



Research article

Challenges and effects of short-term rentals regulation A counterfactual assessment of European cities

Gianluca Bei ^{a,b}, Filippo Celata ^{a,*}^a University of Rome La Sapienza, Via del Castro Laurenziano 9, 00161 Roma, Italy^b Institute of Geography and Spatial Planning, University of Lisbon, Portugal

ARTICLE INFO

Article history:

Received 2 February 2023

Received in revised form 5 June 2023

Accepted 9 June 2023

Available online xxxx

Associate editor: Sara Dolnicar

Keywords:

Short-term rentals

Overtourism

Platform economy

Airbnb

Urban tourism

Urban governance

ABSTRACT

Many overtouristified cities introduced limitations to the diffusion of short-term rentals, and are struggling to guarantee their enforcement, while evidence about the impact of those regulations is limited. The article provides an overview of the instruments adopted by 16 European cities, and an assessment of their effectiveness. By comparing regulated and unregulated cities, we show that the former obtained a persistent reduction in the number of listings of entire apartments, in the ratio between entire apartments and shared rooms, and in the number of professional hosts, but no significant impact on the spatial concentration of short-term rentals in the city. We also provide evidence of the effects of the diverse regulatory strategies, and of the importance of obtaining the cooperation of booking platforms.

© 2023 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

The rapid diffusion of short-term rentals over recent years has induced many cities affected by overtourism to adopt ad-hoc regulations. The concerns of those cities are various, but similar. The most relevant are the negative impacts on housing availability and affordability, (tourism-led) gentrification, inhabitant displacement and sense of alienation from the most touristified neighbourhoods (Benitez-Aurioles & Tussyadiah, 2021; Cocola-Gant, 2018; Cocola-Gant & Gago, 2021; Colomb & de Souza, 2021; Yrigoy, 2019). The huge success of booking platforms such as Airbnb.com have made those effects very visible and rapid, disrupting, and affecting also areas of the city that were previously predominantly residential (Celata & Romano, 2022).

Concerns and even protests against the effects of platform-mediated touristification have been multiplying (Novy & Colomb, 2019), leading to a substantial politicization of the topic (Aguilera et al., 2021). A wide range of stakeholders, from housing movements to the hotel industry, have been particularly vocal in asking for ad-hoc regulations and stricter controls, also in light of the inadequacy or the difficulties in enforcing existing laws and tax regimes. Some cities already had norms on the short-term rental of residential apartments, but needed to update these in light of a radically new scenario, while others were almost completely lacking any regulation (von Briel & Dolnicar, 2021). In Europe, cities like Amsterdam, London, Berlin and Barcelona were among the first to act, and many others followed, leading to a variegated picture where heavily regulated cities coexist alongside those adopting a more moderate approach as well as unregulated ones (Tables 1 and 2).

* Corresponding author.

E-mail addresses: gianluca.bei@uniroma1.it (G. Bei), filippo.celata@uniroma1.it (F. Celata).

The evidence about the impact and effectiveness of those regulatory efforts is scarce, partial and limited to US cities. The article is an attempt to fill this gap and to provide robust quantitative evidence through a preliminary identification of the main characteristics and aims of different regulatory frameworks, a longitudinal analysis of short-term rental dynamics in cities that have adopted greater or less stringent regulations, and a counterfactual comparison with those cities where the issue has remained largely unaddressed. The aim is both to highlight the overall effects of introducing ad-hoc regulations, and to provide preliminary evidence about the differential impact of different regulatory approaches, in order to reflect on what works and under which conditions. In this last regard, we are interested in the effects of adopting limits on the number of days an apartment can be rented on a short-term basis without having to obtain a specific license (time-cap); the introduction of zonal restrictions in order to decongest the most touristified neighbourhoods; and the value-added of obtaining the active cooperation of digital platforms in the sharing of data and enforcement of regulations.

In terms of effects, and based on what previous debates indicated as some the most problematic among those effects, we will assess to what extent regulations: reduce the *pressure* of short-term rentals, intended as the total number of listings of entire apartments; alter the *composition* of the short-term rental supply, i.e. the ratio between entire apartments and shared rooms; curb the *professionalization* of the market, which we estimate through the number of hosts managing more than one apartment; and impact the *spatial concentration* of short-term rentals in the city.

The next Section presents an overview of previous research that provided some useful evidence, particularly with regard to US cities, as well as insights about how to address the topic. In the following Sections we will review the regulatory framework adopted in 16 European cities in order to both identify the panel of 'regulated' and 'unregulated' cities to be used in the counterfactual assessment, and to highlight how the aims and characteristics of regulations diverge or converge. In Section 5 we will present the assessment methods, and their results, while in Section 6 we will provide some insights about the additional effects of different regulatory strategies. In the final Section we will summarize and discuss the main findings.

The effects of short-term rental regulation: the existing evidence

Although the regulation of short-term rentals is a recent and emerging issue, some scholars have already explored the topic and offered useful insights. Research has, for example, focused upon the challenges and failures of enforcing existing or newly introduced regulations, given the elusive nature of the phenomenon. Controlling thousands of rented apartments and online transactions is indeed difficult, if not impossible, with traditional means (Leshinsky & Schatz, 2018; Smigiel, 2020). Regulatory frameworks, moreover, have been blamed for being unable to consider each of the multiple dimensions of the market (Smigiel, 2020; Tedds et al., 2021), and the specificity of each local context of operation (Avdimiotis & Poulaki, 2019). Concerns have also emerged about regulation being unable to impede the growing professionalization of the market, and ending up even favouring bigger commercial players, as they can more easily adapt.

Ferreri and Sanyal (2018) highlighted how those difficulties are inherent to the functioning of the platform economy and, focusing on London, showed how platforms use their power to encourage governments to adopt forms of 'deregulated regulation' that end up de facto giving them greater freedom. The only solution – the authors argued – is to maintain control over online data. It may also be argued that any regulation of short-term rentals, however stringent it is, ends up somehow legitimising and permitting such practice. Other studies have focused on how the interests of different stakeholders influenced the politicization of the topic and its instrumentation into different policy approaches in, for example, Barcelona, Paris, Milan (Aguilera et al., 2021), and several Spanish (de la Calle-Vaquero et al., 2021) and Germany cities (Cassell & Deutsch, 2020).

Empirical investigations of the effects and outcomes of regulations are rarer. Some of those focus on single cities and provide, consequently, only partial evidence. With reference to English-language literature only, van Holm (2020) focused on the zonal restrictions introduced in New Orleans, arguing that the positive effects were largely temporary and that the prohibition of short-term rentals in the French Quarter was compensated by their growth in nearby neighbourhoods. A similar pattern was observed in the French city of Bordeaux, where a decrease in the central area led to an increase in contiguous Municipalities (Robertson et al., 2023).

Comparative assessments of different cities are certainly more illuminating, and closer to the scope of the present article. Koster et al. (2021) compared 18 regulated cities with 88 unregulated ones in Los Angeles County, using quasi-experimental methods. Regulating short-term rentals, the authors estimated, led to a decline of 50 % in Airbnb listings and a decrease of 2 % in house prices and rents. Chen et al. (2021) compared 15 regulated cities and 15 unregulated ones in the US from 2014 to 2016 using a counterfactual method. They observed a significant effect on the reduction of new listings (–31 %), but only soon after the introduction of regulation, compensated by increased growth in the months that followed. Yeon, Kim, et al. (2020) compared New York (regulated) with Washington DC (unregulated) from 2014 to 2017. They observed a decrease of 4.3 % in Airbnb monthly revenues after the adoption of regulation. Using a difference-in-differences model and looking at the same case studies, Yeon, Song, and Lee (2020) find a significant positive impact of regulation on the revenues of lower-end hotels.

Bibler et al. (2022) evaluated the enforcement of registration requirements in Chicago and Los Angeles. They found that such policy decreased Airbnb supply and bookings by 40 % in the areas where it was implemented, as well as housing prices (–4 %). They also found a substantial increase in nonpayment-related notice transfers, indicating that due to decreasing revenues some homeowners were unable to keep paying their loans and risked foreclosure. Somewhat similarly, a recent study on 20 US cities also found a significant reduction in Airbnb listings (–18 %) one year after the introduction of such regulation, using a staggered difference-in-differences method (Bekkerman et al., 2022). Rather than considering this as a successful result of these policies, the authors denounce their collateral effect of reducing the request for housing construction permits and, consequently, 'residential

development' and housing taxes. The conclusion would seem to be that cities should not regulate short-term rentals because those regulations are effective in limiting the conversion of residential apartments into short-term rentals, which is actually their primary aim.

