

THREE ESSAYS ON HOUSING ECONOMICS: THE IMPACT OF COVID-19 ON SHORT-, MEDIUM- AND LONG-TERM RENTAL HOUSING

Catalina Llaneza Hesse

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Catalina Llana Hesse
2023

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Dra. Esther Martinez Garcia (UdG)

Thesis delivered to obtain the doctoral degree by the Universitat de Girona

Dra. ESTHER MARTINEZ GARCIA of the University of Girona,

I DECLARE that the thesis titled 'THREE ESSAYS ON HOUSING ECONOMICS: THE IMPACT OF COVID-19 ON SHORT-, MEDIUM- AND LONG-TERM RENTAL HOUSING, presented by Catalina Llana Hesse to obtain a doctoral degree, has been completed under our supervision and meets the requirements to opt for an International Doctorate.

For all intents and purposes, I hereby sign this document.

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- *Llaneza Hesse, C., Raya Vílchez JM. & Rodón, T. (2023). The resilience of the medium-term rental and the boom of digital nomads. Submitted to the Journal of Urban Economics (see the submission letter in Annex 3).*

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1. Summary

English

This dissertation evaluates the pandemic's impact on three coexisting urban rental markets: traditional long-term rentals (LTR), short-term rentals (STR) primarily catering to tourists, and seasonal month-by-month rentals also known as medium-term rental (MTR).

Using web-scraped Airbnb data and applying fixed effects and dummy interactions at the property level, the first two articles examine the impact of the pandemic in city of Barcelona. The results of the first article reveal a fee reduction and an increase in minimum stay for all types of STRs, particularly stronger for entire dwellings and the accommodations offered by a professionalized host.

Prompted by the increase in listings with minimum stays exceeding 30 days, the second article examines the impact on MTRs compared to STRs. Conversely the findings uncover an increase in fees and supply for MTRs during the pandemic, along with a more favorable occupancy trend. Moreover, compared to STRs, the host of MTRs and of accommodations that switch at least one time between both markets during the pandemic, are more likely to offer accommodations with fewer bedrooms, at a lower fee, and by a super host.

The third article expands to country-level data. Using a hedonic price model and owing to unique micro-data from a real estate company, it uncovers the effects on the cities of Madrid and Barcelona, compared to the rest of Spain. From the results it is to highlight a drop in rental prices during the pandemic of 9% for Barcelona and Madrid. Nevertheless, this effect rebounds after the COVID-19 restrictions are lifted. Additionally uncovered was, that tenants with higher education levels and non-Spaniards with EU nationality faced a stronger price drop. While in terms of rental discounts, defined as the gap between listed and transaction prices, the results suggest an increase during the COVID-19 period. Conversely, after the restrictions were lifted, the discount figures dropped, reaching even lower levels than in the pre-pandemic period.

This dissertation unveils varying responses of urban rental market to the pandemic, with the MTR market emerging as the most resilient. experiencing a growth in prices and supply. Furthermore, it contributes to the existing literature on the impact of the pandemic on rental markets, by being the first to empirically analyze the dynamics of an MTR market and the pandemic's influence on price discounts in the LTR market.

avalua l'impacte de la pandèmia en els tres mercats de lloguer urbà: els lloguers tradicionals a llarg termini (LTR), els lloguers a curt termini (STR) dirigits principalment a turistes, i els lloguers mensuals, també coneguts com a lloguers a mig termini (MTR).

Els dos primers articles examinen l'impacte de la pandèmia a la ciutat de Barcelona. Per fer-ho, es fan servir dades d'*Airbnb* obtingudes mitjançant la tècnica *web-scraping* i una estratègia d'identificació d'efectes fixos i interaccions *dummies* a nivell de propietat. El primer article revela que hi hagut una reducció dels preus i un augment de l'estada mínima per a tots els tipus de STR, especialment per a habitatges sencers i amfitrions professionalitzats. Amb el objectiu d'investigar el l'augment de les ofertes amb estades mínimes superiors a 30 dies, el segon article examina l'impacte de la pandèmia en els MTR, que al contrari que els STR, experimenten un augment en les tarifes i en l'oferta, juntament amb una tendència d'ocupació més favorable. A més, es troba que, en comparació amb els STR, els amfitrions de MTR i d'allotjaments que canvien almenys una vegada entre els dos tipus de lloguer durant la pandèmia, tenen una major probabilitat de ser oferts amb menys habitacions, a un preu més baix i per un *superhost*.

El tercer article amplia les dades al nivell nacional. Utilitzant microdades de una empresa immobiliària i un model de preus hedònics, l'estudi desvela els efectes de la pandèmia sobre el mercat de lloguer a les ciutats de Madrid i Barcelona, en comparació amb la resta d'Espanya. D'entre els resultats, destaca una caiguda mitjana dels preus de lloguer d'aproximadament el 9% per a Barcelona i Madrid. No obstant això, aquest efecte es va revertir després d'aixecar-se les restriccions vinculades al COVID-19. També s'identifica que durant la pandèmia, els llogaters amb nivells més alts d'educació i amb nacionalitat de la UE diferent a l'espanyola van enfrontar una caiguda de preus més pronunciada que altres llogaters. Pel que fa als descomptes de lloguer, definits com la diferència entre els preus anunciats i els preus de transacció, els resultats suggereixen un augment del mateix durant el període de la COVID-19. Al contrari, després que s'aixequessin les restriccions, va caure, arribant fins i tot a nivells més baixos que en el període pre-pandèmic.

Aquesta tesi aborda diverses dinàmiques del mercat de lloguer urbà enfront de la pandèmia en un context de manca en l'oferta d'habitatge i d'expansió del treball a distància. Es conclou que el mercat MTR a sigut el més resistent durant aquest període, ja que experimenta un creixement en els preus i l'oferta. A més, la investigació contribueix a la literatura pel fet de ser pionera en analitzar empíricament la dinàmica d'un mercat MTR i la influència de la pandèmia en els descomptes de preus en el mercat LTR.

Esta tesis evalúa el impacto de la pandemia en los tres mercados de alquiler urbano: los alquileres tradicionales a largo plazo (LTR), los alquileres a corto plazo (STR) dirigidos principalmente a turistas y los alquileres mensuales, también conocidos como alquileres a medio plazo (MTR).

Los dos primeros artículos examinan el impacto de la pandemia en la ciudad de Barcelona. Para ello, se emplean datos de *Airbnb* obtenidos por medio de la técnica *web-scraping* y una estrategia de identificación de efectos fijos e interacciones *dummies* a nivel de propiedad. El primer artículo revela una reducción de los precios y un aumento en la estancia mínima para todos los tipos de STR, especialmente para viviendas enteras y anfitriones profesionalizados. Motivado por el aumento de la oferta en alquileres con estancias mínimas superiores a 30 días, el segundo artículo examina el impacto de la pandemia en los MTR, que por contrario a los STR, experimentan un aumento en las tarifas y en la oferta, junto con una tendencia de ocupación más favorable. Además, encontramos que, en comparación con los STR, los anfitriones de MTR y de alojamientos que cambian al menos una vez entre ambos mercados durante la pandemia, tienen una mayor probabilidad de ofrecer alojamientos con menos habitaciones, a un precio más bajo y por un *superhost*.

El tercer artículo amplía los datos al nivel nacional. Utilizando microdatos de una empresa inmobiliaria y un modelo de precios hedónicos, desvela los efectos sobre el mercado de alquiler en las ciudades de Madrid y Barcelona, en comparación al resto de España. Los hallazgos destacan una caída promedio en los precios de alquiler de aproximadamente 9% para Barcelona y Madrid. Sin embargo, este efecto se revierte después de levantarse las restricciones. También identifica que durante la pandemia, los inquilinos con niveles más altos de educación y con nacionalidad de la UE otra a la española, enfrentaron una caída mayor de precios. En cuanto a los descuentos de alquiler, definidos como la diferencia entre los precios anunciados y los precios de transacción, los resultados sugieren un aumento durante el período de COVID-19. Aun que después de que se levantasen las restricciones, el efecto fue contrario, llegando a niveles incluso más bajos que en el período prepandémico.

Esta tesis aborda diversas dinámicas del mercado de alquiler urbano ante la pandemia, destacando el mercado de MTR como el más resistente, al experimentar un crecimiento en precios y oferta. Además, la investigación contribuye a la literatura existente al ser pionera en analizar empíricamente la dinámica de un mercado MTR y la influencia de la pandemia en los descuentos de precios en el mercado LTR.

2. General introduction

Over the past decade, households across Spain have seen steadily rising rents, especially the households residing in growing urban cities. The rising prices can be mainly attributed to three key factors. Firstly, a housing supply that has failed to keep up with the increasing housing demand (Montoriol Garriga in 2023). Secondly, households' growing preference for renting over buying, influenced by labor market conditions (Spanish Bank, 2020). Third, a shift from residential to tourist rentals, driven by urban tourism (Garcia-López et al. 2020).

Moreover, although working remotely is not new, the COVID-19 crisis accelerated and expanded its practice. As *workcation*¹ and *digital nomadism*² consolidate, an increase in demand for month-by-month rentals is likely. This raises the question of in which way the housing market will adapt its supply to this new demand, and whether this supply will come from the residential or the touristic rental market.

In line with the above context, this dissertation explores empirical evaluations of the impact of the COVID-19 pandemic on the three coexisting urban rental markets: the traditional long-term rental (LTR) market, the short-term rental (STR) market primarily demanded by tourists, and the seasonal month-by-month rental (MTR) market, which falls in between the first two.

I posit that the multifaceted impact of the COVID-19 crisis presents a unique opportunity to discern between the dynamics of each of the three rental markets. Being the primary objective of the dissertation to investigate how the implementation of pandemic-related policies, such as lockdown measures, remote work enhancing policies and travel restrictions, have affected the dynamics of each market separately. A second objective, contingent upon the availability of data, is to identify whether the observed effects are transient or endure after the pandemic. A third objective is to provide insights on the interplay between the three markets and identify the underlying conditions that prompt landlords to transit their properties from one market to another. A transition example could be the conversion of a STR dwelling to an LTR or MTR dwelling, as a response to the dropping STR demand during the pandemic. Another example could be a transition from the LTR market to the MTR market, as a strategy for landlords to circumvent the LTR legal framework and increase their returns.

¹ Workcation is defined as traveling to a destination and working remotely at the same time (Oxford University Press, 2023).

² Digital nomads are defined as person who earns a living working online in various locations of their choosing (Oxford University Press, 2023).

Elucidating all these cross-interrogations is particularly relevant in the post-pandemic housing context, with households facing an increasing cost of living, a drop in real incomes, and an after-pandemic surge of interest rates, generating an even more tense LTR market than in the pre-pandemic time (Montoriol Garriga, 2023).

In Spain, while LTR and MTR markets are regulated at national level, STR market regulations is transferred to the regional level (Autonomous Communities). Local governments can, however, limit both housing and tourist facilities under specific circumstances. For example, in Barcelona – the city for which the studies on the STR and the MTR market are performed - the City Council suspended the granting of STR licenses in 2015 and in March 2017 a Special Tourist Accommodation Plan (PEUAT) was introduced. This regulatory framework established a maximum of 9606 STR licenses and defined STR supply as entire accommodations destined to stays of less than 32 days. Interesting is that after 2017 the MTR market in Barcelona has been steadily growing (AirDNA, 2023).

Regarding the regulation of this market, the classification of leases for purposes other than long-term stays are defined in the art. 3 of National Urban Rental Decree Law 29/1994, including the rentals for seasonal purposes, MTRs. Its jurisprudence establishes that category of seasonal rental does not derive from the agreed contract, but from the purpose of the occupation as business or study purposes, which should be specified in the rental agreement.

Regarding the LTR market, after the reform of the LAU 29/1994 implemented in 2018, the minimum duration of the rental agreements was expanded from three to five years (LAU, art. 9.1). In the combination of these different regulations in a context of a tense LTR market, characterized by an inadequate new housing supply regarding household formation³, the MTR market can present an opportunity for landlords to evade the regulatory framework of LTRs and STRs and offer their rentals on a monthly basis⁴.

Coming to the topic addressed in this dissertation, the impact of the COVID-19 pandemic on each of the rental markets, the expected was, that compared to MTRs, a heavier shock would be experienced by STRs after facing a substantial decline in tourism. Conversely, MTRs were

³ Between 2015 and 2019 in Spain, there were more new households renting homes (610,000) than the total number of new households created during that time (385,000). This happened because fewer people became homeowners (-93,000) and fewer people got below-market rent or free housing (-132,000) (Montoriol Garriga, 2023).

⁴ According to some newspapers (Zui et al., 2020; Grau del Cerro, 2021), the MTR contracts have been implemented to circumvent the law of LTR contracts.

expected to be more resilient, first due to the potential influx of remote workers and second, due to being a closer substitute to LTRs.

Moreover, following the findings by Batalha et al. (2022), a decline in demand for STRs could have partially shifted rental units to the LTR market, resulting in a potential drop in LTR prices. This shift, however, might have been directed towards the MTR market instead, since STR landlords can see monthly rentals as a more attractive and temporal solution a rent of a minimum length of 5 years.

