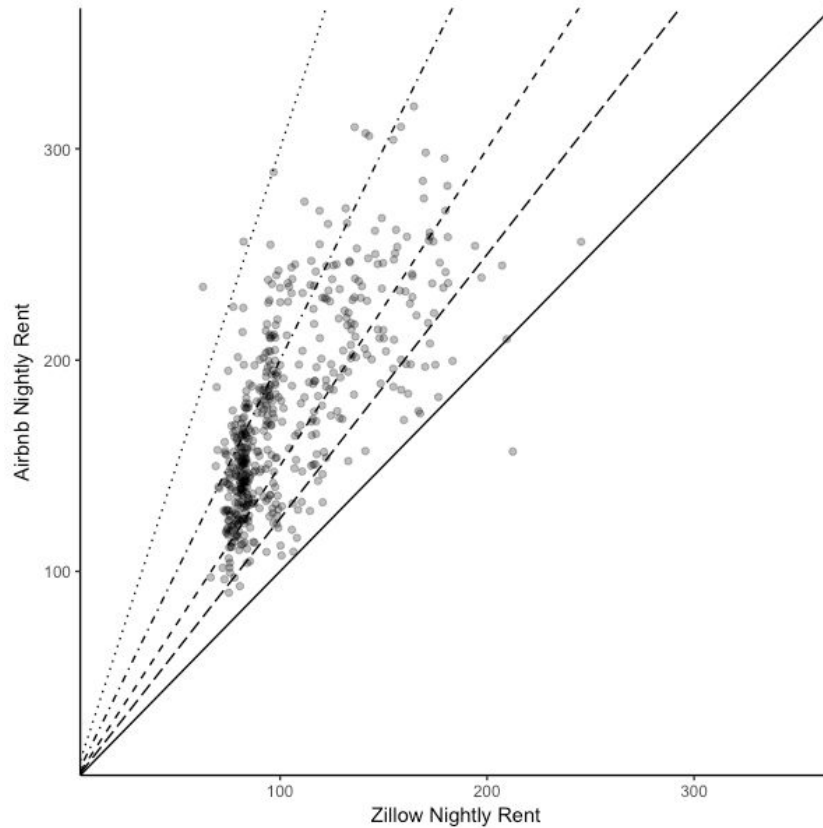
Figure 5: Airbnb Entire Home Rent vs Zillow Rent Index, Census Tracts in 2016: Lines represent short-term to long-term rental ratios of 3 (dotted), 2 (dash-dot), 1.5 (dash), 1.25 (long-dash), and 1 (solid).

The short-term rental market became relatively less profitable between 2011 and 2016, as short-term rents remained flat, while median long-term rents rose by 19 percent in the same neighborhoods. Table 3 shows that across New York City, the listing-weighted average ratio of nightly short-term to long-term rents fell from 1.88 at its peak in 2012 to 1.69 in 2016 (and correspondingly, the number of nights required to outcompete the long-term rental market increased from 194 to 216). The greater stability of short-term rents is likely explained by the greater elasticity of the stock. When short-term rental demand increases, putting upward pressure on prices, residents can easily make their empty spaces available. The long-term rental supply is far less responsive to demand shifts, due to lengthy approval processes and other regulatory hurdles to housing construction, which are particularly burdensome in New York, according to the Wharton Residential Land Use Regulatory Index.

Table 3: Listing-Weighted Average STR/LTR Ratio (Break-Even Nights[28]) by Borough and Year[29]

	2011	**2012**	**2013**	**2014**	**2015**	**2016**
Manhattan	1.73 (211)	1.81 (202)	1.83 (199)	1.73 (211)	1.56 (234)	1.54 (237)
Brooklyn	2.04 (179)	2.09 (175)	1.98 (184)	1.98 (184)	1.96 (186)	1.95 (187)
Queens[30]	NA	NA	2.23 (164)	1.97 (185)	1.90 (192)	1.93 (189)
NYC	1.80 (203)	1.88 (194)	1.88 (194)	1.81 (202)	1.70 (215)	1.69 (216)

There is substantial variation across neighborhoods in relative rents. Brooklyn and Queens had listing-weighted average ratios of approximately 2 in 2016, while Manhattan had a significantly lower ratio of roughly 1.5. This implies that an apartment in Manhattan would need to be rented out an additional 50 nights in a year to outcompete the long-term rental market, compared to a similar apartment in Brooklyn or Queens. As shown in Figure 5, the short-term to long-term ratio is closer to 3 in a handful of outlier tracts in Central Brooklyn and Queens, suggesting that hosts would have to rent their homes for about 120 days to achieve parity with the long-term rental market.