The diffusion of short-term rentals in Europe is indeed more recent, and so it is their regulation. Also because European cities have more limited regulatory power compared to US cities, and have to confront with a more complicated, multi-tiered polity, as we will discuss in the next Section. To our knowledge, and as far as English-language literature is concerned, only one quantitative analysis has so far been conducted on European cities. [Hübscher and Kallert \(2022\)](#) focus in particular on Amsterdam, Berlin and London, and provide some evidence of regulations being effective in the first two cities in decreasing the supply of short-term rentals, redistributing them throughout the city, and reducing the number of hosts managing multiple listings (only in Amsterdam). The study, however, only reports the dynamics observed after regulation, and it is more aimed at comparing cities based on the stringency of their approaches, rather than assessing the effects of regulations through a comparison with unregulated cities.

To conclude, the analyses of US cities have for the most part returned robust evidence about the effectiveness of regulations in reducing the supply of short-term rentals, although such effects may be temporary and compensated by increasing growth outside of the perimeters of the most stringent limitations. Similar evidence for European cities is still missing. Existing research, moreover, either did not consider the efficacy of regulations in pursuing other aims – besides a general reduction in the supply and activity of short-term rentals – or did not return definitive evidence in those regards. Finally, little is known about the diverse impact of different regulatory approaches.

The complexities of short-term rental regulation

The regulation of short-term rentals is rather complex ([Hübscher & Kallert, 2022](#)). Those regulations must indeed, first, be compatible with other norms and regulatory frameworks, which are the responsibility of different tiers of government. Concerns about the negative effects of short-term rentals are particularly felt in overtouristified cities, and all of the regulations analysed in this study are indeed municipal. Those local regulations must take into account existing norms at the regional, national and European level, and a rather complicated multi-level governance and legal framework. The enforcement of regulations requires more generally a collaboration between tiers of government, with the local one frequently lacking the capacity to act alone.

A related issue is indeed political. Different tiers of government have often diverging perceptions, interests and objectives ([Aguilera et al., 2021](#)), as well as different ideological frameworks and political affiliations, leading often to complicated negotiations and even disputes. The preoccupations of national governments are often limited to issues of tax collection, and predominantly driven by an economic rationale according to which the phenomenon is a source of growth and revenues. In this, as [Colomb and de Souza \(2021\)](#) describe, 'several local governments have advocated more interventionist agendas that have clashed with those of regional or national governments that are more favorable to deregulation and liberalization' (p.38). At each level, there is indeed a need to find a balance between diverging interests: regulation must safeguard public interests, and particularly housing accessibility and affordability, but also the legitimate interests of private operators and property rights.

This last point is linked to the economic dimension of the problem. Governments must find a delicate balance between the attempt to reduce the pressure without excessively limiting the benefits the industry provides to a wide range of subjects: homeowners, managing hosts, collateral and intermediary services, tax authorities, etc. ([Grimmer et al., 2019](#)). In cities whose economy is heavily dependent on tourism, the interests in favour of touristification are rather strong and the idea that regulating short-term rentals is an anti-growth policy is widespread. To contrast such an idea requires strong and committed local governments, which also explains why some cities have been very active while others have done almost nothing. As shown in the previous Section, such controversy may also lead to diverging conclusions when assessing the effectiveness of short-term rental regulation.

A crucial tier of government is, in Europe, the European Union, whose policies are in general pro-market and, at least until recently, consider digital platforms not responsible for the transactions they intermediate, similarly to any 'information society service', and according to the E-commerce Directive of 2000. Some disputes between digital companies, property managers and regulating authorities were debated in European courts ([Colomb & de Souza, 2021](#)). At this scale, not only do norms tend to be favorable to digital platforms – which have, at least initially, opposed local regulations by any means – but their lobbying capacity is also strong. Recently, the EU introduced new Directives – particularly the Digital Services Act – which should oblige platforms to share data with public authorities, but whose aim is mainly to favour competition and to limit the accumulation of oligopolistic advantages by much bigger platforms than booking ones. In this context, the EU DG GROW recently launched a 'Short-term rental initiative', to ensure access to short-term rental data by public authorities on a monthly basis, and to level the playing field and market access conditions for different players ([European Commission, 2022](#)).

Last but not least, regulating short-term rentals is ridden with problems of enforcement. The most problematic is that without direct access to detailed data about transactions conducted online, or the possibility of removing or blocking irregular listings, enforcement is either incredibly difficult or extremely costly. A substantial asymmetry emerges, not only due to the scale of digital platforms, but because they alone hold the crucial tools for monitoring the market ([Cox & Haar, 2020](#); [Verdouw & Eccleston, 2022](#)), and such 'datapower' ([Söderström & Mermert, 2020](#)) has a significant influence on regulatory governance. Cooperating with platforms is therefore crucial, but often difficult to achieve in the absence of adequate bargaining power. Public authorities, in fact, depend on platforms, which often also become crucial partners in the design and enforcement of regulations, and in urban governance more generally, imposing their voice and conditions ([Ferreri & Sanyal, 2018](#); [van Doorn, 2020](#)). These public-private

relationships can sometimes lead to ambivalences and failures (Cox & Haar, 2020), but seem inevitable. Many cities have first introduced limits and regulations, and only later realized the crucial role of platforms in their enforcement. But even in the case of an explicit agreement or obligation, data shared by platforms is often incomplete and not very transparent (Cox & Haar, 2020).

Besides lobbying, one peculiarity of the resistance of booking platforms to the attempts to regulate them is their ability to mobilize their users from the bottom up (Stabrowski, 2022). These mobilizations often took the form of 'pro-sharing' associations, based on the idea that the renting of residential apartments to tourists is part of the 'sharing economy', itself associated with several positive values (Celata et al., 2017). Against this benign imaginary, many critical voices have denounced the growing professionalization and standardization of the practice, and the increasing portion of the market which is controlled by corporate hosts (Cocola-Gant et al., 2021).

Von Briel and Dolnicar (2021) distinguish, for example, between 'end-run' cities that already had some sort of regulation but needed to upgrade it, often to make it more stringent, and 'gap' cities, which needed to create a regulatory framework *ex novo*. In both cases, the diffusion of short-term rentals has developed within and through an almost complete policy vacuum. This is indeed a typical case in which platforms have de facto created a new market which, although in theory already existed, was previously latent and barely visible. This situation often leads to 'policy disruptions' (Biber et al., 2017) and 'regulatory fractures' (Tedds et al., 2021), as it creates a regulatory void in which new 'economic processes diverge from the model for which extant regulations were designed' (Sassen, 1994, p. 2291). Filling these voids and coping with these fractures is complicated; it takes time and a great deal of experimentalism. Also, because platform companies upscale rapidly and exploit such a vacuum to acquire relevance in both economic and political terms.

All the above complexities, asymmetries, and trade-offs, as we will see in the next Sections, had a crucial influence on how short-term rental regulation evolved and struggled to obtain an impact through various attempts and adaptations.

The variety of regulatory approaches in European cities

Regulatory approaches adopted in European cities differ in many respects. The first and most relevant source of diversity is the aims cities pursue. Secondly, short-term rental regulation may be more or less stringent. While any city may have, in fact, some level of regulation, approaches may range from complete laissez-faire to various sorts of limitations, up to a total ban or full prohibition, which is actually very rare.

According to Nieuwland and Van Melik (2020), the degree of stringency is correlated to the aims cities pursue. 'Laissez-faire' cities aim solely to better define the scope of short-term rentals, mostly for fiscal purposes. The introduction of specific limitations has additional goals which range from the lesser to the more stringent: preserving residential neighbourhoods, curbing professional activity, reducing the negative effects on housing availability and affordability, rebalancing the territorial distribution of short-term rentals, and contrasting overtourism (Table 1).