Upon data availability, the initial two articles of this thesis focus exclusively on the city of Barcelona using web-scraped data on Airbnb listings (AirDNA). In the first study, we use a fixed effects approach at property level with dummy interactions to capture the consequences of the pandemic. A very similar strategy is applied in the second study. Furthermore, we add some additional dummy interactions to capture the differential effect of the pandemic on each type of rental, as a multiple logistic regression to identify differences in characteristics between STRs, MTRs and dwellings that transit between both markets. Conversely, in the third article, we use daily data from a real estate company at country level, putting a special emphasis on the two most populated cities in Spain, Madrid and Barcelona. In this last research, we apply a hedonic price model with fixed effects and dummy interactions to capture the specific effects on each city. Finally, owing to the availability of the unique real estate micro-data, this last research in addition aims to understand the changes in the preferences of the LTR demand during a pandemic.

Now, shifting our focus to our findings, the first article examines the effects of the pandemic on the STR market in Barcelona, considering the type of accommodation, single room or entire dwelling, as well as distinguishing between professionalized and non-professionalized hosts. The results indicate that the pandemic reduced prices for entire dwellings by an average of 11.3%, compared to a drop of 4.7% for single rooms. This effect is even more significant for professionalized supply, with a 13.6% and 9.8% reduction, respectively. Furthermore, all types of accommodations experienced an increase in minimum stay. Overall, the findings suggest that STR hosts adapted their supply to the drop in demand by offering lower prices and longer stays to attract a more stable demand, especially by those categorized as professionalized hosts. Prompted by the noticeable increase in listings with minimum stays exceeding 30 days, the second article focuses on the impact of the pandemic on MTRs compared to STRs, in terms of prices, occupancy, and supply. The results show that MTRs experienced an increase in daily fees of 9.1% per listing and a supply growth of 27.4% per neighborhood, while STRs have been

impacted negatively in terms of both indicators. In terms of occupancy, the findings suggest a negative impact on occupancy that was stronger for STRs than for MTRs, experiencing an on-average drop of 37.1 p.p. and 25.7 p.p., respectively. In addition, we find that regarding the STRs, the host of MTRs and accommodations that switch at least one time between both markets during the pandemic, offer accommodations with fewer bedrooms, at a lower fee, and are more likely to be offered by a super host.

Lastly, the third study of this thesis examines the impact of the pandemic on the LTR market. Our results suggest that Spanish rental prices experienced an average drop of 1.3% during the entire restriction period, followed by a price increase of 5.1% after restrictions were lifted. However, Madrid and Barcelona experienced a more pronounced impact, with rental prices decreasing by approximately 9% during the pandemic, while post-pandemic prices returned to pre-pandemic levels. In addition, we observe that during the pandemic tenants with higher education levels and non-Spaniards with EU nationality faced more significant price drops than other tenants. While properties with attributes such as outdoor spaces, an extra room, or parking facilities experienced an additional increase. The study also identifies changes in the dynamics of the housing market in terms of rental discounts, defined as the gap between listed and transaction prices, uncovering an average discount increase during the COVID-19 period of almost 28% in the Madrilenian market and 15% in the Barcelonian market, while no effect for the rest of Spain was identified. After the restrictions were lifted, the discount level fell by 42% in Barcelona and 22% in the Madrilenian market. This difference in the discount decline could be an adjustment of the rental cap introduced and lifted in Barcelona during the pandemic. Nevertheless, it could also be explained due to the increment in STRs or MTRs after the travel restrictions were lifted.

In conclusion, this dissertation demonstrates that each of the three urban rental markets was differently impacted by the pandemic, finding for example that prices dropped for STRs and LTRs, while the MTRs showed to be more resilient since experiencing a growth in prices and in supply. Furthermore, it contributes to the existing literature on the impact of the pandemic on rental markets, by being the first to empirically analyze the dynamics of an MTR market and the pandemic's influence on price discounts in the LTR market. Finally, it puts light on the relevance of understanding the interdependence among the three rental markets in the context of an insufficient housing supply and an increasing remote work.

The thesis is structured as follows. After the introduction, the transcripts of the three articles are presented, closing with some general conclusions, a discussion of the thesis limitations, and its main contribution.

3. Articles

3.1 The effect of COVID-19 on the peer-to-peer rental market

Kindly find the published version of this article in Annex 1.

3.2 The resilience of the medium-term rental and the boom of digital nomads

THE RESILIENCE OF THE MEDIUM-TERM RENTAL AND THE BOOM OF DIGITAL NOMADS

Abstract

In the city of Barcelona, rentals between 1 and 11 months have been steadily growing since 2017. These so-called medium-term rentals (MTRs) combine higher prices as long-term rentals (LTRs), with lower management costs as short-term rentals (STRs) and have the flexibility to absorb renters coming from the STR market, as well as from the LTR market. Using fixed effects and web-scraped Airbnb data, this study delves for the first time into the resilience and characteristics of MTRs. Our findings suggest that during the pandemic, MTRs increased their daily fee by 9.1%, or approximately €8, reaching a peak of a 37.2% rise during the second state of emergency in Spain. In addition, we find that the negative impact on occupancy was much stronger for STRs than for MTRs, experiencing a drop on average of 37.1 p.p. and 25.7 p.p., respectively. In terms of supply, our findings indicate an average increase per neighbourhood of 27.4% in MTRs. Finally, we find that relative to STRs, MTRs and accommodations that switched at least one time between markets during the pandemic offer dwellings with fewer bedrooms at a lower fee and are more likely to be offered by a super host.

JEL classification: O18, R3, R31, J61

Keywords: Medium-term rental, COVID-19, Airbnb, Remote working, Digital nomads.

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1. Introduction

The impacts on the housing market of the proliferation of short-term rentals (STR) such as Airbnb, have been a hot topic of research in recent years (see for example Horn & Merante, 2017; Koster et al. 2018; Lee, 2016; Sheppard & Udell, 2016; Duso et al., 2020; Garcia-López et al. 2020). Scholars have also examined the impact of the different regulations introduced by several cities to manage this proliferation, ranging from outright bans on special permits in tense areas to restrictions on the number of rentals (see for example, Yang and Mao, 2019, Yeon et al. 2022; Koster et al., 2021; Robertson et al., 2023). In the case of Catalonia⁴ – the region where the city of Barcelona is located – tourist accommodations are regulated by a tourist rental licence system that allows owners to offer stays for periods of less than 32 days (Decree 159/2012).

Within the rental market and coexisting with STRs are long-term rentals (LTRs), for which the latest Spanish regulation LAU⁵ gives the private tenants the right to stay for at least 5 years.

Here is where the month-by-month rental, hereafter defined in the paper as a medium-term rental (MTR), finds its niche. While the Barcelonian rental market regulates stays of less than 32 days by licensing and stays of 12 months or longer by tenants' rights, this third rental submarket, serving stays between 31 days and 11 months, is less regulated. This intermediary submarket has the ability to absorb housing units from both LTR and STR markets, combining higher prices as LTRs but with lower management costs and a similar degree of flexibility as STRs.

In regard to the shift of housing units from LTRs to MTRs, one polemical example for Barcelona is the *Orsola* building, located in the Example district. This building with 27 flats was bought in 2020 by an investment fund called *Lioness Inversions* to transform all 27 LTRs into MTRs (Nadue, 2022; Benvenuyt, 2022; Mira, 2022). As can be identified in local newspapers (Zui et al., 2020; Grau del Cerro, 2021), the simulation of MTR contracts has been

⁴ The regulations are not centralized at national level but fall to each Autonomous Community (AC). In the case of Barcelona, the city council additionally regulates these markets. The Special Tourist Accommodation Plan (PEUAT) of Barcelona city regulates the introduction of tourist accommodations, as well as youth hostels, tourist apartments and shared homes. In Barcelona, the sanction for offering flats for tourist use (HUTs) without a licence is a fine ranging from 3.001 to 600.000 euros (https://www.habitatge.barcelona/es/noticia/nuevos-criterios-para-evitar-sanciones-desproporcionadas-en-los-pisos-turisticos-irregulares_1091494).

⁵ Acronym for the law of urban rentals, in Spanish “Ley de Arrendamientos Urbanos”.

widespread in the Barcelonian rental market to circumvent the law requiring the extension of the contract to 5 years, which is mandatory in most LTR contracts.

The question is whether these situations represent a general pattern or just incidental cases and whether the COVID-19 pandemic enhanced the MTR market, as by using the data on Airbnb, we observe that some STR hosts recategorized their touristic accommodations as MTRs.

On the demand side, MTRs have been traditionally accommodations suited to students and temporary workers, and according to Airbnb (2022), the volume of reviews on the platform by US guests mentioning the term “remote working” or “work remotely” tripled since the start of the pandemic compared to the same period in 2019. Although the lifestyle of working remotely is not new, the COVID-19 crisis expanded, accelerated, and consolidated its practice, and the increase in digital nomads could establish a need to adapt the housing supply in receiving countries.

A recent study found that during the pandemic, remote workers moved to more affordable neighbourhoods, resulting the emigration to the periphery in a drop in rental prices in the city centre (Delventhal et al. 2022). This research emphasizes the gain in welfare of the remote workers who moved away from the city centre to a more affordable place; could a similar effect be observed at the global level? Could we expect remote workers moving from higher- to lower-income countries to increase their welfare? How would this type of immigration flow impact the LTR market?

Several academic works suggest that the increase in STRs resulted in a shortage and subsequent price increase of residential housing (Horn & Merante, 2017; Koster et al. 2018; Lee, 2016; Sheppard & Udell, 2016; Valentin, 2020; Ayouba et al.2020; Duso et al., 2020; Garcia-López et al. 2020; Rodríguez-Pérez de Arenaza, et al. 2019; Chang, 2020), followed by an out-migration of residents (Cocola-Gant 2016; Lagonigro et al., 2020; Lee 2016) and the creation of “foreign only” enclaves (Cocola-Gant & Lopez-Gay 2020). However, to the best of our knowledge, the dynamics affecting the MTR market have not been addressed in previous studies. By doing so in this article, we believe we contribute to the literature in opening a new branch of housing research.

Overall, the main objective of this study is to examine how MTRs have been affected by the pandemic compared to STRs in terms of prices, occupancy, and supply. Meanwhile, the secondary objective is to identify the characteristics of the listings posted as MTRs compared to those posted as STRs. In summary, we estimate that, compared to pre-pandemic values, MTRs experienced an average increase in daily fees of 9.1% and a supply growth of 27.4%

during the pandemic, while in the case of STRs, both fees and supply were negatively impacted. In the case of occupancy—days rented out of days offered—MTRs suffered a drop of 25.7 p.p., while the occupancy of STRs experienced a stronger decrease, with an average of 37.1 p.p. per listing. Finally, we find that the probability of offering the flat on Airbnb as an MTR, and not as an STR, is affected negatively by the number of bedrooms, daily fee, occupancy rate, and proximity to the Airbus station and the beach but affected positively by the host being recognized as a super host.

2. Background

In this second chapter, we first provide a short account of the evolution of the MTR supply in Barcelona, to later review the relevance of the evolution of remote work, digital nomads, and the related need to cover their housing demand.

2.1 The MTR supply in Barcelona

As previously stated, MTR is a rental market offering stays too long to be considered STR and too short to be counted as LTR. Particularly in the city Barcelona, based on the national and local regulations, an MTR is any accommodation that offers stays between 32 days and 11 months.

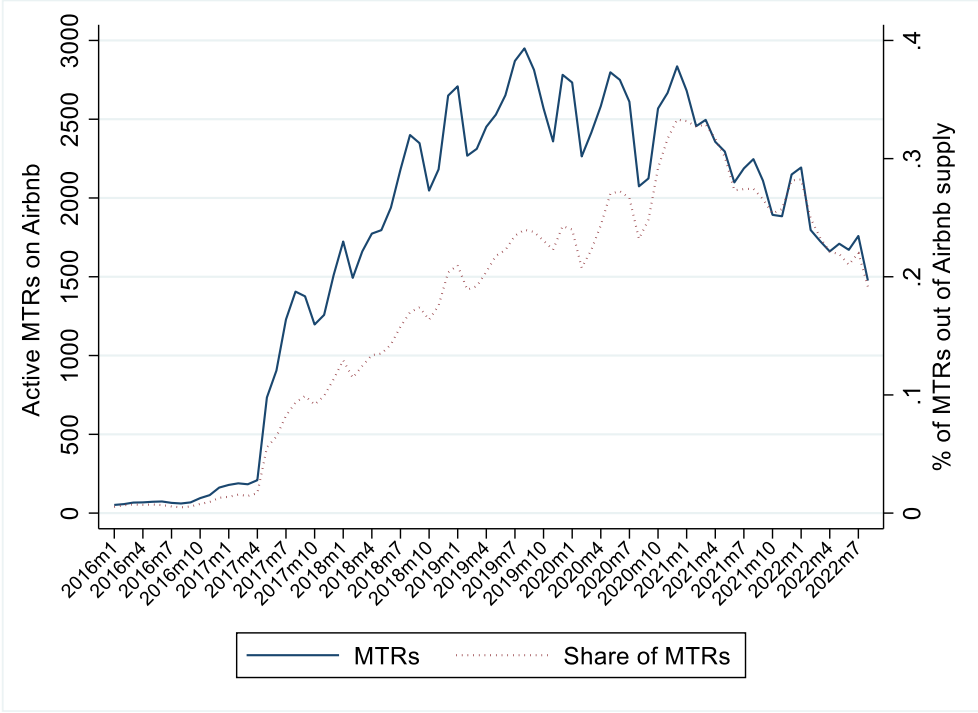
When reviewing the microdata from the Airbnb platform for the city of Barcelona, we see that this segment of the market grew after 2017, the same year where the urbanistic plan for touristic accommodations was implemented following the enforcement of mandatory and temporally limited licenses for tourist accommodations. Reaching its peak in August 2019 with 2,950 active MTR dwellings, representing approximately 24% of the total apartments offered on the Airbnb platform (see Figure 1).