The STR/LTR ratio is generally higher in lower-rent neighborhoods, middle-income neighborhoods, and neighborhoods outside of Manhattan. In other words, the premium that long-term renters are willing to pay to live in the city's most central, highest rent neighborhoods exceeds the premium that short-term renters (visitors) are willing to pay to live in those same neighborhoods. Figure 6 shows how the number of break-even nights falls steadily with distance to midtown Manhattan in 2016. For example, listings in census tracts with break even nights below 146 (rent ratio > 2.5) were an average of 8.6 kilometers away from the Empire State Building in 2016, as compared to just 4 kilometers for those in tracts with break even nights more than than 243 (rent ratio < 1.5). None of the census tracts with short-term to long-term rent ratios greater than 2.5 were located in Manhattan.

Figure 6 also shows that homes in lower-rent neighborhoods need to be rented out for fewer nights on the short-term

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[28] Break-even nights=365/(STR/LTR ratio). Transaction costs are assumed to be zero.
[29] Numbers for the Bronx and Staten Island are not reported due to an insufficient sample size.
[30] Estimates are not reported for Queens in 2011 and 2012 due to an insufficient sample size (five or fewer tracts) in those years.

market to break-even with the long-term market. As for neighborhood income, the relationship between break-even nights and income is U-shaped, with the most profitable neighborhoods being those with incomes just above the citywide median.

These findings suggest that residents of less central, lower-rent, upper-middle-income neighborhoods may simultaneously have the most to gain from home sharing, while also being at risk for dislocation by investors that may seek to remove units from the long-term rental market. However, individual rooms represent 56% of listings outside of Manhattan—and a surprising 71% of listings in the Bronx—suggesting that most hosts in these neighborhoods are residents, rather than investors. And even in these neighborhoods, the risk of conversion appears to be limited, given the relative payoffs from the short-term and long-term rental markets. That said, the topic merits further research.
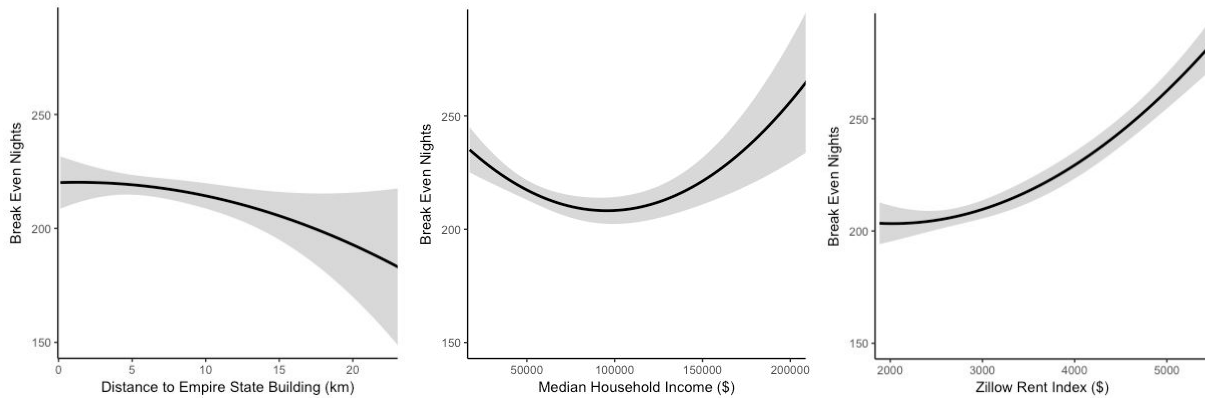

Figure 6: Break-Even Nights vs. Distance to Empire State Building, Income, and Rent in 2016: Lines depict quadratic best fit, with standard error bands in gray. The "break-even nights" estimate is defined as 365/(short-term to long-term rental ratio); that is, the number of nights required for a unit to earn as much as it would in the long-term rental market.

Figure 7: Map of Break-Even Nights in NYC Census Tracts, 2016

VI. Regulatory Responses

The rapid expansion of platform-based short-term rental activity has prompted cities to modernize existing regulations or adopt new ones. Drawing on economic theory as well as our empirical findings, we review options aimed at regulating short-term rental usage, which ideally serve the purpose of minimizing pecuniary and non-pecuniary externalities on city residents while preserving economic value. Given the significant variation we observe across neighborhoods and modes of use, we highlight the importance of approaches that address this variation. For example, since most hosts are occasional users and many rent out single rooms rather than entire homes, regulation that avoids overburdening this group is likely in order. Dedicated hosts should attract more regulatory scrutiny—perhaps more so in areas where their concentration is highest. Our empirical evidence can help guide regulations that permit economically valuable activity at levels that minimize negative spillovers.