Another complicated issue is that of diversifying restrictions per typology of short-term rentals (Grimmer et al., 2019). The premise is often that the rental of residential apartments which are not subject to the norms that regulate other typologies of tourism accommodation, is a non-commercial activity. When the activity is considered 'commercial' it incurs stricter requirements

Table 1
Aims and stringency of short-term rental regulation in European cities, 2019.

City	Main aims and concerns of regulation	Start of regulation	Tiers of government	Stringency	
				Level	Score
Amsterdam	Preserve residential neighbourhoods, curb professional activity, activities definition, fiscality	Feb 2014	Nat, Mun	Very high	6
Barcelona	Contrast overtourism, preserve affordable housing, rebalance territorial distribution, activities definition, fiscality	Jan 2017	Nat, Reg, Mun	High	5
London	Preserve affordable housing, preserve home sharing, activities definition, fiscality	Mar 2015	Nat, Reg, Mun	High	5
Paris	Curb professional activity, preserve residential neighbourhoods, preserve home sharing, activities definition, fiscality	Dec 2017	Nat, Mun	High	5
Berlin	Preserve affordable housing, activities definition, fiscality	May 2016	Nat, Reg, Mun	High	5
Vienna	Preserve affordable housing, preserve home sharing, activities definition, fiscality	Dec 2018	Nat, Reg, Mun	High	4.5
Brussels	Preserve affordable housing, curb professional activity, activities definition, fiscality	Apr 2016	Nat, Reg, Mun	Moderate	3.5
Madrid	Preserve affordable housing, activities definition, fiscality	Mar 2019	Nat, Reg, Mun	Moderate	3.5
Copenhagen	Preserve home sharing, activities definition, fiscality	Jan 2019	Nat, Mun	Moderate	3
Athens	Activities definition, fiscality	Unregulated	Nat	Low	0.5
Lisbon	Activities definition, fiscality (from Nov 2019: preserve residential neighbourhoods and affordable housing)	Unregulated	Nat, Mun	Null	0
Porto	Activities definition, fiscality (from Jan 2020: rebalance territorial distribution)	Unregulated	Nat, Mun	Null	0
Edinburgh	Preserve home sharing (from 2022: preserve residential neighbourhoods and affordable housing)	Unregulated	Nat, Mun	Null	0
Rome	Activities definition, fiscality	Unregulated	Nat, Reg, Mun	Null	0
Florence	Activities definition, fiscality	Unregulated	Nat, Reg, Mun	Null	0
Venice	Activities definition, fiscality	Unregulated	Nat, Reg, Mun	Null	0

Source: based on Colomb & de Souza, 2021; Scottish Government, 2019, 2022; von Briel & Dolnicar, 2021; Hübscher & Kallert, 2022; Nieuwland & Van Melik, 2020; Airbnb Help Center, 2022; Airbnb News, 2019, 2022; Camara Municipal de Lisboa, 2022; Camara Municipal de Porto, 2022; Città di Venezia, 2022; Città Metropolitana di Firenze, 2019; AADE, 2022; Guest Ready, 2022; Greater London Authority, 2022; Regione Toscana, 2022; Regione Veneto, 2022; City of Edinburgh, 2022. The degree of stringency is calculated according to the adoption, partial adoption or non-adoption of the restrictions described in Table 2: see the Supplementary material 1.

Table 2
Requirements and limitations for short-term rentals in European cities.

City	Registration requirement	Authorization requirement	Time-Cap	Residence obligation	Zonal restrictions	Authorization from other parties	Cooperation with / obligations for platforms	Other measures
Amsterdam	Yes	Yes	60 days (from 2020: 30 days)	Yes	Yes (from 2020)	Landlord; condominium/homeowners' association; bank/insurer	Sharing data / block irregular listings (interrupted in 2019); tax collection	Min rental period: 7 days; ban on social housing
Barcelona	Yes	Yes	No	No	Yes (limited in special zones)	Landlord; condominium/homeowners' association	Sharing data/ block irregular listings	Max one accommodation per non-professional hosts
Berlin	Yes	Yes	90 days	Yes	Yes (few licenses restricted to more touristic districts)	Landlord	No	No
Brussels	Yes	Yes	120 days (if primary residence)	No	No	Landlord; condominium/homeowners' association	Obligation to share data	No
Copenhagen	No	No	70 days (100 days on collaborative platforms)	Yes	No	No	Sharing data for tax purposes	No
London	No	Yes (if primary residence, if >90 days)	90 days	No	Yes (few licenses restricted to more touristic boroughs)	Bank/insurer/freeholder	Block irregular listings	Ban on social housing
Madrid	Yes	Yes	No	No	Yes (in central areas only if independent entrance)	Condominium/homeowners' association	Obligation to share data (interrupted)	No
Paris	Yes	Yes (if primary residence, if >120 days)	120 days	Yes	No (recent proposal)	Landlord; condominium/homeowners' association	Obligation to share data and block irregular listings/ block irregular listings in the first four districts	Ban on social housing
Vienna	No	Yes (not if primary residence)	No	Yes	Yes (prohibited in specific zones)	Landlord; condominium/homeowners' association	Obligation to share data and block irregular listings	Ban on social and co-operative housing
Athens	Yes	No	No	No	No	No	Obligation to share data and block irregular listings	No
Edinburgh	Yes	No (from Oct 2022, if not primary residence)	No	No	No	No	No	No
Florence	Yes	No	No	No	No	No	Tourist tax collection	No
Lisbon	Yes	No (from Nov 2019, in containment areas)	No	No	No (from Nov 2019: licenses limited in containment areas)	No	Tourist tax collection	No
Porto	Yes	No (from Jan 2020, in containment areas)	No	No	No (from Jan 2020: licenses limited in containment areas)	No	Tourist tax collection	No
Rome	Yes	No	No	No	No	No	Tourist tax collection (from Jul 2020)	No
Venice	Yes	No	No	No	No	No	Tourist tax collection	No

Source: based on Colomb & de Souza, 2021; Scottish Government, 2019, 2022; von Briel & Dolnicar, 2021; Hübscher & Kallert, 2022; Nieuwland & Van Melik, 2020; Airbnb Help Center, 2022; Airbnb News, 2019, 2022; Camara Municipal de Lisboa, 2022; Camara Municipal de Porto, 2022; Città di Venezia, 2022; Città Metropolitana di Firenze, 2019; AADE, 2022; Guest Ready, 2022; Greater London Authority, 2022; Regione Toscana, 2022; Regione Veneto, 2022; City of Edinburgh, 2022.

and limitations, or is required to be registered otherwise. Such a distinction, however, is operationalized differently. Similarly, regulations are often only applied to the rental of entire apartments, while the rental of single rooms is permitted, if not encouraged, based on the assumption that such 'home sharing' is ultimately benign (Arias-Sans et al., 2022).

Table 2 presents an overview of the main instruments and regulatory approaches applied in those European cities that are the object of our analysis, while Fig. 1 presents a timeline of how the degree of stringency of short-term rental regulation changed in those cities, based on the timing of the adoption of different restrictions.

Most cities require short-term rentals to obtain a registration number, and often to display such registration in the online listing. A more crucial distinction is whether or not short-term rentals must obtain a specific authorization. Some of the cities which we consider 'regulated', moreover, introduced specific 'time-caps', i.e. a limit on the number of days an apartment can be rented on a short-term basis without incurring additional obligations, being considered a commercial activity or a different typology of accommodation. For the same reason, and to avoid or limit the case of so-called multiple listings, i.e. multiple apartments managed by corporate hosts and intermediation agencies, some cities establish a maximum number of listings a single host can manage. To preserve residential neighbourhoods and, again, limit the proliferation of multiple listings, hosting is sometimes permitted only in the host's primary residence. In cities where the main concern is to avoid an excessive overtouristification of central neighbourhoods, zonal restrictions are applied, that range from differential limitations, to the establishment of a maximum number of authorizations, up to a complete ban in certain areas. One of the first to introduce such zoning was Barcelona, through the PEUAT plan in 2017 (Ajuntament de Barcelona, 2022). A restriction that is indirect, but may prove effective in limiting the proliferation of short-term rentals, is to oblige hosts to obtain an authorization from their landlord, if they are tenants, and/or from condominium/homeowners' associations, and even from the bank (in case of a loan), the insurer (for insured properties) or the freeholder (if the owner is on a leasehold).