Despite the absolute supply remaining almost the same at the end of the first year of the pandemic, 2020, with 2,836 MTR units, the proportion of listings identified as MTRs increased to 33.3% of all listings published on Airbnb (AirDNA, 2022), explained by the drop in the supply of STRs.

Nevertheless, during 2021 and 2022, the MTR sector reverted to the previous trends of 2018, at least on the Airbnb platform, showing a supply of 1,759 units in July 2022. A very similar supply is found on Netspick⁶, with 1,743 flats in October 2022.

⁶ Netspick is a broker platform between MTR demand and different MTR suppliers offering month-to-month rentals, including Homelike, Spotahome, and HousingAnywhere

Figure 1. Active MTRs listed on Airbnb in Barcelona, 2022



Source: Own elaboration based on data from AirDNA, 2022. Note: Active is defined as an accommodation that is available or rented in a given month for at least one day. MTR stands for mid-term rentals and are those listings with a required minimum stay of 30 days or longer, while STR stands for short-term rentals defined as listings with a maximum reservation length of 29 days. Please find the geographical distribution of MTRs and STRs for the period 2019-2022 in Figures A2 and A3 in the appendix.

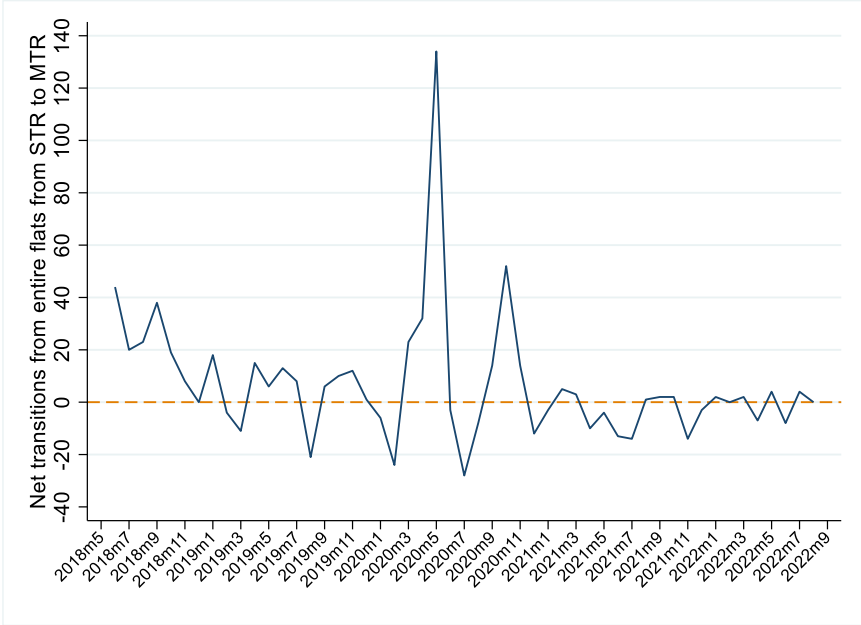
Conversely, the STR supply on Airbnb suffered during the pandemic a strong loss, with some listings removed and others transitioned within the same platform to the MTR market. However, this transit could have been structural or circumstantial, as managers of tourist apartments could have reacted to the strong drop in tourism potentially by transforming their activity, shifting their STR properties to an MTR modality to get through the crisis period and still enable a later recovery of tourist activity.

In Barcelona, we observe that during the pandemic, a temporary supply of 2,033 MTRs appeared on the Airbnb platform but disappeared afterwards. When controlled by the listing ID, we observe that some existing STR listings changed to the MTR sector, especially at the beginning of the pandemic, with the highest number of daily net transitions reaching 136 (see Figure 2).

This evolution is in line with an early study of the effect of the pandemic, which reviews the impact of the pandemic on the STR market in Barcelona using data up to January 2021 (Llaneza and Raya, 2022). This study suggests that the adaptation strategy to accommodate decreasing

demand was to attract an audience with more stable demand, coupled with lower prices and longer stays.

Figure 2. Net transitions of active dwellings from STRs to MTRs in Barcelona, 2022



Note: MTR stands for mid-term rentals and are those listings with a required minimum stay of 30 days or longer, while STR stands for short-term rentals, defined as listings with a maximum reservation length of 29 days. In this graph, accommodations listed for the first time are not included, and “net transitions” refers to the difference between the two transfer options, STR to MTR minus MTR to STR. Source: Own elaboration based on data from AirDNA, 2022.

Inevitably, transitions off the Airbnb platform are not considered in Figure 2. It is also important to keep in mind that, as mentioned in the previous section, the MTR market can absorb not only STRs but also LTRs.

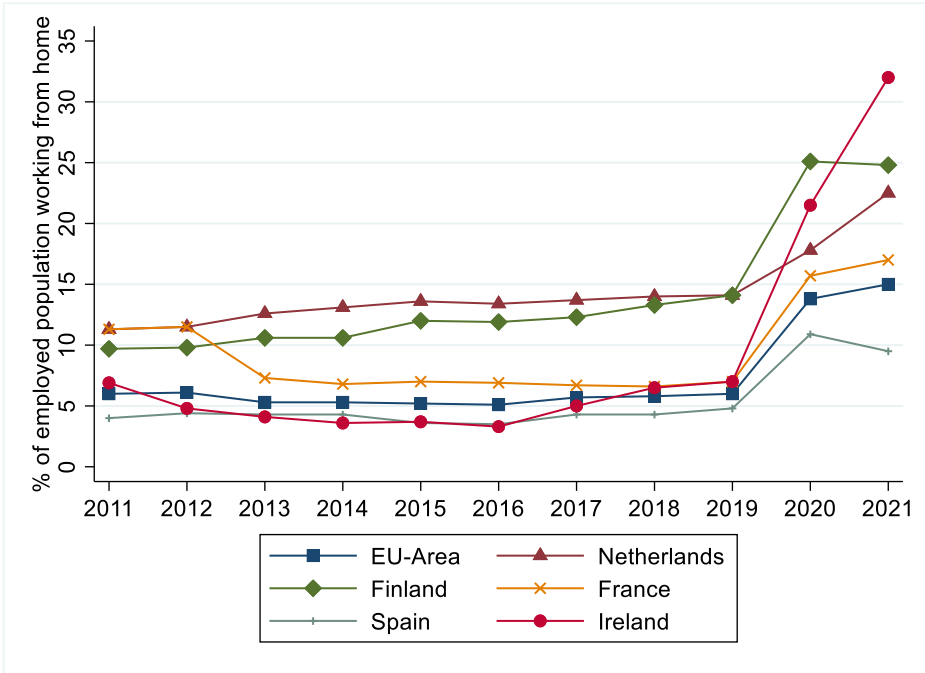
2.2 Remote work and digital nomadism as a source of MTR demand

Before the pandemic, the digital nomadic⁷ lifestyle was mainly adopted by entrepreneurs and freelancers, who were primarily in the business of IT services, marketing, and web design. As a result of the pandemic-related change in work style, a new group of workers became digital nomads: company-employee professionals (MBO, 2021). According to a survey published by Statista, 17% of worldwide digital nomads were company-employed in 2022 (A Brother

⁷ Digital nomads are commonly defined as people who can work from almost anywhere and anytime, thanks to the ubiquity of digital infrastructure and technological advances (Blatt and Gallagher, 2013; IBD, 2022). There is a lack of consensus among scholars on a single definition, but most include concepts such as teleworking, digital technology, geographical mobility, travelling, and in some cases workhour flexibility and coworking spaces (Shawkat et al., 2021).

Abroad, 2022). In the EU, the employed population usually working from home increased on average (19 countries), from 5.4% in 2019 to 15% in 2021 (see Figure 3). Some countries, such as Ireland and Finland, even surpassed the 25% mark for people working from home out of total workers.

Figure 3. Evolution of homeworkers (%) for selected EU areas, 2011-2021



Note: The figure shows the yearly change in the percentage of the employed population that usually works from home out of the total employed population. Source: Eurostat, 2022

As digital nomadism becomes popular, countries have started to create incentives to attract foreign remote workers by establishing “digital nomad visas”⁸. These provide residency—up to 1 year in most cases—to location-independent workers or introduce tax exemption policies. In Spain, even though few details are known to date, in December 2022, the parliament passed a new law to attract start-ups, including the creation of a digital nomad visa for autonomous workers and employers from foreign countries (La Moncloa, 2022).

However, why would digital nomads choose Barcelona for a temporary stay? After the launch of the platform *CoworkingSpain* (2022), Spain positioned itself as the second-best country to work remotely thanks to the speed of the internet, the large number of coworking spaces, and current visas for freelancers. Two online digital nomad guides (digitalnomads.world.com, nomadlist.com) describe Barcelona as a city with a great work–life balance, good internet

⁸ To date, 49 countries have established digital nomad visas (Johnson, 2023), including Madeira (Digital nomads, 2023), Costa Rica (Du Preez, 2022), Estonia (E-Resident, 2023) and Croatia (Republic of Croatia, 2022).

connectivity, good public transport, and large stock of coworking spaces. After Porto, Madeira, and Lisbon, Barcelona ranks fourth in the list of best places for digital nomads in Europe. Nevertheless, according to both websites, the main limitation of the city is high accommodation prices. However, they are still lower (in absolute terms) than London, Paris, Stockholm, or Berlin (Eurostat, 2022), and according to the country manager of Homelike in an interview with a Spanish newsletter, most digital nomads in Barcelona have German, English or American nationality (El Mundo Financiero, 2021). In the interview, the CEO also said that the accommodation demand of digital nomads increased by 219% from 2020 to 2021 (ibid., 2021). Despite descriptive evidence about the increased numbers of digital nomads in many countries (MBO, 2021), there is a lack of evidence and understanding for how this increasing trend could be converted into an increased demand for temporary accommodations.

Previous works have examined the impact of migrants on the housing sector (d'Albis et al., 2019; Akbari and Aydede, 2012). However, given the profile of digital nomads, who on average are young, educated, and come from rich countries, the evidence from previous studies arguably cannot be applied to this new trend. COVID-19 has led to increased migration among those seeking to take advantage of remote work and the lower cost of living. When cities differ in productivity, a shift to remote work incentivizes some workers to relocate from high-productivity cities to low-productivity cities with cheaper housing while maintaining their jobs in the origin city (Brueckner et al. 2021, Delventhal et al. 2022, Gupta et al. 2022).

In summary, as companies started promoting remote work during and after the COVID-19 crisis, real estate markets will adapt to this new demand from professionals who choose to work remotely in different cities or countries. A crucial issue to focus on then is that this demand, earning northern European wages and living in the less expensive south, could drive housing prices up by motivating the transition of LTRs to MTRs and ejecting locals who can no longer afford to live in the city centre. Following this phenomenon, two exploratory studies in Barcelona, one of the Gòtic area and one of the Sant Antoni area, using quantitative and qualitative techniques, reveal that the process of population restructuring is characterized by a decrease in long-term residents and inhabited dwellings and the arrival of young, highly educated and foreign-born residents, who are increasingly mobile and form a transient population (Cocola-Gant, Lopez-Gay and Russo, 2020; López-Gay, Ortiz-Guitart & Solana-Solana, 2022).

This change was especially notable during the pandemic, when the demand from tourists and, consequently, the demand for STRs fell considerably, so that suppliers had higher incentives to adapt.

3. Data and Methods

3.1 Data description

To evaluate the impact of the pandemic on the MTR market, we use a dataset provided by *AirDNA* that covers monthly data from November 2014 to June 2022 (both months included). We exclusively analyse entire flat listings posted on the major collaborative economy accommodation platform *Airbnb*, considering it a representative sample of the Barcelonian MTR market⁹.

Given that we want to uncover whether the effects of the pandemic were different on STRs and MTRs, we use the information on minimum stay (in days) to define MTRs as listings that require a minimum reservation length of 30 days or more and STRs as listings offering a stay of fewer than 30 days. Importantly, the regulation in Barcelona restricts STR stays to 31 days; nevertheless, after observing the distribution of the variable minimum stay, we decided to include days 30 and 31 within the MTR threshold (see Figure A2 in the Annex). In the appendix, we show that after testing the robustness of our results with a 28-Day threshold and a 30-Day threshold, we find almost identical results (see Table A2).