Cities around the world have adopted a wide range of approaches to regulating short-term rentals with varied objectives. One concern is ensuring taxes are collected on short-term rental activity, with some cities requiring hosts to register and remit taxes directly to the government (e.g., San Francisco until recently) and others asking platforms

like Airbnb collect and remit taxes, as in Amsterdam, Lisbon, and London.[31] As for quality and safety concerns, most cities appear to have implicitly delegated cleanliness and hygiene issues to the platforms (whose peer-feedback-based reputation systems can provide an effective self-regulatory solution to this issue of information asymmetry).[32] Issues of public safety are more complex, but short-term rentals are bound by standard housing and building codes, such as requirements for smoke detectors, safe electrical wiring, and clean water.[33]

In this section we assess regulatory responses that specifically address externalities tied to usage levels, as described in Section 2, and primarily consider interventions governments have recently enacted. We focus on *how* the usage limits should be designed, and do not cover the important and legally complex question of *who* will enforce them.[34] We do not advocate for any single approach, given the uncertainty about the nature and magnitude of any externalities, and how these might vary across geographies. Rather, we use an economic lens, as well as our empirical findings, to lay out strengths and weaknesses of different approaches.

Bans

Some municipalities, such as Fort Lee, New Jersey[35] or Santa Monica, California,[36] have enacted outright bans on unhosted short-term rentals. Others have imposed restrictions, either for particular types of properties or for selected neighborhoods. For example, Portland, Maine bans short-term rentals in single-family homes that are not owner-occupied, with the exception of the islands off the coast of Portland which have a long history of vacation rentals (Billings, 2017). In New Orleans, short-term rentals are banned in the French Quarter (Adelson, 2017). In Chicago, an alderman can propose that a precinct become a "restricted residential zone," in which short-term rentals cannot operate, and the City Council voted to approve the first restricted zone in June, 2017, when the alderman of the 13th ward was able to secure valid signatures from 25 percent of registered voters in four of the Ward's 48 precincts (Spielman, 2017). New York City bans rentals of fewer than 30 days in buildings with three or more units

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[31] As of September 2017, over half of Airbnb's US listings were in jurisdictions where Airbnb collects and remits taxes on behalf of hosts. This approach is a specific example of a broader philosophy of "data driven delegation" advocated in Sundararajan (2016a and 2016b).

[32] An extensive literature about online reputation systems has documented similar mitigating effects for problems of information asymmetry across a range of peer-to-peer marketplaces (e.g., Fradkin, Grewal, and Holtz (2017)). For discussion of the possible scope of reputation systems replacing government regulation, see Sundararajan (2012).

[33] In fact, buildings classified for transient use face stricter fire safety standards in New York City (vs those designated for permanent occupants), since transient occupants are believed to face greater risks in the event of a fire due to unfamiliarity with a building's escape routes and emergency procedures (Parcerisas and Watson, 2017)

[34] Cohen and Sundararajan (2015) explain the short-term rental digital platform should be viewed as an efficient actor to solve the negative externality caused by itself due to its tremendous potential enforcement capacities.

[35] The Fort Lee municipal laws require a minimum stay of 30 consecutive days (Lang, 2017)

[36] Santa Monica City Council bans the rental of an entire unit for less than 30 days (Sanders, 2015)

if the permanent resident is not present, and imposes steep fines on illegal short-term rental units (Dobbins, 2017).[37]

From an economic perspective, bans are generally an unnecessarily blunt and inefficient approach to addressing externalities; there is likely to be some level of short-term rental activity for which the benefits outweigh the full social costs. While eliminating the possibility of any negative externality, bans also eliminate all value that would have accrued to hosts who could have earned income, guests who would prefer to stay and spend in the banned area, and the municipality that would have received tax dollars. For example, we estimate—very roughly—that the ban on short-term rentals in buildings of three or more units in New York City, if enforced, might impact $140M to $350M in host income.[38]

Caps on number of short-term rental nights

A number of jurisdictions have adopted caps on the number of nights a host can offer their unit as a short-term rental. The motivation behind this approach is that such a cap sharply reduces the incentive for a landlord or entrepreneur to convert a long-term rental into a short-term rental, while still allowing full-time residents to share their homes.[39] For example, Japan recently passed a nationwide law imposing a 180-night cap on all short-term rental units,[40] a level that is also in place in Philadelphia.[41] London allows residents to rent out their units in the short-term market for a maximum of 90 nights per year.[42] Most caps do not apply to "hosted" stays, meaning the Airbnb host is present during the stay, as is the case with the vast majority of individual room listings.[43] For example, the 180-night cap in San Jose,[44] as well as the 90-night cap in New Orleans (Adelson, 2017), apply only to unhosted stays.