Finally, several cities sign agreements with platforms or oblige them to block illegal activity, share data or collect taxes. The most relevant and stringent form of cooperation is where platforms agree to block or remove irregular listings on their websites, for example when apartments exceed the time-cap, or if they do not display the right license (Colomb & De Souza, 2021). In other cases, greater or less detailed data about online transactions are passed to governments and controlling authorities. Cooperation can also take only the form of a direct tax levy from the platform, which is often voluntary – as digital platforms are exempted from this duty by EU norms – and mainly limited to the daily tourist tax. This latter is particularly the case of those cities we consider 'unregulated', confirming that tax collection is their only aim.

The last source of diversification is in the enforcement strategies adopted. In addition, or in the absence of a cooperation agreement with platforms, cities may have dedicated inspectors that check for the legality of short-term rentals. They may have a staff dedicated to data analysis, often through the monitoring or scraping of online data. Some cities, finally, allow residents the possibility of reporting illegal activities through online forms or dedicated telephone services.

What kind of impact those cities achieved, and how these impacts may eventually be influenced by the specific strategy adopted, is discussed in the following Sections.

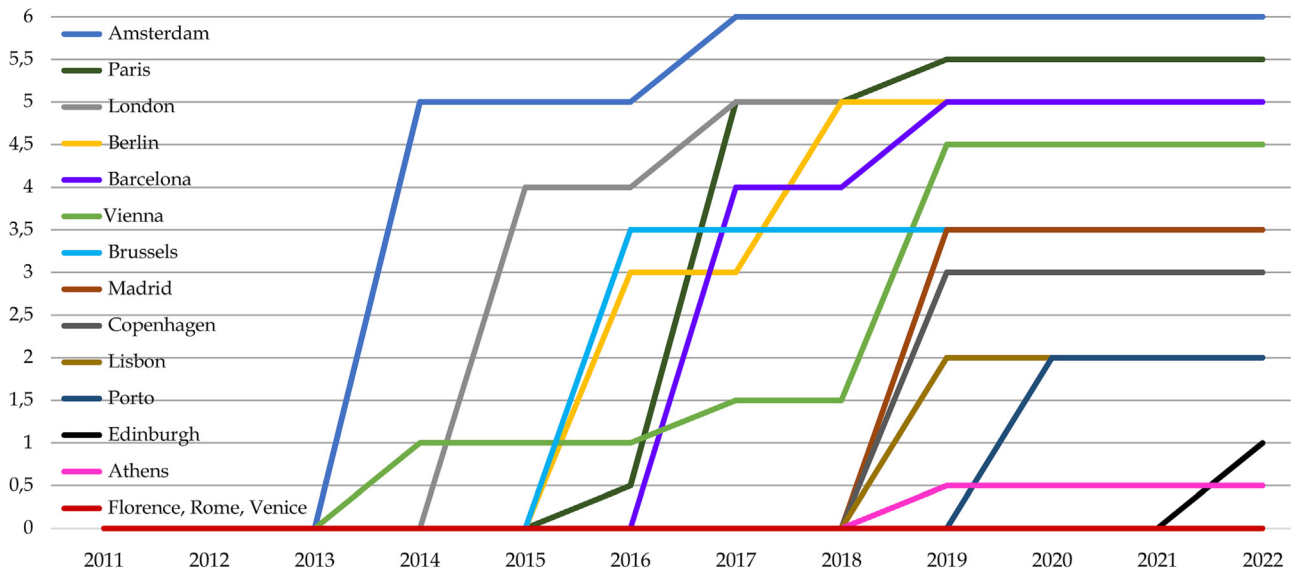


Fig. 1. Degree of stringency of short-term rental regulation in 16 European cities, 2011–2022.

Source: based on Colomb & de Souza, 2021; Scottish Government, 2019, 2022; von Briel & Dolnicar, 2021; Hübscher & Kallert, 2022; Nieuwland & Van Melik, 2020; Airbnb Help Center, 2022; Airbnb News, 2019, 2022; Camara Municipal de Lisboa, 2022; Camara Municipal de Porto, 2022; Città di Venezia, 2022; Città Metropolitana di Firenze, 2019; AADE, 2022; Guest Ready, 2022; Greater London Authority, 2022; Regione Toscana, 2022; Regione Veneto, 2022; City of Edinburgh, 2022. The degree of stringency is calculated according to the adoption, partial adoption or non-adoption of the restrictions described in Table 2: see the Supplementary material 1.

The effects of short-term rental regulation multiple aims: the counterfactual assessment

Aims of the assessment

Besides providing the first – to our knowledge – counterfactual assessment of short-term rental regulation in European cities, our goal is also to estimate the effectiveness of those regulations with regards to four of their main aims, in order to consolidate the fragmented evidence existing so far.

We first explore the effects of regulation in decreasing the ‘*pressure*’ of short-term rentals on the housing market, assuming as a proxy the total number of listings of entire apartments. The idea is that the mere listing of an apartment on booking platforms implies such apartment being not inhabited and unavailable for residents, with all the implications in terms of housing availability and affordability we discussed in the previous Sections. We therefore consider only entire housing units and not the rentals of rooms in apartments inhabited by their owner or tenant because, as already mentioned, the latter are normally exempted from restrictions, as they do not negatively affect residentiality (Arias-Sans et al., 2022).

To take this into account, we also assess if regulation has significant effects on the ‘*composition*’ of the supply, i.e. the ratio between listings per entire apartment vs. listings per private room. This is not necessarily an explicit aim of regulations, but something that is worth assessing also as some sort of confirmation that limitations for entire apartments actually work or, in other words, that regulations produce a more balanced market, in favour of more genuine and less impacting forms of ‘home sharing’.

Thirdly, we assess the outcome of regulations on the distribution of short-term rentals in the city and their ‘*concentration*’, using as a proxy the degree of spatial clustering of listings per entire apartment, measured through the Average Nearest Neighbour – a widely used spatial index of concentration. The problem in many cities is in fact not necessarily the diffusion of short-term rentals per se, but their excessive congestion in certain parts of the city. Decreasing such congestion, which may even favour less touristified and peripheral neighbourhood, is either an explicit aim of restrictions, particularly in cities adopting any sort of zoning, or an implicit one.

Finally, we are interested in how regulations influence the ‘*professionalization*’ of the market, i.e. to what degree hosting short-term rentals is a professional, commercial activity, intermediated by ad-hoc agencies and ‘corporate hosts’. Most regulatory schemes assume in fact, as already mentioned, that the rental of residential apartments to tourists is a non-commercial practice, and many scholars highlighted how the increasing professionalization and corporatization of the market dramatically increase pressures and impacts (Cocola-Gant et al., 2021). Such a dimension is more difficult to measure directly. We opted to use the number of hosts managing multiple listings as a proxy, which may not totally correspond to the degree of professionalization, but is correlated (Chen et al., 2022; Hübscher & Kallert, 2022), also for the sake of simplicity and clarity.

Method and data

In our counterfactual assessment, each of the above-described four indicators is used as a dependent variable, while the independent or treatment variable is simply the presence or absence of a degree of stringency that is, at least, moderate (Table 1). All cities, as already mentioned, have some sort of regulation: we consider ‘unregulated’ those cities where regulations are not really aimed at limiting the growth of short-term rentals, and whose stringency is therefore very low. We want to emphasize that some of these cities, such as Lisbon, Porto and Edinburgh, recently implemented restrictions to short-term rentals, but we consider them as ‘unregulated’ because they were so during the period of our analysis.

Data refers to listings on Airbnb.com, which is not the only platform for short-term rentals, but certainly the most successful and more explicitly targeted at the short-term rental of residential apartments. We assembled a dataset about the above-mentioned variables based on data scraped from the platform by InsideAirbnb.com. In case of missing data, particularly in the early period of Airbnb diffusion, we opted for data available on TomSlee.net. The two datasets are consistent, as they both use the same web-scraping routine. Such consistency was also verified by comparing observations from the two sources in periods when both are available. The geolocation of data permitted us moreover to assure that the area of the cities from where data are scraped is homogeneous – in most cases it corresponds to the Municipality – and to calculate the spatial concentration index.