Since we use the minimum stay to categorize the listing as either MTR or STR, the observations that do not present any value for this variable are dropped, resulting in 859,606 valid observations out of a possible 868,547. In addition, we exclusively analyse listings that were available or rented for at least one day during the given month.

The main variables used to compare the impact of the pandemic on the MTR and the STR market at the property level are the average daily rate (ADR) and the occupancy rate, defined as the proportion of days reserved out of the sum of available days and reserved days. Both variables are offered at the listing level. The third variable we review is the supply density, observable at the neighbourhood level, which is defined as the number of flats offered per 1000 housing units in a neighbourhood (for more detailed information on the three variable outcomes, see Table A1 in the annex).

⁹ To give a comparative example, we analysed 1759 flats in July 2022, more than the MTRs posted on one of the main MTR platforms, Netspick, which had 1743 posts in October 2022.

3.2. Econometric strategy

In the first part, to identify whether the pandemic affected STRs differently than MTRs in terms of average daily rate (ADR) and occupancy, we use the following econometric model for our two outcomes of interest Y per property p in time (month/year) t :

$$(1) \quad Y_{pt} = \alpha + \beta_1 Covid_t + \beta_2 MTR_t + \beta_3 Covid_t * MTR_t + \delta_p + \theta_t + \gamma_{pt} + \epsilon_{pt}$$

where $Covid_t$ is a dummy for the treatment period (\geq March 2020)¹⁰, so that β_1 is the coefficient that captures the average impact of COVID-19 on our variables of interest, ADR and occupancy. And MTR_t is a dummy that takes the value 1 for listings categorized as MTR and 0 for those designated as STR. So that, our primary focus then centres on the coefficient β_3 , representing the interaction between both dummy variables, COVID-19 and MTR, allowing us to identify the differential effect of COVID-19 on MTRs compared to STRs.

All time-invariant characteristics of the property are encapsulated by property-level fixed effects δ . Any other significant factor that could have impacted the outcome variables over time is captured by the month-year fixed effects θ . Furthermore, we include several control variables as if the host is defined as a super host and the number of reviews, since both variables have been found to be important factors in explaining daily rate and occupancy (Gyódi, 2022) (see the complete list of control variables in the A2 table in the annex).

In addition, the panel data used in this study are unbalanced, since some properties have no information at some point in time during the studied period; it could have been listed on the platform after the beginning of the studied period, removed from listing before the end of the studied period, or been posted and blocked at different points in time during the studied period.

$$(2) \quad Y_{pt} = \alpha + \sum_{i=1}^5 (\beta_i Phase_i + \vartheta_i Phase_i * MTR_t) + \beta_6 MTR_t + \delta_p + \theta_t + \gamma_{pt} + \epsilon_{pt}$$

In the case of our second model, the equation involves five terms associated with five different periods, so that β_i captures the impact of each phase on the dependent variables. Following the legal restrictions imposed in Spain, β_1 is the coefficient that captures the effect for the first phase, between March 2020 and June 2020, during the first emergency period. β_2 is the coefficient that captures the effect for the second phase, the period between the first and second states of emergency (from July 2020 to October 2020). β_3 is the coefficient that captures the

¹⁰ We choose this cut in time, since previously most borders were closed, and our interest is to identify what happened after they were opened again.

effect for the third phase, the second state of emergency, between November 2020 and April 2021. Finally, the after pandemic is divided into two time periods: β_4 is the coefficient for the “soft regulation” phase, that captures the effect between May 2021 and January 2022, while β_5 captures the “recovery effect”, between February 2022 and August 2022.

On the other hand, ϑ_i represents coefficients associated with interactions between each phase and MTR listings, indicating how the effect of each phase varies depending on whether it is associated with MTRs.

Our third and fourth models review the effect of the pandemic on the quantity of listed accommodations per neighbourhood Q_{nt} , splitting the sample in this case between STRs and MTRs. Using data collated at the neighbourhood level¹¹ n and month t , there are no property fixed effects to include. Instead, several control variables γ are included in the model¹² (see the complete list in Table A2 in the Annex). In addition, fixed effects at the month-time level θ and neighbourhood fixed effects δ are included to capture any time-invariant characteristics not controlled by the accommodation’s characteristics and tourist attractions. Following the same periods established for Model 2, changes in supply density are also reviewed in five phases.

4. Results: Differential effect of COVID-19 on MTRs

Table 1 presents the results of Equation (1) for the two outcomes: daily rates and occupancy rate. Table 2 presents the results of Equation (2) for the same two outcome variables using a fixed-effect approach at the property level. While Tables 3 and 4 review the impact on the supply of MTRs and STRs by analysing the density of dwellings. Finally, we present the results of several robustness checks.

4.1 Average daily rate and occupancy rate

In general, the coefficient of COVID-19 indicates that the period between March 2020 and August 2022 is associated with an average decrease of 12.7% in daily rates and an average drop of 37.1 p.p. in occupancy for the listings offered as STRs on the Airbnb platform (see Table 1). In regard to the differential effect, conversely to STRs, the results suggest that the pandemic positively affected daily rates for MTRs, with an increase of 9.1%.

¹¹ Barcelona has 73 neighbourhoods.

¹² We compute for all control variables the mean values at the neighbourhood level.

Table 1. Average effect of COVID-19 on ADR and occupancy: MTR versus STR

	(1) ln ADR US	(2) Occupancy %
COVID-19	-0.127*** (0.00616)	-0.371*** (0.00412)
MTR	-0.229*** (0.0145)	-0.149*** (0.00974)
COVID-19*MTR	0.218*** (0.0114)	0.114*** (0.00602)
Constant	4.931*** (0.109)	0.684*** (0.0399)
Observations	352,787	522,174
R-squared	0.164	0.168
N° of listings	19,695	20,633
Control character.	YES	YES
Listing FE	YES	YES
Year and Month FE	YES	YES

Note: Mean ADR pre-COVID for MTR=89.17 and for STR=111.84. The pre-COVID mean refers to the monthly overall average for MTRs and STRs in 2018 and 2019. MTR stands for mid-term rentals and are those listings with a required minimum stay of 30 days or longer, while STR stands for short-term rentals defined as listings with a maximum reservation length of 29 days. Source: AirDNA, 2022. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

By converting these percentages into monetary terms, we can interpret the results as an average rise in daily fees of approximately €8 for MTRs and a drop of €14 for STRs.

For our second variable of interest, occupancy, we also observe differential patterns, where instead of falling 37.1 p.p. as in STRs, the occupancy rate for MTRs falls 11.4 p.p. less, arriving at a drop of 25.7 p.p. instead. These results suggest that the impact of COVID-19 is different for both rental categories: while the daily rate dropped for STRs, it rose for MTRs, but in regard to occupancy, both sectors suffered during the pandemic. However, MTR listings were impacted less than STR listings.

After splitting this almost 2-and-a-half-year period into five phases, we can identify that the effect on the daily rate of MTRs is consistent over the complete period and reaches its peak during the second state of emergency introduced in Spain (Real Decreto 926/2020), between November 2020 and April 2021, with a monthly average increase in ADR of 37.2% (see Table 2).

On the other hand, the effect on the ADR of STRs is only negative during the first and second phases—the first state of emergency and summer of 2020—with monthly average drops of 12.5% and 20.6%, respectively (see Table 2).

Table 2. Effect of COVID-19 on ADR and occupancy in five phases: MTR versus STR

	(1) ln ADR US	(2) Occupancy %
1st state of emergency	-0.125*** (0.00621)	-0.366*** (0.00423)
1st state of emergency *MTR	0.258*** (0.0150)	0.162*** (0.00660)
Between phase	-0.206*** (0.00795)	-0.420*** (0.00493)
Between phase*MTR	0.332*** (0.0173)	0.155*** (0.00739)
2nd state of emergency	0.0145 (0.00979)	-0.251*** (0.00579)
2nd state of emergency *MTR	0.372*** (0.0171)	0.169*** (0.00871)
Soft regulation phase	0.0890*** (0.0128)	-0.143*** (0.00650)
Soft regulation phase*MTR	0.131*** (0.0160)	0.0723*** (0.0100)
Recovery phase	0.120*** (0.0146)	-0.0425*** (0.00824)
Recovery phase *MTR	0.00951 (0.0193)	-0.0540*** (0.0121)
Constant	4.684*** (0.112)	0.375*** (0.0404)
Observations	352,787	522,174
R-squared	0.173	0.174
Number of id	19,695	20,633
Control rental characteristics	YES	YES
Property FE	YES	YES
Year and Month FE	YES	YES

Note: MTR stands for mid-term rentals and are those listings with a required minimum stay of 30 days or longer, while STR stands for short-term rentals defined as listings with a maximum reservation length of 29 days. Source: AirDNA, 2022. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Nevertheless, during the second state of emergency, the daily rates stopped falling, followed by an increase, compared to pre-pandemic figures, of 8.9% and 12% in the soft regulation and recovery phases, respectively.

Regarding the analysis of the variable occupancy in phases, for both markets, the period with the strongest effect occurs between states of alarm during the summer of 2020, a season characterized normally by a stronger STR availability, as well as by a stronger demand for short-term stays. During this phase, the occupancy in STRs dropped by 42 p.p., compared to the 26.5 p.p. drop in the occupancy of MTRs. During the second state of emergency and the recovery phase, the effect is still significant and negative, albeit smaller. In the case of STRs, the average negative effect was approximately 24 p.p. during the second state of emergency, dropping to 14.2 p.p. in the soft regulation phase. The effect decreases significantly for STRs during the recovery phase, dropping only 5.4% compared to pre-pandemic numbers, a sign of a steady market recovery from the pandemic shock. While the drop-in occupancy decreases in the MTR market as the COVID-19 crisis is left behind, this submarket is still suffering a drop of 9.7% in occupancy in the last phase analysed.

4.2 Supply density

If we look at the impact of the COVID-19 crisis on the density of both submarkets in terms of supply per 1000 houses, we find that the impact of the pandemic has been significantly different for both housing sectors. The results of Table 3 show that MTRs have increased their density on average by 0.9 listings per 1000 houses per neighbourhood. This translates into a rise of 27.7% considering the mean density of 3.32 MTRs per 1000 housing units before the pandemic.

Table 3. Average effect of COVID-19 on supply density: MTR versus STR

	Supply density	
	MTR	STR
COVID-19	0.919*** (0.231)	-6.689*** (1.116)
Constant	4.499* (2.374)	15.10*** (4.842)
Mean pre-COVID	3.32	12.15
Observations	3,066	4,874
N° of neighbourhoods	62	71
R-squared	0.074	0.278
Control listing character.	YES	YES
Neighbourhood FE	YES	YES
Year and Month FE	YES	YES

Note: Mean pre-COVID refers to the monthly overall average MTRs or STRs per 1000 housing units in 2018 and 2019. MTR stands for mid-term rentals and are those listings with a required minimum stay of 30 days or longer, while STR stands for short-term rentals defined as listings with a maximum reservation length of 29 days. Source: AirDNA, 2022. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.

During the same period, the STR sector suffered a drop-in supply of 55.1% or, in other words, 6.9 listings per 1000 houses. This result is consistent with the differentiated impact on ADR and occupancy discussed previously, hitting STRs harder than MTRs.

When we look at the effect per period, we uncover that for MTRs, the effect was larger during the second state of emergency, twice as large as the period just after, while in the recovery phase, the impact is negative, close to zero and not significant (see Table 4). Models show that the two strongest periods of growth occurred during both states of alarm, with an increase of 1.6 new and 1.4 listing per 1000 houses during the first and second states of alarm, respectively.

Table 4. Effect of COVID-19 supply density in five phases: MTR versus STR

	Supply density	
	MTR	STR
1 st state of emergency	1.566*** (0.474)	-4.299*** (0.748)
Between phase	1.142*** (0.365)	-5.930*** (1.012)
2 nd state of emergency	1.426*** (0.377)	-7.632*** (1.181)
Soft regulation phase	0.785*** (0.201)	-7.622*** (1.297)
Recovery phase	-0.0499 (0.251)	-7.181*** (1.319)
Constant	4.899** (2.402)	13.53*** (5.037)
Mean pre-COVID	3.32	12.15
Observations	3,066	4,874
N° of neighbourhoods	62	71
R-squared	0.082	0.288
Control listing character.	YES	YES
Neighbourhood FE	YES	YES
Year and Month FE	YES	YES

Note: mean pre-COVID refers to the monthly overall average MTRs or STRs per 1000 housing units in 2018 and 2019. MTR stands for mid-term rentals and are those listings with a required minimum stay of 30 days or longer, while STR stands for short-term rentals defined as listings with a maximum reservation length of 29 days. Source: AirDNA, 2022. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.

In the case of STRs, the negative and significant effect on the STR supply is essentially stable throughout the entire period. However, we observe a slightly stronger effect during and after

the second state of emergency, arriving at an average loss per neighbourhood per month of 7.6 units, which translates into an average drop of 35% in STR supply compared to the pre-pandemic average density.