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[37] We have little data on enforcement, but it is driven by complaints, as the Mayor's Office of Special Enforcement only inspects properties in response to the 311 complaints (Parcerisas and Watson, 2017). From February 2017 to April 2017, nine individuals or entities had been fined a total of $65,000 (Dobbins, 2017).

[38] The median entire home listing earns $5-6k over the course of a year in NYC. Since the earnings distribution is skewed to the right, we use $6k to $12k as a range for entire home average annual earnings. In 2016, there were 32.5k entire home listings with a booking in NYC, and 71 percent of NYC housing units were in buildings with 3 or more units, according to the ACS. To construct our estimate, we use a range of 70% to 90% for Airbnb entire home units in buildings with three or more units, understanding that this might be incorrect. Combining these ranges, we estimate that the impact on host income ranges from roughly $140M to $350M.

[39] Explanatory notes from the UK Deregulation Act 2015, Sections 44-45, which regulates London short-term rentals, state that "The purpose behind the provision was to protect London's existing housing supply, for the benefit of permanent residents, by giving London boroughs greater and easier means of planning control to prevent the conversion of family homes into short term lets." See
http://www.legislation.gov.uk/ukpga/2015/20/notes/division/5/46

[40] For review of the regulation, see http://airstair.jp/minpaku_new_law/

[41] For review of the regulation, see http://www.phila.gov/li/PDF/Limited%20Lodging%20Information%20Flyer.pdf

[42] For review of the regulation, see http://simplyhospitality.com/short-term-lets-uk-rules-regulations/

[43] According to Airbnb survey data from 2016, 92% of hosts who said that they rent a private or shared room in NYC said that they rent their primary residence, defined as the place they live in for most of the year (sample size of 348).

[44] For review of the regulation, see http://sanjoseca.gov/DocumentCenter/View/37863

These regulations have the advantage of mostly affecting commercial, rather than casual users, as few permanent residents can rent their units for more than 90 nights in a year. Further, our finding that lower-income areas in New York disproportionately feature hosted, individual room stays, suggests that exempting hosted stays may have progressive distributional effects. However, the blunt nature of night caps also has drawbacks. Primary among these is that several classes of non-commercial units would also be impacted. One such class are Accessory Dwelling Units (ADUs), small and sometimes partial units that are attached to one's primary home. In some cases, homeowners will make the choice of whether to use this space for short-term or long-term rentals. But in many cases these units are not appropriate for long-term rentals due to lack of a kitchen or other functionality, or because the homeowner wishes to maintain the flexibility to house visiting family members or friends.[45] Another class of non-commercial units affected are second homes, which may take the form of vacation rentals, or in cities as pied-à-terres. These spaces embody the type of space for which the sharing economy is perhaps best suited. Without short-term rentals, many of these ADUs and second homes would be left empty, and cities would have not reduced any of the pecuniary externalities the caps were intended to limit.[46]

A further drawback to the night-cap form of regulation is that it may be very difficult for a city to monitor "cross-platform" activity. In some cities, hosts must register their unit as a short-term rental, and Airbnb has committed to monitoring the number of nights booked to ensure hosts stay below legal limits. While a single platform may agree to monitor and limit the number of nights a unit may be listed, units may also be listed on other platforms, as well as on advertising sites like Craigslist. In this case, the city must take on the responsibility of collecting nights information from multiple platforms, matching listings between platforms, monitoring totals, and reporting information back to platforms in a timely fashion. The technical complexity of this form of regulation is itself a drawback. Worse, platforms that choose to comply with the regulation are potentially at a disadvantage to those who choose not to comply, making it competitively unfavorable for any platform to be the first to participate in joint regulation.