The frequency of observations is monthly, although in some months data are missing, and were therefore interpolated. The period of observation is from 2013, up to the end of 2019, also to avoid dynamics being affected by the consequences of the Covid-19 pandemic, for a total of 80 months.

Model specifications

To highlight a significant effect of regulations on the four dependent variables, we compare regulated cities with unregulated ones using a counterfactual method, i.e. considering regulation as a ‘treatment’ that, if effective, must produce a significant divergence in the dynamics we observe in ‘treated’ cities with respect to untreated ones. The timing of the introduction of regulations varies between cities: what we consider the year and month when a proper regulation of short-term rentals started is indicated in Table 1.

We had to choose counterfactual methods that work well with this type of data, i.e. a longitudinal panel of unbalanced time cross-sectional data with a staggered adoption of treatment. We tested two models, in order to confirm the robustness of our results, also because each of the two produces different outcomes.

The first is a *two-way fixed-effect*, that is widely used for estimating the average effect of a policy based on a difference-in-differences technique, also when the treatment starts in different periods (Wooldridge, 2005), by implementing a regression model with fixed results for times (our monthly observation before and after the treatment) and units (the cities that are part

of our panel). The coefficient connected with the treatment variable is a weighted sum of the average treatment effect. The function to estimate the effect of the treatment is:

$$\log(y_{it}) = \delta D_{it} + g_{it} + \eta_i + \lambda_t + u_{it}$$

where $\log(y_{it})$ is the natural logarithm of our dependent variables – pressure, composition, concentration and professionalization – for the city i at month t ; δ is the coefficient of interest which represents the effect of regulation; D_{it} indicates the dummy variable that is equal to 1 when the city i started regulation at month t ; g is the vector of covariate values for the city i at month t ; η_i are city-fixed effects, and λ_t are time-fixed effects; u_{it} is the error term.

The second model is a *fixed effect counterfactual estimator*, which permits us to estimate the impact of regulation by implementing counterfactual estimators with time-series cross-sectional data. This second model is considered more robust,¹ also because it permits us to evaluate how the impact of regulation unfolds over time (Liu et al., 2022). The estimation of effects is performed by constructing a predicting model based on three steps: “first, the model treats treated observations as missing values and builds the predictive model with only untreated observations; second, it predicts counterfactual outcomes for treated observations from the predictive models obtained in the first step; third, it calculates the average treatment effect on treated units (ATT) by taking an average of the differences between observed outcomes and counterfactual (predicted) outcomes for the treated observations” (Pan & Qiu, 2022, p. 16).

We decided to use the natural logarithm of the dependent variables in order to be able to express the impact of regulation in terms of percentage. We also added some covariates, to control for exogenous conditions which may affect short-term rental dynamics. Comparable data at the Municipal scale is scarce, and we opted for OECD data about resident population, population density, GDP and employment for metropolitan core areas. The use of our controls was effective in improving the reliability of our results, as reported in the Supplementary material. A proper assessment of causality would be more effective with a higher number of observed units, but we cannot but include in the panel all the main touristic cities in (western) Europe for which we have consistent data, and that are subject to EU norms, given their importance in regulating the market.

Results

The results of our models are reported in detail in the Supplementary material, and indicate that the introduction of regulation had a significant and substantial impact on the general *pressure* of short-term rentals, i.e. the number of listings of entire apartments. According to the fixed effect counterfactual estimator the effect on pressure is -28.8% . The estimator permits us moreover to produce a dynamic plot, which is also useful for observing if, indicatively, effects persist over time, as is the case for the indicator of pressure (Fig. 2). These results are confirmed by the two-way fixed-effect model which indicate an effect on pressure of -18.1% .

In terms of *composition*, the assessment also returned significant results: according to the fixed effect counterfactual estimator, the ratio between entire apartments and shared rooms decrease by -24.4% . The two-way fixed-effect confirms the results, and indicate an effect on composition of -9% after regulation. Such impact seems likely to persist and consolidate over time, up to the second year after the adoption of regulation (Fig. 2).

In terms of *professionalization*, we observe also a substantial impact. According to the fixed effect counterfactual estimator the number of hosts managing multiple listings decrease by -25.2% ; according to the two-way fixed-effect model by -18% . The effect persists and consolidates over time, and particularly during the first two years (Fig. 2).

Uncertainty estimates were also calculated, and all of the above-mentioned results are significant at a 0.001 confidence level (see the Supplementary material).

When it comes to the degree of *spatial concentration*, neither model returned significant results, meaning that we cannot observe any significant effect in terms of the decongestion and de-concentration of short-term rentals in the city.

The additional effects of different regulatory approaches

While those cities that we consider unregulated have quite similar approaches to short-term rentals, regulated cities differ in many respects, such as primary aims, typologies of restrictions, degree of stringency. It may be therefore not totally correct to consider them as homogeneously treated/regulated. On the other hand, it would be interesting to assess the additional effects of specific regulatory approaches.

The two-way fixed-effect model allows us, in fact, to compute the additional impact of particular policy strategies by adding their adoption or non-adoption as a dummy covariate and comparing cities adopting them with the general trend. We did so, in particular, for those approaches to short-term rental regulation that we consider more relevant, as well as easier to assess in terms of adoption/non-adoption.

The first of those measures is the time-cap, which is frequently used, but with some relevant exceptions (Barcelona, Madrid and Vienna). Second, as already mentioned, we considered the presence of an explicit agreement with digital platforms, which

¹ Although *two-way fixed-effect* models are still widely used in impact assessment when the timing of policy changes are staggered over time, recent literature has shown that estimates can be biased, unless specific conditions are met (de Chaisemartin & D'Haultfoeuille, 2020). In the discussion we will therefore focus primarily on the general results of the *fixed effect counterfactual estimator*, but present also those of the *two-way fixed-effect* model for the sake of confirmation and robustness check.

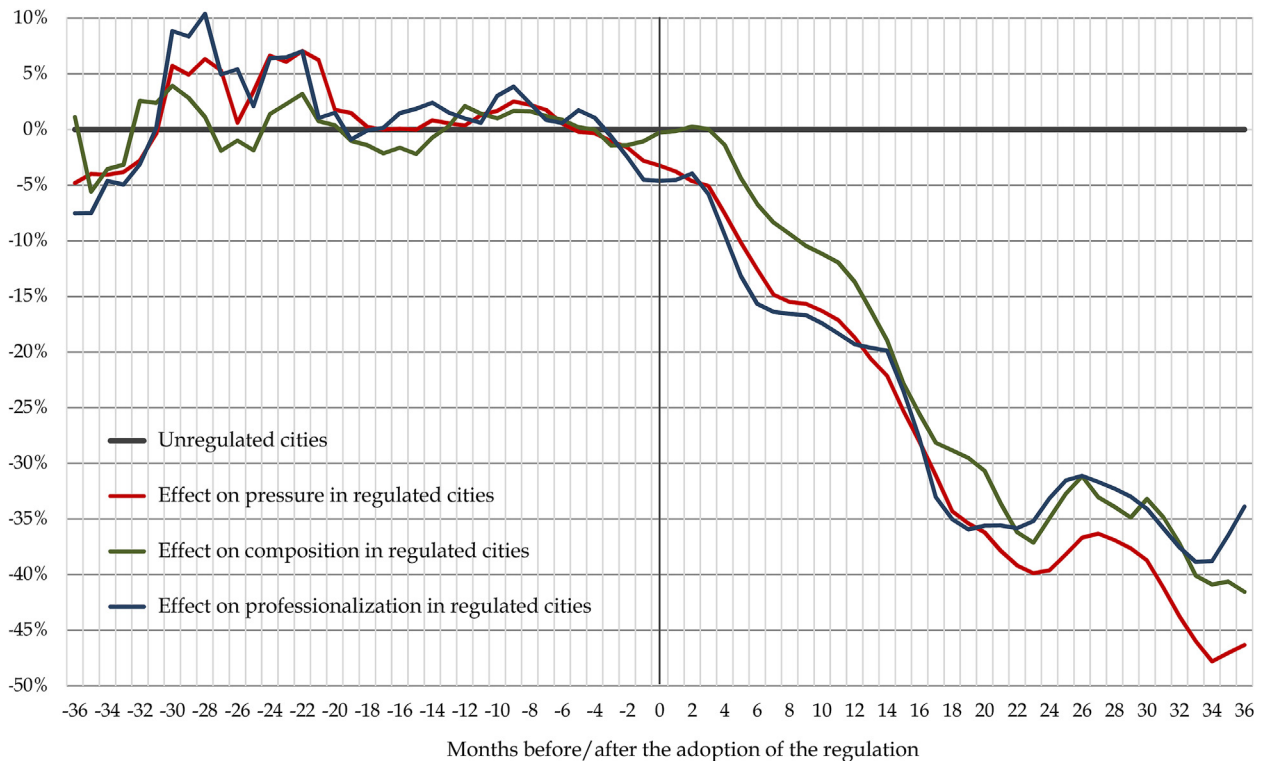


Fig. 2. The effects on pressure (number of listings of entire apartments), composition (ratio between entire apartments and shared rooms), and professionalization (number of hosts managing multiple listings), before and after the adoption of short-term rental regulation,^a 2013–2019, quarterly averages.