One could believe that the lost STR listings shifted to MTRs. However, this transition is only partial, since the loss in STRs listed on Airbnb is between 3 to 5 times larger than the gain of MTRs listed on Airbnb. One explanation for this difference is that hosts could have listed their dwellings on other MTR platforms or as an LTR, this last would follow the findings of Batalha et al. (2022). The authors suggest that the decline in STRs during the pandemic explains an increase of 20% in listed LTRs as well as a drop in LTR daily rates of 4.1%. Therefore, some STRs might have shifted to the LTR market as well.

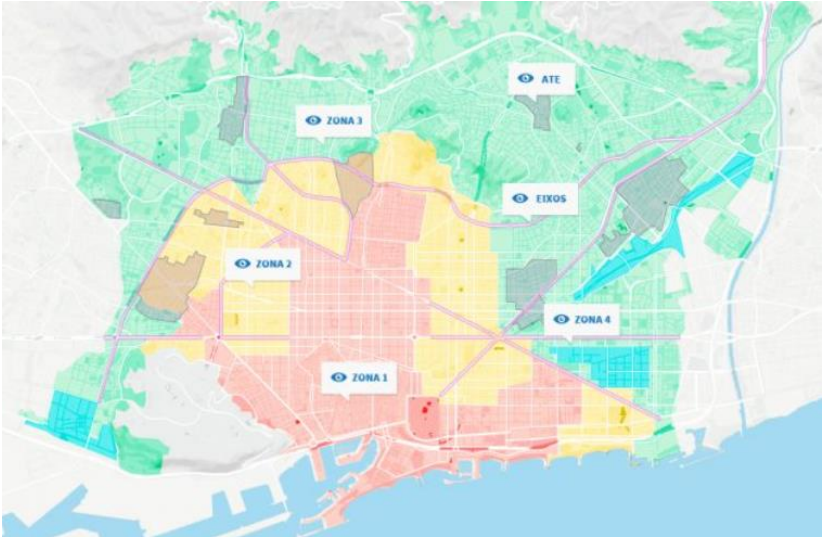
4.3 Robustness exercises

As previously mentioned, we set the cut-off day of the variable minimum stay at 30, defining as MTR listing those that require a minimum stay of 30 days or longer, while STR listings have a maximum reservation length of 29 days, after identifying in the distribution of days a clear frequency increase after Day 29 (see Figure A1 in Annex). Nevertheless, the STR regulation in Barcelona applies to properties offered for stays up to 31 days. Therefore, to test whether the chosen cut day for the minimum created a bias in the results, we reran the models using two alternative thresholds. The first alternative cut day follows the official cut day based on the 32-day STR regulation, decreasing the MTR sample by excluding listings with a minimum stay of 30 or 31 days. The second alternative cut day, on the other hand, uses Day 28 as the threshold, adding to the original MTR sample the listings requiring a minimum of 28 or 29 days. Following the results shown in Tables A3 and A4, the effect on daily rates remains almost identical, and the sample with the 32-day threshold shows the positive effect on daily rates increasing from 9.1% to 12.4%. In regard to occupancy, the effect is almost identical across models. However, compared to the baseline results, the 32-day cut sample shows a 2 p.p. smaller negative impact on occupancy for MTRs. In sum, the chosen threshold does not bias our findings.

As an additional robustness check, following the line of other Airbnb-related studies conducted for the city of Barcelona, such as Garcia-López et al. (2022), Maté-Sanchez-Val (2020) and Maldonado-Guzmán (2020), in which areas with a higher density of Airbnb listings were analysed separately, we test the effect only on those areas of the city of Barcelona that are

considered “tense areas” under the PEUAT¹³ framework. In Barcelona, after the PEUAT urbanistic plan, tense areas are zones 1 and 2 (see red and yellow areas in Figure 4).

Figure 4. PEUAT zones for the city of Barcelona



Note: PEUAT stands for urbanistic plan for touristic accommodations. Source: <https://ajuntament.barcelona.cat/pla-allotjaments-turistic/ca>

To date both zones together have 8,408 out of a total of 9,434 licences for touristic accommodations, while no new licences are granted for accommodations located in these two zones. Moreover, when testing the effects only for those dwellings located in the high-density zones, once again, the effects of the pandemic are almost identical in terms of daily rate and occupancy (see Table A5 in Annex).

5. Profiling: STR, Transitioned listings, and MTR

Restricting the analysis to the period during and after the pandemic, between April 2020 and August 2022, we estimate a multinomial logit model to examine the characteristics associated with three different rental categories: STRs, MTRs, and flats that transitioned between STR and MTR during the analysed period. The multinomial logit model is an appropriate model when the dependent variable is categorical with more than two outcomes. This approach is useful for situations in which we want to be able to classify subjects based on values of a set of predictor variables, which in this case are a set of geographical, economic, and housing-specific attributes

¹³ Urbanistic plan for touristic accommodations for the city of Barcelona (for more detail visit <https://ajuntament.barcelona.cat/pla-allotjaments-turistic/ca>)

of the rentals. Based on multiple independent variables, we aim to predict the probability of belonging to each of the three categories.

Finally, we exponentiate the multinomial logit coefficients to estimate the relative risk ratios (RRRs) and thus identify the characteristics associated with each accommodation category. The RRR of a coefficient indicates how the risk of the outcome falling in the comparison group compared to the risk of the outcome falling in the reference group changes with the variable in question. In sum, $RRR > 1$ means that the risk of the outcome falling in the comparison group increases as the variable increases. In other words, the characteristic is more likely to be in the comparison group than in the reference group. An $RRR < 1$ indicates that the outcome is more likely to be in the reference group than in the comparison group. STRs are used as the reference group, as they are the most frequently occurring group.

Following Batalha et al. (2022), we expect that MTRs and transitioned flats to be more likely to have fewer rooms than STRs. Explained by the difference in the purposes of the stay: while STRs are appealing to groups on holiday, MTRs are demanded by students, remote workers, or couples, rather than a group of people or a big family. The results in Table 5 are in line with our expectation, showing that if a flat has one more bedroom, the relative risk of changing from MTR to STR is expected to decrease by a factor of 0.896. In the case of transitioned flats, the decrease is by a factor of 0.783. In simple words, transitioned and MTR properties tend to have fewer rooms than STR flats.

In regard to occupancy, the relative risk of being MTR relative to STR drops by a factor of 0.37 when occupancy doubles. Thus, a flat with a higher occupancy is less likely to be an MTR than an STR. In terms of prices, an increase in ADR decreases the relative risk of being MTR or transitioned relative to STR. In other words, for every extra euro increase in ADR, the probability of being STR versus transitioned and MTR is reduced by 0.7 p.p. and 0.8 p.p., respectively. In addition, super hosts are more likely to offer flats in both submarkets—as transitioned units or as MTR—than they do in the STR submarket. On one hand, longer stays demand a relatively better host than short stays since more time translates into a greater likelihood of interaction and hence more readiness needed from the host. On the other hand, super hosts react more strongly to changes in market dynamics, having a higher probability of transitioning their units than remaining STRs.

In addition, MTRs tend to be further away from the coast and airbus stations than STRs. These results make sense since the demand for STRs is driven by proximity to the beach as part of the Barcelonian experience, as well as proximity to the station for the airport bus (also close to

Catalunya Square and Gran Via, main street). Finally, the results show that transitioning flats, relative to flats that exclusively offer STRs, are closer to the beach and further away from the metro station and that the probability of transforming an STR listing into a transitioning one increases by 14.8% every month during the analysed period.

Table 5. Multinomial logistics (in RRRs): MTRs and transitioning flats relative to STRs

	Transitioning flats	MTRs
Occupancy (%)	1.009 (0.113)	0.370*** (0.025)
ADR (in euros)	0.993*** (0.001)	0.992*** (0.000)
Super host	1.180* (0.101)	1.191*** (0.063)
N° of bedrooms	0.783*** (0.033)	0.896*** (0.022)
Nearest beach (in km)	1.490*** (0.158)	0.670*** (0.046)
Nearest airbus (in km)	1.146 (0.140)	0.831** (0.062)
Nearest metro (in km)	0.468** (0.157)	0.804 (0.165)
log_time (monthly level)	1.148*** (0.051)	1.038 (0.026)
Constant	0.000 (0.000)	17.412** (20.484)
Observations	20,152	20,152
Pseudo R-squared	0.188	0.188
Neighbourhood FE	YES	YES

Note: MTR stands for medium-term rentals and are those listings with a required minimum stay of 30 days or longer. STR stands for short-term rentals defined as listings with a maximum reservation length of 29 days, and transitioning units are those flats that are STR at least once and MTR once during the analysed period. Source: AirDNA, 2022. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.

In summary, the results of the multinomial logistic regression analysis highlight that property owners' willingness to offer their flat as an MTR, and not as an STR, is affected negatively by the number of bedrooms, ADR, occupancy rate, and proximity to the Airbus station and the beach. Meanwhile, the willingness of property owners to change from STRs to MTRs with a more flexible framework, here defined as transitioning flats, is affected negatively by the number of bedrooms, ADR, and proximity to the metro and affected positively by proximity to the beach. Last, offering the flat as an MTR, at least once, is positively affected if the owner is a super host.

6. Conclusion

There is a lack of empirical evidence on the nature and magnitude of MTRs, which are considered too long to be counted as an STR and too short to be counted as an LTR. Understanding this submarket is important, especially in residential areas under conditions in which tourist arrivals are strong, the STRs and the LTRs are regulated, and the supply of LTRs is limited, translating into very inelastic demand and supply of LTRs. First, due to the rise of digital nomads and the trend of working abroad that could translate into an increased demand for this type of rental. Second, because this submarket partially absorbed STRs after the regulation in Barcelona was imposed and third, since STR supply was underutilized when tourism dropped during the pandemic, the MTR submarket suffered from the economic shock to a lesser extent than the STR markets. The fourth reason is unrelated to STRs, as the simulation of MTR contracts is a practice used to circumvent the legal framework for LTR contracts, making MTRs especially attractive in rental markets with price controls and/or regulations that favour the security of tenants.

As a first academic approach to understanding the MTR market, using fixed effects models and several interaction terms to isolate the differential impact of the different periods of the pandemic, this study explores the resilience of the MTR market under the shock of the pandemic compared to the STR market. As expected, because the MTRs lack regulation and have high flexibility, we find that compared to the impact on the STRs, this submarket was resilient and even grew on average at neighbourhood level during the COVID-19 pandemic.

In summary, we find that due to the pandemic, the listings of MTR accommodations increased their daily rate by 9.1% on average, which in euro terms translates into an average increase in daily rates of approximately €8 for MTRs, unlike STRs, which instead experienced an average drop of 12.7% or €14.

Additionally, the findings reveal that the negative impact on occupancy was much stronger for STRs than for MTRs, with average drops of 37.1 p.p. and 25.7 p.p., respectively, over the complete period. In both cases, the negative impact on occupancy is the largest during 2020, but occupancy recovers in 2022 by showing an almost non-existent effect for the second and third trimesters of 2022. Regarding the supply density—listings per 1000 housing units—the findings indicate that MTRs increased on average by 0.9 units at the neighbourhood level, while STRs dropped on average by 6.9 units at the neighbourhood level. This translates into an average increase of 27.7% and a drop of 55.1%, respectively. One could argue that STR listings shifted to MTR, resulting in an apparent loss of STR units. However, this compositional shift

is not a comprehensive account of the change since the loss in STRs listed on Airbnb is between 3 to 5 times larger than the gain of MTRs listed on Airbnb. One explanation is that hosts could have listed the remaining lost STRs as LTRs. Another explanation is that some STR units went to other platforms that offer exclusively MTRs and were thus lost from the sample. However, these hypotheses have not been tested in this study. Finally, using a multinomial logistic regression analysis, we show that the probability of offering the flat on Airbnb as an MTR rather than an STR is affected negatively by the number of bedrooms, ADR, occupancy rate, and proximity to the airbus station and the beach. In addition, the practice of shifting accommodations between STRs and MTRs increased by almost 15% per month during the analysed period.

Regarding the limitations of the analysis, improvements could be made by using MTR microdata from platforms that exclusively offer MTRs such as Netspick or Homelike, as well as microdata on demographics of MTR demand.

We believe that it is important to know whether the proliferation of MTRs is influencing the spatial patterns of the city of Barcelona, especially after the introduction of the new “start-up law” in December 2022 in Spain to attract digital nomads. Last but not least, we believe that identifying where the units shift from the STR or LTR market is of high relevance, as one could better identify the possible negative effects on affordability for long-term residents.