Caps on number of short-term rental units

A few cities have opted instead to allow activity but to introduce citywide or localized caps on the number of short-term rentals, often distinguishing between permanent residences and dedicated short-term rentals. The underlying assumption behind this approach is that externalities are likely to be minimal so long as tourism activity is sufficiently dispersed and dedicated short-term rentals remain a small percentage of the housing stock. For

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[45] Jurisdictions could address this inefficiency by treating ADU rentals as "hosted," and not subject to a cap.

[46] On the margin, short-term rentals could potentially increase the prevalence of second homes by making ownership more affordable. But banning short-term rentals is an inefficient means of limiting second homes (compared to, say, a second home tax), as it would encourage existing second homes to remain empty.

example, the City Council in Portland, Maine recently passed a law limiting the number of non-owner occupied units in multifamily buildings that can be registered as short-term rentals to 300 (excluding the islands), a number that is slated to be reviewed annually by the City Council (Billings 2017). The City of Nashville has adopted a cap on the number of non-owner occupied single family short-term rental properties allowed in each census tract of Davidson County—interestingly, rather than setting a fixed cap, the cap is set as a percentage of each tract's housing stock, allowing the number of dedicated short-term rentals to grow with the housing stock.[47] The City of Chicago has targeted localized externalities by recently amending its municipal code to limit the number of units in a building that can be used as short-term rentals—regardless of owner-occupancy—to six, or a quarter of the units in a building, whichever is less (Associated Press, 2017).

This class of regulation has the potential to be more efficient than outright bans, and, depending on implementation, a blanket night cap on all short-term rental nights. These regulations commonly recognize that there are two fundamentally different types of short-term rental units—the occasionally rented permanent residence and the dedicated rental or second home—and they treat these categories differently. In doing so, they can target localized externalities and ensure that full-time short-term rentals remain a small percentage of the housing stock.

However, unit caps can also have drawbacks. They target the number of units rather than the intensity of nightly use, which may better proxy externalities related to tourism levels. For example, in Portland, Maine, the cap on registered units might mean that on some nights, there may be just a handful of short-term rentals booked, while on others there are 300 booked (Billings 2017). An analogy that highlights this possible inefficiency is limiting traffic congestion by regulating the number of cars people own rather than the number of miles they drive. Unit caps also raise the challenge of how permits should be allocated, and what the correct number of permits is. Experience from the taxi medallion world suggests that once a cap level is chosen, it can be hard to adjust, as this might require new legislation, and incumbents would likely resist increases (Horwitz and Cumming, 2012). For example, Honolulu County in Hawaii has not issued a single new short-term rental permit since 1989, despite precipitously increasing demand (Associated Press, 2017). Finally, if permit levels are chosen across too wide a geographic region, limits would potentially bind even if there are sub-regions where higher levels of activity would be welcome.

A hybrid regulatory approach would combine night caps with unit caps. For example, a city might allow short-term rental activity in any housing unit up to a certain number of nights per year, and also issue licenses for a tolerable number of uncapped units, dependent on the housing stock, that would accommodate second homes or other dedicated rentals.

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[47] For review of the regulation, see
http://www.nashville.gov/Codes-Administration/Construction-and-Permits/Short-Term-Rentals.aspx

Regulating activity levels via taxes and fees

Another approach that is widely used in other contexts (ranging from traffic congestion to environmental pollution) that feature negative externalities is to charge fees or taxes on usage (Baumol, 1972). The principle behind this approach is that properly-designed taxes allow the highest value activity to take place, but limit activity that generates the most negative externalities. The taxes generated can also be used as pecuniary transfers to agents affected more by the externalities.

Taxes and fees in short-term rentals currently take several forms. As described earlier, in most cities hosts are required to pay a transient occupancy tax (a.k.a. TOT, or hotel tax). In some cities, hosts are additionally required to pay annual registration fees to legally operate as short-term rentals. Beyond simply being a source of revenue for the city, these taxes and fees can also be an efficient lever to regulate activity levels, especially if they increase with usage and dissuade owners from converting long to short-term rentals. For example, in Portland, Maine registration fees increase with the number of units registered by a host (Billings 2017). Such a regime captures the principle that a host with one unit may well be renting out their primary residence (while traveling) or second home, but a host with multiple units is likely not, and will be taxed appropriately.