^aInsofar as the start of regulation differs in each city, and that we only used data from 2013 to 2019, the number of observations tend to decrease towards the extremes of the time period, i.e. in the very first and last of the 40 months before and after regulation. For this, the time plot in Fig. 2 is restricted to 36 months before and after regulation.

is the case for Barcelona, Paris, London, and Amsterdam until January 2019.² Thirdly, we considered the adoption of zonal restrictions, i.e. stricter quotas of licenses for short-term rentals in specific areas of the city, which is not the case for Brussels, Paris, Madrid, Copenhagen and Amsterdam in the period of observation.

Given the smaller number of treated units, in this case it is even more problematic to detect a causal relationship; what we observe is instead the additional effects obtained by cities adopting certain strategies, without pretending that such outcome is entirely due to the specific strategy adopted. Moreover, we observe the effects from when the above-mentioned measures were adopted, as it not always corresponds to the start of the general regulation. Cooperation agreements with platforms, in particular, are often signed years or months after the first regulation is introduced, in order to solve enforcement problems, also thanks to the bargaining power that the existence of a strict regulation gives cities vis-à-vis booking platforms.

The two-way fixed-effect model was therefore adapted to estimate the additional effect of adopting specific regulatory approaches as follows:

$$\log(y_{it}) = \delta D_{it} + \lambda M_{it} + g_{it} + \eta_i + \lambda_t + u_{it},$$

where M_{it} indicates the dummy variables iteratively given by time-cap, zonal restrictions and cooperation agreements for the city i at month t ; λ is the interaction coefficient between D_{it} and M_{it} , and represents the additional effect of adopting the specific instrument.

The complete results are reported in the Supplementary material. In particular, in cities adopting explicit zonal restrictions we observe an additional and highly significant effect of -13.9% both in terms of pressure, and composition. In terms of professionalization the results are not significant. In terms of spatial concentration, effects are significant, but very low: zonal restrictions have apparently obtained some but very minimal results.

² In January 2019 Airbnb decided to stop cooperating with the city of Amsterdam in response to its decision to reduce the time-cap from 60 to 30 days. Furthermore, the local government declared it no longer needs such cooperation due to the introduction of a national registration system and the obligation for platforms to advertise only registered listings and report data to supervisory bodies on a regular basis (Cox & Haar, 2020).

Cities that entered into agreements of cooperation with booking platforms obtained a very high and highly significant ($p < 0.001$) additional effect of -12% in terms of pressure. The additional effects in terms of composition and professionalization are substantial as well – -8.6% and -9.5% respectively – although the significance is lower.

Cities that adopted the time-cap obtained an additional impact of around -7.7% in terms of pressure. They also show a substantial additional effect on professionalization, of -6.8% . Those results, however, are not only lower but also less significant ($p < 0.05$). The effects on composition of the time-cap are not significant.

Discussion and conclusions

The regulation of short-term rentals is high on the agenda of many European cities. All of the cities we analysed in the paper have at least started debating the issue, while those that have already acted often struggle to understand whether, and under which circumstances, regulations are effective. The years before the Covid-19 pandemic were marked by a very pervasive growth of the phenomenon. Even those cities that acted more proactively and introduced the most stringent regulations had to deal with huge problems of enforcement, continuously adapting and experimenting solutions. Stories of success are indeed rare. But a proper evaluation cannot be based solely on observing the dynamic of short-term rental expansion, which has indeed for the most part continued, even in the most stringent and resolute cities.

In the paper, we proposed a counterfactual assessment in order to detect how short-term rental dynamics in regulated cities diverge from the same dynamics in cities that, at least until 2019, did not adopt any sufficiently stringent regulation.

The results are significant and highly positive. The strongest impact we observe is a reduction of the pressure of short-term rentals of almost -30% , when measured in terms of the number of listings of entire apartments on Airbnb.com, which confirm what had been already observed in US cities.

Besides this general result, we also attempted to assess the impact in terms of other aims of short-term rental regulation. Particularly strong and significant are the results regulated cities obtained in curbing the growing professionalization of the market: the percentage of hosts managing multiple listings decreased by approximately -25% . This result is important, particularly in light of the fear that regulating the market may end up, paradoxically, favouring larger, more professional and equipped intermediaries, which does not seem to be the case. The effects on composition, i.e. the ratio of entire apartments over shared rooms, are also positive and significant (-25%). Regulating short-term rentals, in short, produces a more sustainable growth and a more balanced market. According to our results, these effects seem not limited to the period soon after regulation, but persist over time, at least until the second year after adoption.

In terms of the spatial concentration of short-term rentals, on the contrary, the effects are not significant, and only minimal in those cities that introduced specific zonal restrictions. The attempt to redistribute short-term rentals more evenly in the city seems therefore a rather complicated task, unless a complete ban is introduced in the most touristified neighbourhoods.

We also attempted to assess the additional effects cities obtained based on the particular policy mix adopted. In particular, zonal restrictions may produce very limited zonal effects, but cities adopting such zoning obtained a substantial additional effect of -13.9% in terms of a reduced pressure of short-term rentals over the whole city, and of a more balanced composition of the supply in favour of home-sharing. The additional effects obtained by cities adopting a time-cap is less significant, and in terms of, only, reduced pressure, and decreasing professionalization. This is probably because the usage of short-term rentals managed by intermediaries is high and the time-cap affects professional hosts more than non-professional ones. On the contrary, zonal restrictions do not seem to display any significant additional effect in terms of reduced professionalization, indicating that probably professional hosts can more easily cope with a limitation of the number of licenses for short-term rentals in specific neighbourhoods, or that such limitation affects professional and non-professional operators similarly. However, in terms of pressure and composition, the additional effects we observe in cities adopting the time-cap is lower, which does not necessarily mean that the measure is ineffective, but only that the divergence between cities with or without a time-cap is lower. Also because on the one hand, the time-cap is adopted in many regulated cities, rendering the counterfactual assessment more complicated, while on the other hand the few cities not adopting a time-cap have probably found other means to make their regulations equally effective. In general, the policy-mix may vary between cities, also in order to adapt to contextual circumstances. What is crucial is the commitment towards the adoption of sufficiently stringent regulations. It should also be noted that designing and implementing zonal restrictions may turn out to be much more complicated than general, 'spatially-blind', city-wide restrictions such as the time-cap.

Finally, yet importantly, obtaining the cooperation of booking platforms through specific agreements aimed at data sharing or the blocking of irregular listings is crucial to guarantee the enforcement of any regulation, reduce the pressure of short-term rentals, balance their composition, and decrease the tendency towards a growing professionalization of the market. Overtouristified cities must not only confront with a growing number of tourists, but with a specific form of touristification that is induced by the operation of new digital players that are hugely successful as well as highly disrupting, and whose functioning is opaque and asymmetrical. To obtain the cooperation of those platforms is necessary to reduce such asymmetry and eventually use their 'datapower' as an instrument of urban governance (Sadowski, 2020; Söderström & Mermel, 2020). Obtaining such cooperation, however, is challenging, in the absence of adequate bargaining power, and unless the obligation to – at least – share data with controlling authorities is definitively established at the EU level and ratified as well as operationalized in each member country, as cities struggling to regulate short-term rentals have repeatedly asked for. In this, the recent proposal from the European Commission for regulation on data sharing for short-term rental services is extremely relevant (see: European Commission, 2022), but it will take time to come into force and display its effects. It will therefore be essential to monitor how such an

initiative evolves, and if it will be adequate not only to improve platforms' accountability or tax collection, but also to assist the enforcement of specific local regulations and restrictions.