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Appendix

Table A1. Central tendencies of outcome variables

Description			Mean August 2019	Median August 2019	Mean August 2022	Median August 2022
<i>ADR</i>	Average daily rate (ADR) of booked nights. ADR = Total Revenue/Booked Nights. Includes cleaning fees.	<i>STR</i>	127	92.92	249.75	192
		<i>MTR</i>	101.45	69.03	107.85	77
<i>Occupancy</i>	Occupancy Rate = Total Booked Days/(Total Booked Days + Total Available Days). Calculation only includes vacation rentals with at least one booked night.	<i>STR</i>	0.56	0.72	0.94	0.74
		<i>MTR</i>	0.28	0.07	0.46	0.23
<i>Supply density</i>	The number of listings per 1000 housing units per neighbourhood	<i>STR</i>	1.11	0.47	0.75	0.32
		<i>MTR</i>	0.41	0.18	0.23	0.11

Table A2. Control variables

	Listing level (Outcomes: ADR and occupancy)	Neighbourhood level (Outcome: supply density)
Super host	X	
Heating	X	
Pet friendly	X	
Internet	X	
Response rate	X	X
Cleaning fee	X	X
Security deposit	X	X
Maximum guests	X	X
N° of bedrooms	X	X
Blocked days		X
Rating overall		X

Figure A1. Minimum stay distribution among all flats in February 2022

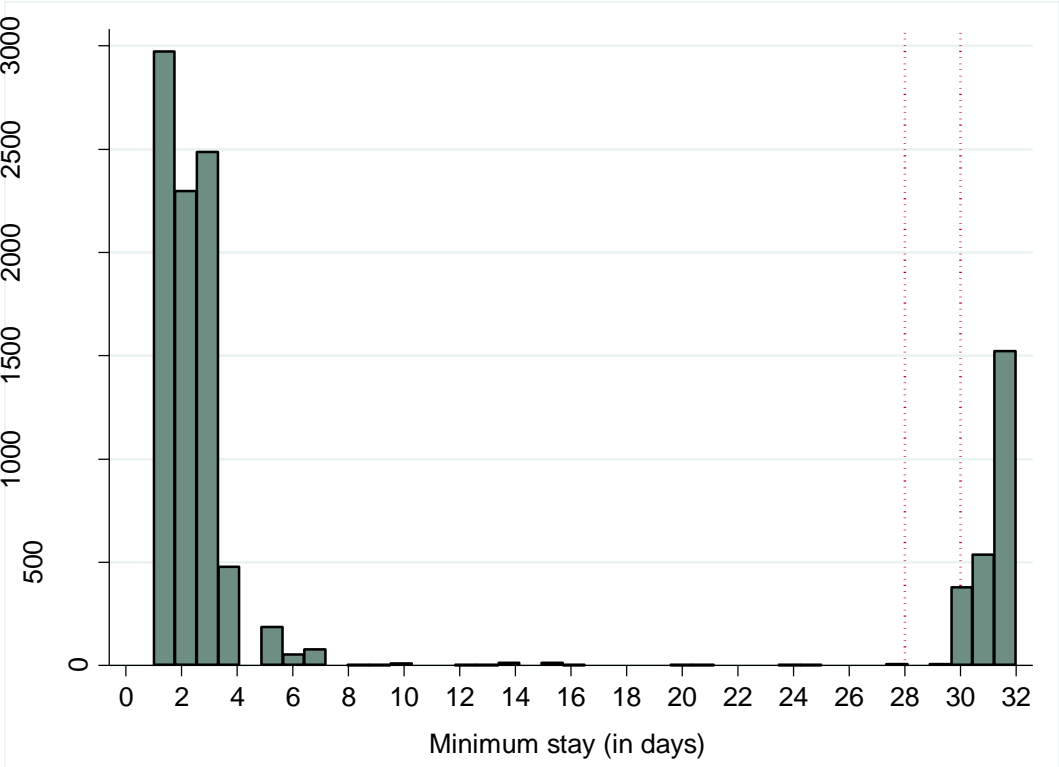


Figure A2. Maps of MTR density (per 1000 housing units) for 2019-2022

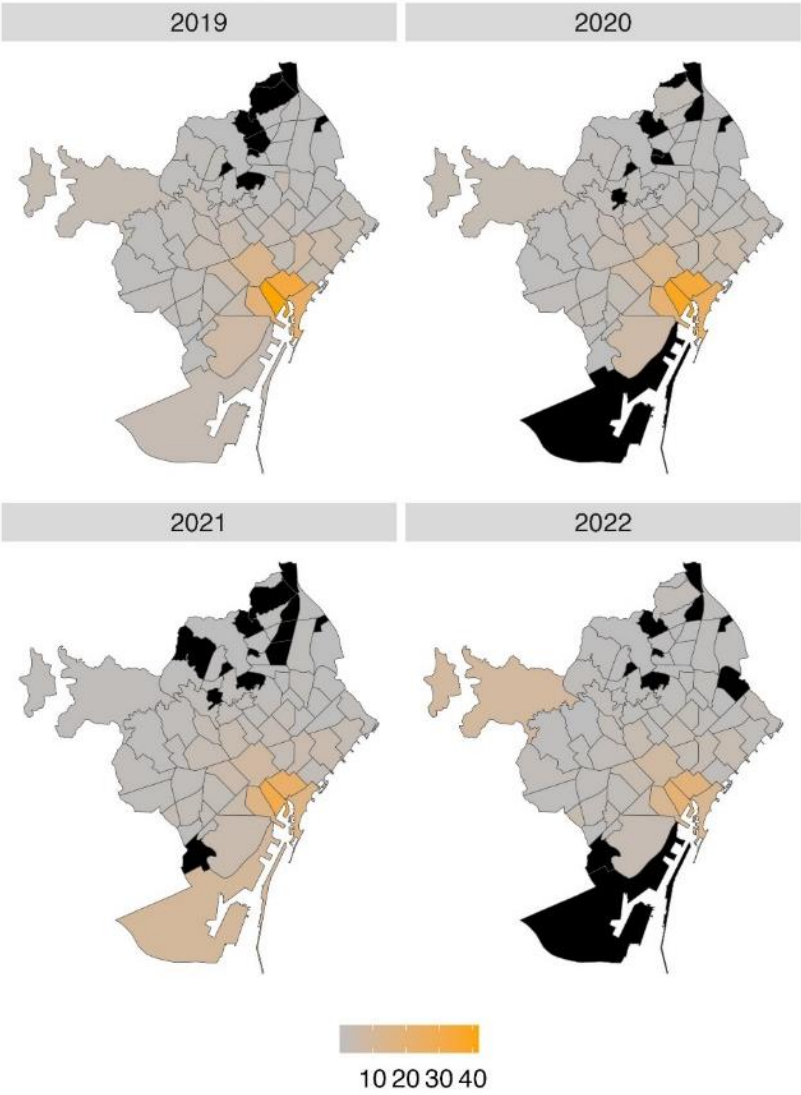


Figure A3. Maps of STR density (per 1000 housing units) for 2019-2022

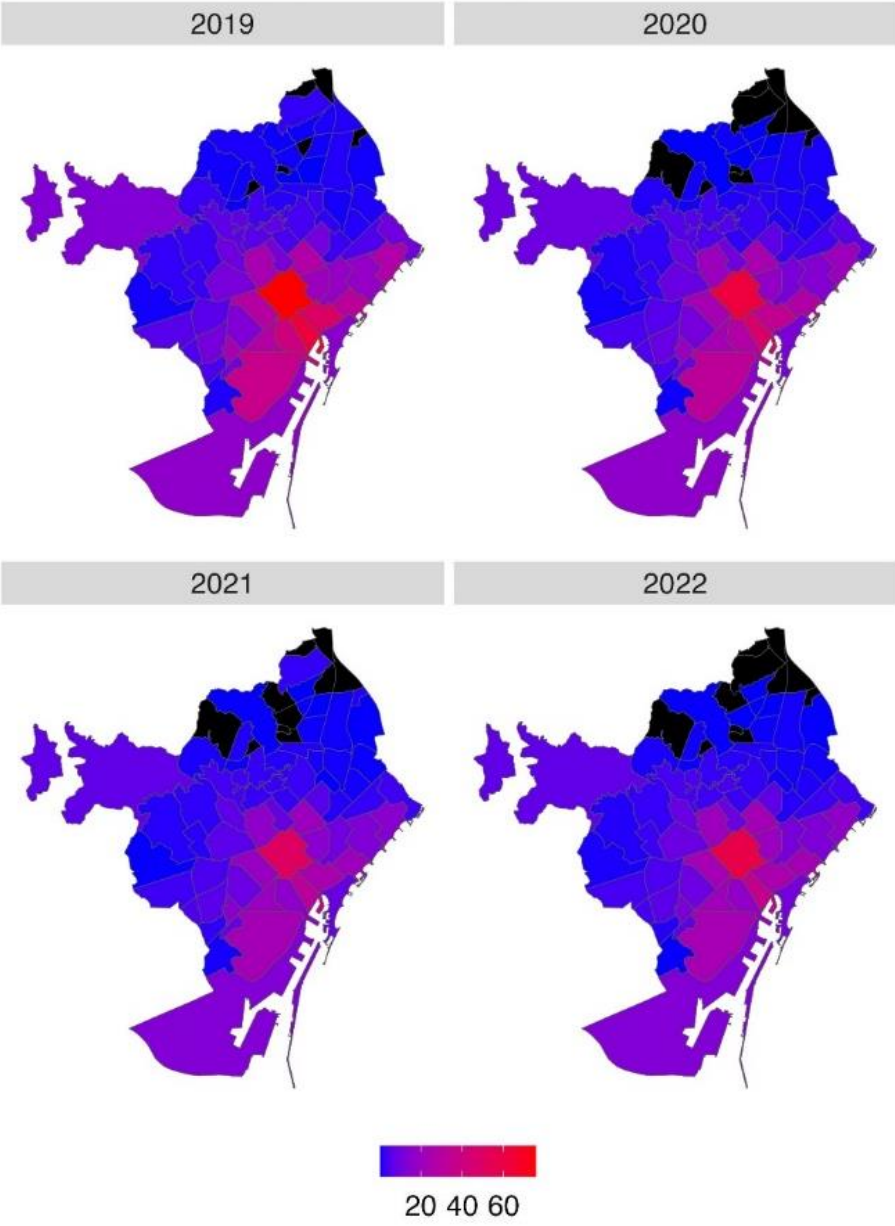


Table A3. Robustness cut-Day 32

	(1)	(2)
	ln ADR US	Occupancy %
Covid	-0.123*** (0.00614)	-0.367*** (0.00405)
MTR	-0.100*** (0.0163)	-0.128*** (0.00910)
Covid*MTR	0.247*** (0.0137)	0.132*** (0.00661)
Constant	4.921*** (0.109)	0.677*** (0.0399)
Observations	352,787	522,174
R-squared	0.162	0.167
Number of id	19,695	20,633
Control rental charact	YES	YES
Property FE	YES	YES
Year and Month FE	YES	YES

MTR stands for mid-term rentals and are those listings with a required minimum stay of 32 days or longer, while STR stands for short-term rentals defined as listings with a maximum reservation length of 31 days. Source: AirDNA, 2022. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A4. Robustness cut-Day 28

	(1)	(2)
	ln ADR US	Occupancy %
Covid	-0.127*** (0.00616)	-0.371*** (0.00412)
MTR	-0.222*** (0.0144)	-0.149*** (0.00999)
Covid*MTR	0.220*** (0.0116)	0.114*** (0.00602)
Constant	4.930*** (0.109)	0.683*** (0.0399)
Observations	352,787	522,174
R-squared	0.164	0.168
Number of id	19,695	20,633
Control rental charact	YES	YES
Property FE	YES	YES
Year and Month FE	YES	YES

MTR stands for mid-term rentals and are those listings with a required minimum stay of 28 days or longer, while STR stands for short-term rentals defined as listings with a maximum reservation length of 27 days. Source: AirDNA, 2022. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A5. Robustness tense zones

	(1)	(2)
	ln ADR US	Occupancy %
Covid	-0.130*** (0.00632)	-0.373*** (0.00425)
MTR	-0.234*** (0.0150)	-0.151*** (0.0101)
Covid*MTR	0.219*** (0.0118)	0.119*** (0.00616)
Constant	4.947*** (0.111)	0.697*** (0.0419)
Observations	329,509	484,373
R-squared	0.168	0.168
Number of id	18,078	18,909
Control rental charact	YES	YES
Property FE	YES	YES
Year and Month FE	YES	YES

Source: AirDNA, 2022. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

3.3 Shocks on the urban rental market during and after a global pandemic

SHOCKS ON THE URBAN RENTAL MARKET: DURING AND AFTER A GLOBAL PANDEMIC

Abstract

Using a hedonic price approach and unique daily and granular microdata from an important real estate agency, we analyse changes in the long-term rental market during and after the pandemic in Spain, placing particular emphasis on the cities of Madrid and Barcelona. Additionally, we focus on the fluctuations across different time frames, property features, and tenant characteristics. Our findings reveal that the pandemic initially led to a 1.3% average drop in rental prices across Spain, followed by a price increase of 5.1% after restrictions were lifted. However, Madrid and Barcelona experienced a more pronounced impact than the rest of Spain, with rental prices decreasing by approximately 9% during the pandemic. Later, postpandemic prices in both cities returned to prepandemic levels. In addition, we observe that tenants with higher education levels and non-Spaniards with EU nationality faced more significant price drops during the pandemic than other tenants. Meanwhile, properties with features such as outdoor spaces, an extra room, or parking facilities saw an additional increase in rental prices. Regarding rental discounts (the gap between listed and transaction prices), we only find significant effects on Barcelona and Madrid after the second state of emergency was introduced. Following the lifting of restrictions, the city of Barcelona witnessed a remarkable 42% decrease in rental discounts compared to the prepandemic value, while in the Madrilenian rental market, the drop was 10.5%, and the average drop for the rest of Spain was 32%.