A challenge associated with taxes and fees is their potential for regressive distributive effects. For example, active hosts who live in more valuable homes that command higher short-term rents can more easily afford a fixed registration fee, which would exclude hosts who are less active or live in socioeconomically less favorable neighborhoods or properties. One possible way to differentiate between casual and commercial hosts is to impose a *threshold*: allow hosts to rent their unit up to a threshold number of nights without paying any fee, and charge a fee that escalates with usage after that. For instance, in Philadelphia, hosts may rent out their space for up to 90 nights a year without registering with the city, but they must register and pay a fee as a "Limited Lodging Home" if they host between 91–180 nights, and must further secure a "Visitor Accommodations" permit if renting for more than 180 nights. This approach mitigates the regressive nature of a flat fee, which would otherwise discourage the most casual, non-commercial users of the platform. Alternatively, percentage-based taxes (like TOTs) could vary based on the intensity of usage of a particular unit. For example, Massachusetts recently proposed higher tax rates after a listing books 60 nights, which would presumably discourage conversion of long term rentals.[48] More generally, a high tax on listings rented above some number of nights could be used to ensure second homes and other units that would otherwise remain empty are utilized, but other housing units are not converted into short-term rentals.

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[48] Bill (H.3454) proposes to impose a four percent tax on earnings from "residential" listings, defined as primary residence listings rented fewer than sixty nights per year, and to impose an eight percent tax on "commercial" listings, defined as non-primary residences or units rented more than sixty nights per year (a city or town may impose an additional local excise tax of up to five percent on residential listings and ten percent on commercial listings). See https://malegislature.gov/Bills/190/H3454

Localized Regulation

While most jurisdictions have adopted a single, city-wide set of rules, we show significant variation in the prevalence of short-term rentals together with variation in their relative profitability across New York City's neighborhoods. This variation raises the possibility of neighborhood-specific regulatory responses, like those recently enacted in Portland, Maine,[49] New Orleans,[50] or Chicago (if residents vote to support).

A flexible regulatory scheme might naturally result in different neighborhoods having different levels of regulation. For example, a city-wide regime that minimally regulates casual, part-time hosts but registers, taxes, and caps the number of full-time hosts may leave some neighborhoods preferring more tourist activity, and other neighborhoods preferring less. Because of this heterogeneity across neighborhoods and their preferences, along with the observed variation in short-term rental concentrations, there is an economic argument for neighborhood-specific rules. Neighborhoods differ in their long-term rental market characteristics, desire for economic impact and development, and preferred levels of tourism. Regulation for a community concerned about neighborhood change may not be right for a predominantly vacation rental zone. Said differently, the nature and level of externalities may depend on the neighborhood itself, hence the case for a localized response.

One form of highly localized regulation is that enacted by homeowner associations (HOAs). HOAs might be particularly well equipped to target localized spillovers, like turnover and noise. Cohen and Sundararajan (2015) elaborate on this point: "The existence of [HOAs] in the potential regulatory mix suggests an interesting potential division of regulatory responsibility—delegate regulatory responsibility relating to information asymmetry to platforms like Airbnb (whose interests are naturally aligned with the global aggregation of information and the mitigation of adverse selection and moral hazard), and let HOAs play a key role in the regulation of local externalities, as the guest-noise and strangers-in-the-building externalities are typically local and primarily affect HOAs' membership. Homeowners and renters have a continuous, high-bandwidth relationship with their HOA; these organizations are credible, can monitor compliance, and possess robust enforcement capabilities. Buildings and communities may then naturally differentiate into "Airbnb-friendly" and "Airbnb-free," allowing future buyers and renters to self-select."

However, neighborhood approaches may be less appropriate if localized externalities from the increased presence of non-residents spread to other neighborhoods and undermine quality of life in a city as a whole. They are also not appropriate if there is evidence of citywide spillovers from the removal of long-term rentals from the housing stock.

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[49] Portland caps the number of short-term units in non-owner-occupied buildings at 300, excluding the islands (Billings 2017).

[50] Short-term rentals are banned in the French Quarter, but legal in other neighborhoods with licenses (Adelson 2017).

Further, localized regulations or fees could be complex to administer, could be confusing for city residents and guests, and might have concerning distributional effects.

VII. Conclusion

Before crafting the most efficient and equitable responses, cities need more empirical work to understand the evolution of the short-term rental market and the nature of the externalities associated with it. We have taken a step in this direction, describing the usage patterns and relative profitability of Airbnb in New York City, across neighborhoods and over time. Between 2011 and 2016, Airbnb spread to less central, residential neighborhoods, where short-term rentals tend to be more profitable relative to the long-term rental market. However, overall, the short-term rental market does not appear to be as profitable as many assume—even in these less central, residential neighborhoods—and it has become relatively less profitable over time. Given the limited incentives to convert housing units that we observe in the data, along with the downward trend in these incentives over time, it seems unlikely that Airbnb is currently having a major effect on the affordability of rental housing in New York City.