Our research has also some limitations, particularly when it comes to going beyond a general assessment of how regulations affect the overall number of short-term rentals. What we defined as 'professionalization' is, in particular, a process that can take different forms (Cocola-Gant et al., 2021). Our index, based on multi-management, does not take into account this nuance, and may either overestimate or underestimate the phenomenon. The same applies to the distribution of short-term rentals in the city: we merely measured their overall degree of spatial clustering, and we cannot exclude that results could be significant when using a different index or comparing more carefully specified neighbourhoods in the city.

Our evaluation of the 'best' policy mix is also limited, and should be considered only indicative and preliminary. The model we use in this respect can in fact be biased unless specific conditions are met (de Chaisemartin & D'Haultfoeuille, 2020); these results are in many cases less significant compared to those of the general models; and here it is even more complicated to deduce a causal relationship due to the more limited number of treated cases. A clear-cut distinction between cities adopting or not adopting a particular measure, moreover, is complicated. Cooperation agreements with platforms, to give just one example, can be very different in terms of scope and effectiveness. Obtaining a reliable, consistent dataset, moreover, is challenging, as tourism statistics have only just started to attempt to include short-term rentals, while booking platforms do not publish any sufficiently detailed or transparent data. The only option is to rely on web scraping, which is ridden with technical difficulties and does not return any official, validated statistics.

Results, finally, vary, in some cases substantially, depending on the assessment method. As already mentioned, the results of the second model – the *fixed effects counterfactual estimator* – should be considered more robust and reliable, and consistently indicate an average reduction of approximately 25–30 % in terms of pressure, composition and professionalization. Future research may both refine our results with more accurate data, and verify them with different methods. What we are interested in, however, is not measuring the exact magnitude of the impact of regulations, but detecting effects that are significant and whose magnitude is substantial, as it is the case for most of our assessments.

Our results, in short, confirm the need to go beyond the policy vacuum that still characterizes some cities, and introduce specific regulations. To those that have already done so but still struggle to meet the challenge, our results indicate that introducing specific regulations produces indeed rather positive results, if compared with cities that have done almost nothing. Regulating the market may not definitely eliminate the negative effects of touristification, but substantially reduce its pressure on the housing market, particularly in terms of housing availability for residents and therefore, indirectly, tourism-led gentrification and the depopulation of cities' cores. To those who oppose those regulations accusing them of being anti-growth, our results indicate that this is not the case. No European city has introduced an explicit prohibition to short-term rentals, with the only exception of professional ones in some zones within the historic centre of Vienna. The effects of regulations are instead that of producing a more balanced market, favouring non-professional hosts as well as the rental of rooms instead of entire apartments, and helping cities in the complicated task of maintaining an equilibrium between the multiple functions they perform towards those who inhabit them, and those who visit them as tourists.

Funding

The research received support from the Italian National Ministry of University and Research, Research Projects of Relevant National Interest, PRIN 2017, n. 2017EWXN2F, Title: *The Short-Term City: Digital Platforms and Spatial (In)Justice* [STCity].

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgement

The authors wish to thank Augusto Cerqua for his invaluable help in the design of the counterfactual assessment models and in the revision of their results.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.annals.2023.103605>.

References

- AADE (2022). Short-term rental property. Available at: <https://www.aade.gr/polites/akinita/brahyhronia-misthosi-akiniton> (last accessed: 30 Dec 2022).
- Aguilera, T., Artioli, F., & Colomb, C. (2021). Explaining the diversity of policy responses to platform-mediated short-term rentals in European cities: A comparison of Barcelona, Paris and Milan. *Environment and Planning A: Economy and Space*, 53(7), 1689–1712.
- Airbnb Help Center (2022). Responsible hosting in Greece. Available at: <https://www.airbnb.com/help/article/1246> (last accessed: 30 Dec 2022).