JEL classification: I18, R31

Keywords: Long-term rental market, rental prices, price discount, hedonic price model COVID-19, restrictive policies

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1. Introduction

The COVID-19 pandemic has had far-reaching impacts on nearly every aspect of human lives, and the housing rental market was no exception. The temporal drop in tourism, the short- and possible long-term impact on the labour market, and the related changes in housing preferences have been openly discussed. After recent studies, workers with jobs that could be done remotely were able to relocate their home, beginning to prioritize larger living spaces or outdoor areas, moving out of urban areas and into suburban or rural areas (Tomal & Helbich, 2022, Tajani et al. 2021, Coven et al. 2020, Bloom and Ramani, 2022), especially high-income earners with remote work modalities (Haslag and Weagly, 2021). Furthermore, the drop in the demand for short-term rentals (STRs) due to travel restrictions could have shifted the previous STR supply to the long-term rental market (LTR) (Batalha et al., 2022). In summary, the goal of this paper is to estimate the impact of the pandemic on the LTR market, reviewing uneven effects across size, dwelling characteristics, and tenant profile. Three research questions are addressed. First, how did the pandemic impact rental prices in Spain and across the two most populated cities in Spain, Barcelona and Madrid? Additionally reviewing the heterogeneous effects across different sizes and types of dwellings. Second, we review the impact on the price discount to identify changes in the dynamics of the housing market. Finally, we review the uneven impact across the tenant's profile by demographic characteristics such as age, education, gender, civil status, and employment status.

Our study finds an average drop in Spanish rental prices -excluding the cities of Madrid and Barcelona- during the complete restriction period—from March 14 of 2020 to April 20 of 2022—equal to a 1.3%, followed by a price increase of 5.1% after restrictions were lifted. However, Madrid and Barcelona experienced a more pronounced impact, with rental prices per square metre decreasing by approximately 9% during the pandemic. Later, postpandemic prices in both cities returned to prepandemic levels. This finding is in line with the findings of Farmaki et al. (2020) and Kadi et al. (2020), who discuss the recovery effect as a response to the partial return of the LTR market on the STR market. Additionally, the recovery effect could be interpreted as a result of the partial shift of the real estate demand towards LTR demand due to the increasing difficulties in buying a property in the current Spanish scenario with an inflation above 10%, increasing interest rates and several additional difficulties in obtaining financing in good conditions (Bank of Spain, 2020).

The effects found on the capital cities were stronger than those at the country level, following the results from Tomal & Helbich, 2022, Tajani et al. 2021, Coven et al. 2020, Bloom and

Ramani, 2022, and Haslag and Weagly, 2021. Moreover, at least for Madrid, the largest price decline was found in one-bedroom flats, which are more likely to be licenced as STRs. These findings are in line with those from Batalha et al. (2022), who study the impact of the pandemic on housing and rental prices and supply in areas with a high density of STR. After this study, most touristic areas in Lisbon, rental prices decreased 3.5%, coupled with an increase in the supply of 20%. The authors conclude that landlords switched their STRs to the LTR market during the pandemic, but they do not identify transitions from the property market. Another study that uncovers a dropping effect on prices is Francke & Korevaar (2021). Similarly, Tomal & Helbich (2022) found that the pandemic lowered rents and modified the relevance of some housing characteristics for rental prices during the pandemic in Cracow. In terms of preferences, our results show that three characteristics gained importance during the pandemic: having an extra room that translated into an increase in rent of 1.49%, having a parking lot that translated to a 1.33% increase and having an exterior that resulted in a 2.96% increase. Following our results, Tajani et al. (2021), analysing the Italian housing market, uncovered changes in market demand concerning a preference for outdoor spaces, both condominiums and private (terraces and balconies), as well as for properties located in peripheral areas of the city, as many renters look for more affordable and less densely populated areas to live in. As a result, rental prices started to decline in some urban areas and to rise in some suburban and rural areas. Similar findings were found in Liu & Su (2021).

To the best of our knowledge, this is the first study that reviews the impact of the pandemic on rental discounts -the gap between listed and final rental prices-. Thanks to having access to listing and transaction prices, we can analyse the change in the differences between both prices in percentage terms. Following our results, the pandemic influenced price discounts. Compared to the prepandemic discount level, which was 3.33% for Madrid and 3.57% for Barcelona during the pandemic period, the price discount increased in both cities, by 0.93 p.p. in Madrid and 0.52 p.p. in Barcelona. To put this effect in perspective, this translates into an increase of almost 28% for Madrid and 15% for Barcelona. After restrictions were dropped, the discount increase at the country level was reversed, with drops of 0.35 p.p. and 1.5 p.p. for Madrid and Barcelona, respectively. Particularly interesting is the large drop observed in the city of Barcelona, which had a 42% drop in price discount compared to the prepandemic period figure of 3.57%. This large drop in price discount could be an adjustment of the rental cap introduced and dropped in Barcelona during the pandemic. However, it could also be explained as a result

of the increment in touristic flats after the travel restrictions were dropped, since both explanations can be translated into a shortage of supply and thus in a drop in price discount. Past research has demonstrated the presence of ethnic and gender disparate treatment in the rental housing market (Ahmend and Hammarstedt, 2008, Flage 2018, De La Campa and Reina, 2023). In this line, we explore whether, during the pandemic, some demographic characteristics made tenants experience a higher drop in prices. We find that during the pandemic, tenants with lower education experienced a smaller drop in prices compared to tenants with higher education. In addition, the results suggest that non-Spaniards with EU nationality experienced a greater drop in prices compared to Spaniards, with a difference of 3.42%. There was a larger drop in prices for populations with profiles of higher income during the pandemic period, which could be interpreted as a risk-averse selection of renters. This difference was particularly observed for tenants renting one to two bedrooms.

To the best of our knowledge, our paper contributes to the recent strand of research in four ways. First, this is one of the first papers investigating the effect of the pandemic on the rental market, since most have focused on changes in the property market (see Hu et al., 2021; Kartal et al., 2021; Kaynak et al., 2021; Liu & Su, 2021; Qian et al., 2021; Tajani et al., 2021; Yoruk, 2020 and Yilmazkuday, 2021). Second, it contributes by being the first study to focus on the impact of the pandemic on price discounts by utilising both transaction and listing prices. Third, we review the uneven drop in prices based on tenants' demographics. Finally, while most of existing studies use aggregated and/or lagged data from official statistics or information collected in real time from real estate websites using web-scraping techniques (automated retrieval of internet data), we add to the literature that, rather than competing with official statistics or web-scraped listing information, we exploit data from one of the largest real estate agencies in Spain, detecting trends with enhanced timeliness (daily indices in real time vs. monthly/quarterly with lag) and high granularity (ZIP code level vs. region level at best).

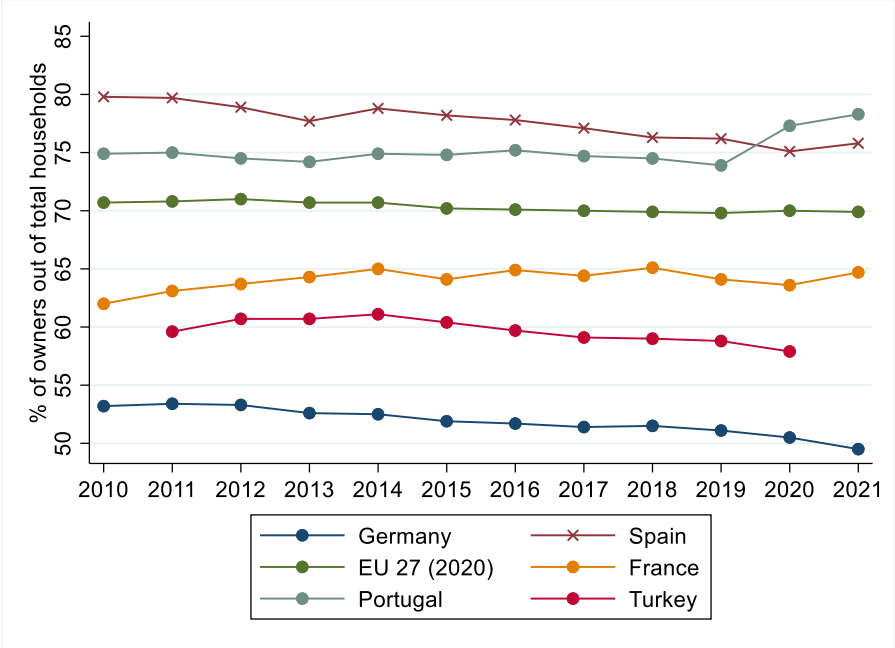
This paper is organized as follows. Section 2 presents a brief review of the Spanish housing market, while Section 3 describes the empirical strategy and presents descriptive statistics. Section 4 reports the results, and finally, Section 5 provides a summary of the main conclusions and implications of the paper.

2. The Spanish housing market and the onset of the pandemic

Even though Spain, compared to the European averages, has a high share in homeownership (see Figure 1), this share has been decreasing since the financial crisis of 2008, a time when

excessive risk was taken when asking for mortgage loans (Akin et al. 2014). Between 2010 and 2021 the share of ownership dropped approximately 5 p.p. (Spanish bank, 2020). After the economic crisis was left behind, households started avoiding risky behaviours and faced a deteriorated and uncertain labour market—associated with temporary contracts and unemployment—limiting them to save and access borrowing. Conversely and in contrast to the real estate market, the closest substitute, the rental market, has faced rising demand and consequently rising prices.

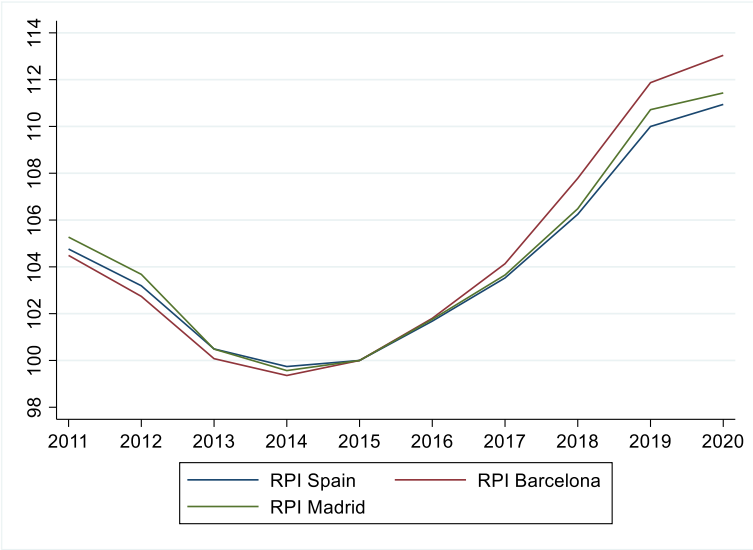
Figure 1. Evolution homeownership rate for selected EU countries and EU-27



Source: Eurostat, 2022. Note: EU27 (2020) refers to EU 28 excluding the UK.

Additionally, the increasing shift of residential dwellings to STR in central districts has decreased the supply of LTR in those areas, tensing the prices even more. Especially for the cases of Barcelona and Madrid—two highly populated cities that are analysed separately in this study—the increasing demand against a backdrop of an inelastic housing supply largely explains the higher increases in rental prices in these areas (see Figure 2).

Figure 2. Evolution of the rent price index (RPI), 2011-2020



Source: IPVA, INE, 2022. Note: The index basis year is 2015

During the pandemic, unemployment rose, and GDP dropped (see Figure 3). However, as in most advanced economies, transfer payments to households as employment subsidies were introduced to offset the effect of the crisis. Particularly for housing, a rental aid program was introduced in April 2020 and consisted of transfers—up to a maximum amount of 900 euros/month and 100% of the rental income—to households for rental payment to help minimize the economic and social impact of COVID-19 on tenants. The aid program ended in 2021 (Ministry of Transport, Mobility and Urban Agenda, 2022).

In addition, in March 2020, a moratorium on foreclosures/home repossessions and renter evictions (BOE, Real Decreto-ley 11/2020)¹⁶, as well as deferment of mortgage payments to prevent defaults, were imposed (ibid, 2020).