Using an economic lens, we reviewed the advantages and disadvantages of different regulatory approaches designed to address the externalities that may arise from the short-term rental market, including bans, night-caps, unit caps, taxes, and fees. Bans, on one end of the spectrum, eliminate the possibility of any negative externality arising from the short-term rental market, but they also eliminate all value that would have accrued to hosts, guests, as well as the municipality. On the other end of the spectrum, taxes and fees acknowledging different modes of use allow the highest value activity to take place, but limit the overall level of activity, thereby minimizing negative externalities. Allowing taxes or fees to vary with usage can serve to discourage the conversion of short-term rentals to long-term rentals, and allowing taxes and fees to vary by neighborhood ensures that a regulatory approach that makes sense for a community concerned with neighborhood change is not applied to a predominantly vacation rental zone.

In future work, we plan to research the determinants of the variation in the short-term to long-term rental ratio across neighborhoods. We also plan to consider how the relative profitability of short-term rentals may behave in a long-run equilibrium, what the level of Airbnb rental activity may be in this steady state, and what this implies about the impact of the various regulatory approaches discussed in this paper.

References

Adelson, Jeff. "New Orleans begins roll out of short-term rental law enforcement", *The New Orleans Advocate* (May 14, 2017). Retrived from http://www.theadvocate.com/new_orleans/news/politics/article_5b428d14-38e0-11e7-8ae2-7b5409eacfab.html

Agnew, Harriet. "French hoteliers step up Airbnb fight over short-term lets." *Financial Times* (March 6, 2017). Retrieved from https://www.ft.com/content/075f106e-01ae-11e7-aa5b-6bb07f5c8e12?mhq5j=e6

Associated Press. "Chicago Set to Begin Enforcing Tougher Short-Term Rental Laws," *Skift* (March 16, 2017). Retrieved from https://skift.com/2017/03/16/chicago-set-to-begin-enforcing-tougher-short-term-rental-laws/

Associated Press. "The Latest: Hawaii lawmakers mull short-term rental bills." *NewsOK* (February 7, 2017). Retrieved from http://newsok.com/article/feed/1163484

Baumol, William J. "On taxation and the control of externalities." *The American Economic Review* 62.3 (1972): 307-322.

Benner, Katie "Airbnb Sues Over New Law Regulating New York Rentals." *The New York Times* (October 21, 2016). Retrived from https://www.nytimes.com/2016/10/22/technology/new-york-passes-law-airbnb.html

Billings, Randy. "Portland's new rules limit short-term rentals, add fees for hosts." *The Portland Press Herald* (March 27, 2017). Retrieved from http://www.pressherald.com/2017/03/27/portland-enacts-rules-for-short-term-rentals/

Brousseau, Fred, Julian Metcalf, and Mina Yu. "Analysis of the impact of the short-term rentals on housing." *San Francisco City Budget and Legislative office* (May 13, 2015). Retrieved from https://www.scribd.com/doc/265376839/City-Budget-and-Legislative-Analysis-Report-on-Short-term-Rentals

Campbell, John Y., Stefano Giglio, and Parag Pathak. "Forced sales and house prices." *The American Economic Review* 101.5 (2011): 2108-2131.

Cohen, Molly, and Arun Sundararajan. 'Self-regulation and innovation in the peer-to-peer sharing economy." *University of Chicago Law Review Dialogue* 82 (2015): 116-131.

Dobbins, James. "Making a Living With Airbnb." *The New York Times* (April 7, 2017). Retrieved from https://www.nytimes.com/2017/04/07/realestate/making-a-living-with-airbnb.html

Ellen, Ingrid Gould, Johanna Lacoe, and Claudia Ayanna Sharygin. "Do foreclosures cause crime?" *Journal of Urban Economics* 74 (2013): 59-70.

Elsen, Tracy. "SF's Population Is Growing Way Faster Than Its Housing Stock." *Curbed San Francisco* (February 4, 2015). Retrieved from https://sf.curbed.com/2015/2/4/9995388/sfs-population-is-growing-way-faster-than-its-housing-stock

Filippas, Apostolos, and John Horton. "The Tragedy of your Upstairs Neighbors: Is the Negative Externality of Airbnb Internalized?" *Working Paper* (2017)

Fradkin, Andrey, Elena Grewal, and David Holtz. "The determinants of online review informativeness: Evidence from field experiments on Airbnb. " *Working Paper* (2017)

Glaeser, Edward and Gyourko, Joseph. "The Economic Implications of Housing Supply." *Zell/Lurie Working Paper 802*, Wharton School (2017).