- Airbnb News (2019). Denmark approves forward-thinking home sharing rules and simplifies tax. Available at: <https://news.airbnb.com/denmark-approves-forward-thinking-home-sharing-rules-and-simplifies-tax/> (last accessed: 30 Dec 2022).
- Airbnb News (2022). Understanding new planning permission rules for second homes in Edinburgh. Available at: <https://news.airbnb.com/en-uk/understanding-new-planning-permission-rules-for-second-homes-in-edinburgh/> (last accessed: 30 Dec 2022).
- Ajuntament de Barcelona (2022). Peuat, tourist accomodation plan. Available at: <https://ajuntament.barcelona.cat/pla-allojaments-turistics/en> (last accessed: 30 Dec 2022).
- Arias-Sans, A., Quaglieri-Domínguez, A., & Russo, A. P. (2022). Home-sharing as transnational moorings: Insights from Barcelona. *City*, 26(1), 160–178.
- Avdimiotis, S., & Poulaki, I. (2019). Airbnb impact and regulation issues through destination life cycle concept. *International Journal of Culture, Tourism and Hospitality Research*, 13(4), 458–472.
- Bekkerman, R., Cohen, M. C., Kung, E., Maiden, J., & Proserpio, D. (2022). The effect of short-term rentals on residential investment. *Marketing Science*. <https://doi.org/10.1287/mksc.2022.1409>.
- Benitez-Aurioles, B., & Tussyadiah, I. (2021). What Airbnb does to the housing market. *Annals of Tourism Research*, 90, Article 103108.
- Biber, E., Light, S. E., Ruhl, J. B., & Salzman, J. E. (2017). Regulating business innovation as policy disruption: From the model T to Airbnb. *Vanderbilt Law Review*, 70, 5.
- Bibler, A., Teltser, K., & Tremblay, M. J. (2022). Short-term rentals, home prices, and housing affordability: Evidence from Airbnb registration enforcement. *Andrew Young School of Policy Studies Research Paper Series*. <https://doi.org/10.2139/ssrn.3846919>.
- Camara Municipal de Lisboa (2022). Alojamento Local. Available at: <https://www.lisboa.pt/cidade/economia-e-inovacao/setores-estrategicos/alojamento-local> (last accessed: 30 Dec 2022).
- Camara Municipal de Porto. (2022). Alojamento Local. Available at: <https://portaldomunicipio.cm-porto.pt/pt/-/alojamento-local> (last accessed: 30 Dec 2022).
- Cassell, M. K., & Deutsch, A. M. (2020). Urban challenges and the gig economy: How German cities cope with the rise of Airbnb. *German Politics*. <https://doi.org/10.1080/09644008.2020.1719072>.
- Celata, F., Hendrickson, C. Y., & Sanna, V. S. (2017). The sharing economy as community marketplace? Trust, reciprocity and belonging in peer-to-peer accommodation platforms. *Cambridge Journal of Regions, Economy and Society*, 10(2), 349–363.
- Celata, F., & Romano, A. (2022). Overtourism and online short-term rental platforms in Italian cities. *Journal of Sustainable Tourism*, 30(5), 1020–1039.
- Chen, W., Wei, Z., & Xie, K. (2022). Regulating professional players in peer-to-peer markets: Evidence from Airbnb. *Management Science*, 69(5), 2893–2918.
- Chen, Y., Huang, Y., & Tan, C. H. (2021). Short-term rental and its regulations on the home-sharing platform. *Information & Management*, 58(3), Article 103322.
- Città di Venezia (2022). Locazioni Turistiche. Available at: <https://www.comune.venezia.it/content/locazioni-turistiche-0> (last accessed: 30 Dec 2022).
- Città Metropolitana di Firenze (2019). Locazioni Turistiche. Available at: <https://www.cittametropolitana.fi.it/locazioni-turistiche/> (last accessed: 30 Dec 2022).
- City of Edinburgh (2022). Short-term let control area. Available at: <https://consultationhub.edinburgh.gov.uk/sfc/short-term-let-consultation/> (last accessed: 30 Dec 2022).
- Cocola-Gant, A. (2018). Tourism gentrification. In L. Lees, & M. Phillips (Eds.), *Handbook of gentrification studies* (pp. 281–293). Celsentham: Edward Elgar Publishing.
- Cocola-Gant, A., & Gago, A. (2021). Airbnb, buy-to-let investment and tourism-driven displacement: A case study in Lisbon. *Environment and Planning A: Economy and Space*, 53(7), 1671–1688.
- Cocola-Gant, A., Jover, J., Carvalho, L., & Chamusca, P. (2021). Corporate hosts: The rise of professional management in the short-term rental industry. *Tourism Management Perspectives*, 40, Article 100879.
- Colomb, C., & de Souza, T. M. (2021). *Regulating short-term rentals*. Property Research Trust. <https://doi.org/10.52915/KKDK3578>.
- Cox, M., & Haar, K. (2020). Platform Failures. How short-term rental platforms like Airbnb fail to cooperate with cities and the need for strong regulations to protect housing. *Study commissioned by members of the IMCO committee of the GUE/NGL group in the European Parliament*. Available at: <https://left.eu/content/uploads/2020/12/Platform-Failures-Airbnb-1.pdf> (last accessed 30 Dec 2022).
- de Chaisemartin, C., & D'Haultfoeuille, X. (2020). Two-way fixed effects estimators with heterogeneous treatment effects. *American Economic Review*, 110, 2964–2996.
- de la Calle-Vaquero, M., García-Hernández, M., & Mendoza de Miguel, S. (2021). Urban planning regulations for tourism in the context of overtourism. Applications in Historic Centres. *Sustainability*, 13(1), 70.
- European Commission (2022). Tourist services-short-term rental initiative. Available on:
- Ferreri, M., & Sanyal, R. (2018). Platform economies and urban planning: Airbnb and regulated deregulation in London. *Urban Studies*, 55(15), 3353–3368.
- Greater London Authority (2022). Short term and holiday lets in London. Available at: <https://www.london.gov.uk/programmes-strategies/housing-and-land-improving-private-rented-sector/short-term-and-holiday-lets-london> (last accessed: 30 Dec 2022).
- Grimmer, L., Vorobjovas-Pinta, O., & Massey, M. (2019). Regulating, then deregulating Airbnb. The unique case of Tasmania (Australia). *Annals of Tourism Research*, 75, 304–307.
- Guest Ready (2022). Porto approves new regulations for short-term rentals. Available at: <https://www.guestready.com/blog/porto-approves-regulations-short-term-rentals/> (last accessed: 30 Dec 2022).
- Hübscher, M., & Kallert, T. (2022). Taming Airbnb locally: Analysing regulations in Amsterdam, Berlin and London. *Tijdschrift voor Economische en Sociale Geografie*, 114(1), 6–27.
- Koster, H. R., van Ommeren, J., & Volkhausen, N. (2021). Short-term rentals and the housing market: Quasi-experimental evidence from Airbnb in Los Angeles. *Journal of Urban Economics*, 124, Article 103356.
- Leshinsky, R., & Schatz, L. (2018). "I don't think my landlord will find out": Airbnb and the challenges of enforcement. *Urban Policy and Research*, 36(4), 417–428.
- Liu, L., Wang, Y., & Xu, Y. (2022). A practical guide to counterfactual estimators for causal inference with time-series cross-sectional data. *American Journal of Political Science*. <https://doi.org/10.1111/ajps.12723>.
- Nieuwland, S., & Van Melik, R. (2020). Regulating Airbnb: How cities deal with perceived negative externalities of short-term rentals. *Current Issues in Tourism*, 23(7), 811–825.
- Novy, J., & Colomb, C. (2019). Urban tourism as a source of contention and social mobilisations: A critical review. *Tourism Planning & Development*, 16(4), 358–375.
- Pan, Y., & Qiu, L. (2022). How ride-sharing is shaping public transit system: A counterfactual estimator approach. *Production and Operations Management*, 31(3), 906–927.
- Regione Toscana (2022). Comunicazione locazioni turistiche. Available at: <https://www.regione.toscana.it/-/comunicazione-locazioni-turistiche> (last accessed: 30 Dec 2022).
- Regione Veneto (2022). Locazioni Turistiche. Available at: <https://www.regione.veneto.it/web/turismo/locazioni-turistiche> (last accessed: 30 Dec 2022).
- Robertson, C., Dejean, S., & Suire, R. (2023). "Airbnb in the City": Assessing short-term rental regulation in Bordeaux. *The Annals of Regional Science*. <https://doi.org/10.1007/s00168-023-01215-4>.
- Sadowski, J. (2020). Cyberspace and cityscapes: On the emergence of platform urbanism. *Urban Geography*, 41(3), 448–452.
- Sassen, S. (1994). When the state encounters a new space economy: The case of information industries. *American University Journal of International Law and Policy*, 10(2), 769–789.
- Scottish Government (2019). Short-term lets – Consultations annexes. <https://www.gov.scot/publications/short-term-lets-annexes-consultation-regulatory-framework-scotland/> (last accessed: 30 Dec 2022).
- Scottish Government (2022). Short-term lets: Regulation information. Available at: <https://www.gov.scot/publications/short-term-lets/> (last accessed: 30 Dec 2022).
- Smigiel, C. (2020). Why did it not work? Reflections on regulating Airbnb and the complexity and agency of platform capitalism. *Geographica Helvetica*, 75(3), 253–257.
- Söderström, O., & Mermet, A. C. (2020). When Airbnb sits in the control room: Platform urbanism as actually existing smart urbanism in Reykjavík. *Frontiers in Sustainable Cities*, 2, 1–7.
- Stabrowski, F. (2022). Political organizing and narrative framing in the sharing economy. Airbnb host clubs in New York City. *City*, 26(1), 142–159.
- Tedds, L. M., Cameron, A., Khanal, M., & Crisan, D. (2021). Why existing regulatory frameworks fail in the short-term rental market: Exploring the role of regulatory fractures. The School of Public Policy Publication, University of Calgary.
- van Doorn, N. (2020). A new institution on the block: On platform urbanism and Airbnb citizenship. *New Media & Society*, 22(10), 1808–1826.

- van Holm, E. J. (2020). Evaluating the impact of short-term rental regulations on Airbnb in New Orleans. *Cities*, 104, Article 102803.
- Verdouw, J., & Eccleston, R. (2022). Airbnb and the hidden barriers to effective regulation: A case study of short-term rentals in Tasmania. *Urban Policy and Research*. <https://doi.org/10.1080/08111146.2022.2076213>.
- von Briel, D., & Dolnicar, S. (2021). The evolution of Airbnb regulation: An international longitudinal investigation 2008–2020. *Annals of Tourism Research*, 87, Article 102983.
- Wooldridge, J. M. (2005). Fixed-effects and related estimators for correlated random-coefficient and treatment-effect panel data models. *Review of Economics and Statistics*, 87(2), 385–390.
- Yeon, J., Kim, S. J., Song, K., & Kim, J. (2020). Examining the impact of short-term rental regulation on peer-to-peer accommodation performance: A difference-in-differences approach. *Current Issues in Tourism*, 25(19), 3212–3224.
- Yeon, J., Song, H. J., & Lee, S. (2020). Impact of short-term rental regulation on hotel industry: A difference-in-differences approach. *Annals of Tourism Research*, 83, Article 102939.
- Yrigoy, I. (2019). Rent gap reloaded: Airbnb and the shift from residential to touristic rental housing in the Palma Old Quarter in Mallorca, Spain. *Urban Studies*, 56(13), 2709–2726.

Filippo Celata is full professor at the University of Rome La Sapienza, where he teaches economic geography, local development and spatial data analysis. His research is about urban and regional economies and policies, and about the effects of digital platforms on cities, inequalities and sociospatial relations.

Gianluca Bei is conducting a joint PhD in economic geography at the University of Rome La Sapienza and at the University of Lisbon. His research is about the policies and regulations of platform-mediated touristification in European cities.