Gurran, Nicole, and Peter Phibbs. "When Tourists Move In: How Should Urban Planners Respond to Airbnb?"*Journal of the American Planning Association* 83.1 (2017): 80-92.

Gutierrez, Javier, et al. "Airbnb in tourist cities: comparing spatial patterns of hotels and peer-to-peer accommodation." *arXiv preprint arXiv:1606.07138* (2016).

Guttentag, Daniel. "Airbnb: disruptive innovation and the rise of an informal tourism accommodation sector." *Current issues in Tourism* 18.12 (2015): 1192-1217.

Gyourko, Joseph, and Raven Saks Molloy. "Regulation and Housing Supply." *Handbook of Regional and Urban Economics,* 5 (2015), 1289-1337.

Horwitz, Jeff and Chris Cumming. "Taken for a ride." *Slate* (June 6, 2012). Retrived from http://www.slate.com/articles/business/moneybox/2012/06/taxi_medallions_how_new_york_s_terrible_taxi_system_makes_fares_higher_and_drivers_poorer_.html

Kakar, Venoo, et al. "Effects of Host Race Information on Airbnb Listing Prices in San Francisco." (2016).

Lackner, Abby, Anita Roth, and Christopher Nulty. "REPORT: The Airbnb Community in San Francisco." *Airbnb* (June 8, 2015). Retrieved from https://timedotcom.files.wordpress.com/2015/06/the-airbnb-community-in-sf-june-8-2015.pdf

Lang, Christopher. "N.J. towns, state government move to regulate short-term rentals." *NorthJersey.com* (February 1, 2017). Retrieved from http://www.northjersey.com/story/news/2017/02/01/nj-towns-state-government-move-regulate-short-term-rentals/96248564/

Parcerisas, Daniel, and Sarah Watson. "Sleeping Around: Short-term Rentals and Housing in New York City." *CHPC Report* (March, 2017). Retrieved from http://chpcny.org/assets/Sleeping-Around-Final-for-Web.pdf

Quattrone, Giovanni, et al. "Who benefits from the sharing economy of Airbnb?" *Proceedings of the 25th International Conference on World Wide Web* (2016)

Sampson, Robert J., Stephen W. Raudenbush, and Felton Earls. "Neighborhoods and violent crime: A multilevel study of collective efficacy." *Science* 277.5328 (1997): 918-924.

Sanders, Sam. "Santa Monica Cracks Down On Airbnb, Bans 'Vacation Rentals' Under A Month." *NPR* (May 13, 2015). Retrieved from http://www.npr.org/sections/thetwo-way/2015/05/13/406587575/santa-monica-cracks-down-on-airbnb-bans-vacation-rentals-under-a-month

Schuetz, Jenny, Vicki Been, and Ingrid Gould Ellen. "Neighborhood effects of concentrated mortgage foreclosures." *Journal of Housing Economics* 17.4 (2008): 306-319.

Sherman, Amy. "Does Airbnb decrease housing values, as Miami Beach mayor says?" *Politifact Florida* (March 20, 2017). Retrieved from http://www.politifact.com/florida/statements/2017/mar/20/philip-levine/does-airbnb-decrease-housing-values-and-increase-w/

Spielman, Fran. "Southwest Side alderman is first to declare ward off-limits to Airbnb." *The Chicago Sun Times* (June 22, 2017). Retrived from
http://chicago.suntimes.com/news/southwest-side-aldermen-is-first-to-declare-ward-off-limits-to-airbnb/

Sundararajan, Arun. "Why the government doesn't need to regulate the sharing economy." *Wired* (October 22, 2012). Retrived from
https://www.wired.com/2012/10/from-airbnb-to-coursera-why-the-government-shouldnt-regulate-the-sharing-economy/

Sundararajan, Arun. "What Governments Can Learn From Airbnb And the Sharing Economy." *Fortune* (July 12, 2016a). Retrived from http://fortune.com/2016/07/12/airbnb-discrimination/

Sundararajan, Arun. *The Sharing Economy: The End of Employment and the Rise of Crowd-Based Capitalism.* MIT Press (2016b).

Zervas, Georgios, Davide Proserpio, and John W. Byers. "The rise of the sharing economy: Estimating the impact of Airbnb on the hotel industry." *Journal of Marketing Research* 54 (2017): 687-705.