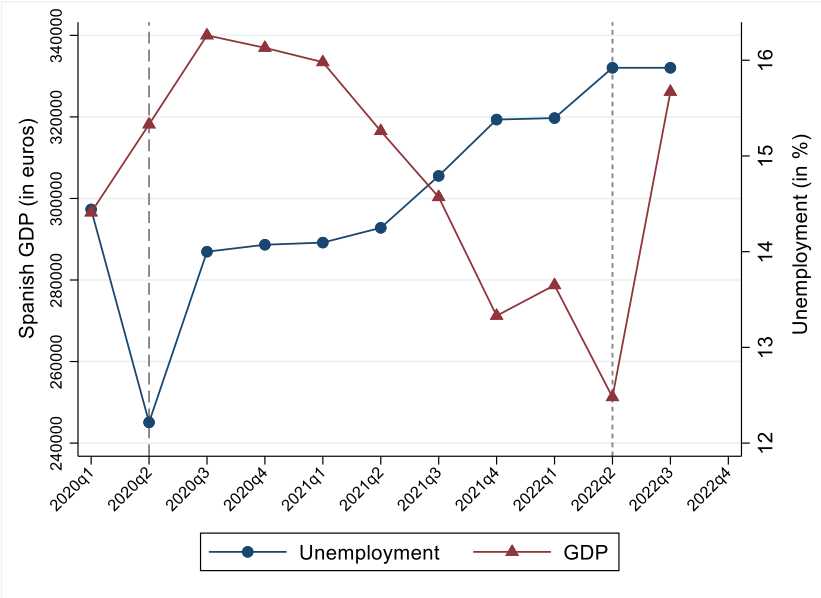
Finally, in the case of Catalonia -Autonomous Community (AACC) in which Barcelona is the capital-, a rental price cap was introduced on the 18th of September 2020 (BOE, Ley 11/2020)¹⁷. Regarding the impact of the regulation, early research estimates that on the one hand, the prices did fall for treated dwellings within the high price range, while the prices of those within the lower price range rose (Garcia Montalvo and Monràs, 2023). On the other hand, the overall

¹⁶ Royal Decree-Law 11/2020, of March 31, adopting urgent complementary measures in the social and economic sphere to address COVID-19. Reference BOE-A-2020-4208."

¹⁷ Law 11/2020, of September 18, on urgent measures concerning rent containment in residential lease contracts and the amendment of Law 18/2007, Law 24/2015, and Law 4/2016, related to the protection of the right to housing. Reference BOE-A-2020-11363.

supply of rental units declined by approximately 10 percent, with a very large drop for units above the reference price that was not compensated for by an increase in units below the reference price (ebd, 2023).

Figure 3. Evolution of GDP and unemployment in Spain during the pandemic



Source: INE, 2022. Note: The first reference line refers to the start of the pandemic in the second quarter of 2020, while the second reference line refers to the drop in COVID-19 restriction measures in Spain as a proxy of the end of the pandemic effects during the second quarter of 2022.

3. Empirical strategy

3.1 Data description

We use a unique dataset obtained from a real estate company with franchisers in most of the Spanish provinces. For instance, this real estate company signed 4,470 rental contracts in 2019, of which 1244 were signed in Madrid and 543 in Barcelona. At the national level, the real estate agency closed 2% of the total new rental contracts signed in 2019 in Spain (Ministerio de Fomento and INE, 2023).

The rental contracts dataset includes information on the date that the contract was signed, at what price it was signed and at what price it was first listed. Additionally, the data describes the rented dwelling in terms of size, age of property, number of bathrooms and bedrooms, whether it includes a parking lot and an exterior area (terraces, balcony, or garden), and whether the

building has an elevator. Finally, it details tenants' demographic characteristics, such as gender, labour status, employment status, age, marital status, education level, and number of holders. In total, we have complete information on a total of 33,412 observations distributed across a time span that starts in January 2013 and ends in December 2022.

Table 1 provides information on rental prices (€/m²) and price discount (%) – relative difference in transaction price concerning the listed price- for Spain and, particularly, for Madrid and

Table 1. Descriptive statistics

	Mean	Std. Dev.	Median	p25	p75
Madrid					
Pre-Covid					
Price (€/m ²)	12.369	3.744	11.667	9.67	14.433
Discount (%)	3.33	5.013	0.000	0	6.25
Covid					
Price (€/m ²)	13.812	3.102	13.333	11.552	15.625
Discount (%)	4.028	5.205	0.000	0	6.667
Post Covid					
Price (€/m ²)	14.894	3.472	14.444	12.338	17
Discount (%)	2.581	4.385	0.000	0	5.063
Barcelona					
Pre-Covid					
Price (€/m ²)	12.285	3.683	11.538	9.615	14.118
Discount (%)	3.574	5.212	0.000	0	6.667
Covid					
Price (€/m ²)	14.539	3.332	13.971	12.182	16.34
Discount (%)	3.107	4.928	0.000	0	5.556
Post Covid					
Price (€/m ²)	16.457	3.701	15.672	13.636	18.75
Discount (%)	1.098	2.64	0.000	0	0
Rest of Spain					
Pre-Covid					
Price (€/m ²)	7.785	2.966	7.500	5.851	9.286
Discount (%)	2.946	5.087	0.000	0	5.405
Covid					
Price (€/m ²)	9.391	2.748	9.231	7.558	10.938
Discount (%)	2.401	4.413	0.000	0	4.167
Post Covid					
Price (€/m ²)	9.99	2.794	9.823	8.125	11.667
Discount (%)	1.639	4.02	0.000	0	0

Source: produced by the authors based on real estate daily dataset.

Barcelona, before, during, and after the COVID-19 pandemic. After the summary statistics, prior to the COVID outbreak, the average price per square metre (€/m²) stood at approximately 12.4€ in Madrid, 12.3€ in Barcelona and 7.8€ in the rest of Spain, accompanied by a mean discount of approximately 3 and 4%. As the COVID period began, the average price rose to in all cases. Subsequently, during the post-COVID phase, the average price continued its upwards trajectory, reaching approximately 14.9€ in Madrid, 16.5€ in Barcelona and 10€ in the rest of Spain, while the mean discount decreased in all cases, but especially in Barcelona.

Additionally, see that Madrid consistently held the highest average price across before and after the pandemic. Meanwhile, Barcelona exhibited the highest average price post pandemic, consequently the most significant percentage increase in average price from the pre-COVID to the post-COVID era. Conversely, Madrid exhibited the highest mean discounts during the pandemic period, while Barcelona showcased the most remarkable reduction in mean discount from the pre-COVID to the post-COVID period.

3.2. Methodology

At its simplest, the hedonic equation is a regression of prices (rents or values) on housing characteristics (Rosen, 1974). The independent variables represent the individual characteristics of the dwelling, and the regression coefficients may be transferred into estimates of the implicit prices of these characteristics, such as size, number of bedrooms and bathrooms, location, whether it has an elevator or a terrace, etc. Formally, our hedonic model is similar in spirit to Anundsen and Røed Larsen (2018) and Røed Larsen (2021), while also including several dummy variables to uncover the specific effect of the pandemic on the rental market, with a particular focus on the two most populated cities of Spain, Madrid (MAD) and Barcelona (BCN). The hedonic price regression is then given by:

$$(1) Y_{it} = \alpha + \beta_1 Covid_t + \beta_2 PostCovid_t + \beta_3 MAD_i + \beta_4 BCN_i + \beta_5 Covid_t * MAD_i + \beta_6 PostCovid_t * MAD_i + \beta_7 Covid_t * BCN_i + \beta_8 PostCovid_t * BCN_i + \delta_i + \theta_t + \gamma_i + \varphi_{it} + \epsilon_{it}$$

Y_{it} denotes the dependent variable, which are rent price (in logs) and price discount, defined as the gap between listed and transaction prices (in %), for property i at time t . $Covid_t$ is a dummy variable for the treatment period so that β_1 is the coefficient that captures the impact of COVID-19 on our variables of interest. The treatment period starts with the introduction of the first state of emergency and ends with the drop of the last restriction, accounting for the period from 14 March 2020 to 20 April 2022. Meanwhile, $PostCovid_t$ is a dummy variable for the recovery

period, including the signed rental contracts from 21.04.2022 until 31.10.2022. Therefore, the rental contracts signed before the pandemic are employed as counterfactuals. As the counterfactual sample differs in terms of rental units and therefore their characteristics, we control for location by estimating postcode-level fixed effects δ , while any significant factor impacting the outcome variables over time is captured by the yearly fixed effects θ . In doing so, we exploit within-group variation over time since we control for the average differences across postal codes and year (which is a very granular group) in any observable or unobservable predictors, such as differences in quality. Additionally, γ stands for several control variables going from tenant-demographic attributes such as gender and employment status to several dwelling characteristics (see the full list of control variables in Table A1 in the Annex).

Finally, we control for the effect of the rental cap φ introduced on the 18th of September 2020 in the AACC of Catalonia (BOE, Ley 11/2020)¹⁸. The rental cap was dropped within the pandemic period after being struck down by the Constitutional Court in March 2022. Since this cap only affected cities belonging to Catalonia, we include a dummy variable that is equal to 1 in case the city corresponds to that AACC, and the date corresponds to the period under rent cap regulation.

Our second model introduces a more time-detailed analysis by dividing the time period into five phases j : the 1st state of emergency, the in-between phase, the 2nd state of emergency, the soft regulation phase and the recovery phase period.

$$(2) Y_{it} = \alpha + \sum_{j=1}^5 (\beta_1 Phase_j + \beta_2 MAD_i + \beta_3 BCN_i + \beta_4 Phase_j * MAD_i + \beta_5 Phase_j * BCN_i) + \delta_i + \theta_t + \gamma_i + \varphi_{pt} + \epsilon_{it}$$

Therefore, β_1 is the coefficient that captures the effect for the first phase, between 14 March 2020 and 21 June 2020, the first state of the emergency period (Administration, Spanish government, 2023). β_2 is the coefficient that captures the effect for the second phase, from 22 June 2020 to 24 October 2020, the period between the first and second states of emergency. β_3 is the coefficient that captures the effect for the third phase, the second state of emergency, between 25 October 2020 and 9 May 2021. where β_4 is the coefficient that captures the effect between 10 May 2021 and 20 April 2022 and β_5 is the coefficient that captures the effect

¹⁸ Law 11/2020, of September 18, on urgent measures for rent control in residential lease agreements and the amendment of Laws 18/2007, 24/2015, and 4/2016, concerning the protection of the right to housing. Reference BOE-A-2020-11363.

postpandemic, from 21 April 2022 onwards, the day that mandatory facemask regulations were dropped in Spain.

Finally, we test whether the preferences of tenants in terms of dwelling characteristics were affected by the pandemic and whether some demographics experienced differential treatment during the pandemic. To do so, we introduce interaction terms of each characteristic with the treatment dummy variable $Covid_t$.

4. Results

In the first subchapter of this section, we present our results in terms of changes in prices and price discounts during and after the pandemic. In the second subchapter we review the impact on the same variables but disaggregate the time span in five phases. In addition to the general effects on prices, in the third subchapter we continue to exploit possible heterogeneous effects by dwelling size and other dwelling characteristics, as well as by the tenant's demographics.

4.1 Impact on prices and discount: 2 phases

First, we explore the average effect of the pandemic on rental prices in Spain in general and for Barcelona and Madrid in particular. As seen from the results in Table 1, the Spanish rental prices, excluding the rentals signed in the cities of Madrid and Barcelona, fell 1.3% during the pandemic, recovering after the last restrictions were dropped, with a rent increase of 5.1% compared to prepandemic new rental prices.

When we compare the effect between the Spanish two most populated cities and after controlling for the rent cap introduced in Barcelona during a brief in-pandemic period, a very similar effect of a drop in prices of 9% is found. The postpandemic prices for both cities are almost identical to the prepandemic prices. These findings are in line with two arguments of previous COVID-19-related studies. The first study found an increasing preference for tenants to reside in peripheral areas with lower density compared to urban cities such as Barcelona and Madrid (Tomal & Helbich, 2022; Tajani, Morano, Di Liddo, Guarini, & Ranieri, 2021; Liu & Su, 2021). The second argues that the drop in prices is a result of the shift of STR supply towards the LTR supply as a response of the supply to dropping tourism (Batalha et al., 2022).

Table 2. Effect of COVID-19 on prices¹⁹

	(1)	(2)
	Ln(Price)	Discount (%)
Covid	-0.0130** (0.00540)	-0.0393 (0.183)
Post Covid	0.0508*** (0.00691)	-0.927*** (0.234)
Covid*MAD	-0.0771*** (0.00375)	0.925*** (0.127)
Post Covid*MAD	-0.0449*** (0.00770)	0.579** (0.261)
Covid*BCN	-0.0775*** (0.00619)	0.512** (0.210)
Post Covid*BCN	-0.0534*** (0.00992)	-0.570* (0.336)
Constant	2.941 (2,591)	0.923 (87,863)
Observations	33,489	33,489
R-squared	0.889	0.147
Tenants' charact	YES	YES
Dwelling charact	YES	YES
Postcode FE	YES	YES
Year FE	YES	YES
RentCap	YES	YES

Notes: The omitted outcome is the period before the pandemic. MAD stands for Madrid and BCN for Barcelona. The standard errors are in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Our second research interest is on the effect of the pandemic on price discounts, understood as the difference between listed prices and transaction prices in percentage terms. We expect to find an increase in the price discount to indicate the cooling down effect on the rental housing market as a response to the dropping transactions during the pandemic.

As seen in Table 2, our outcomes are coupled with our expectation in regard to the cities of Barcelona and Madrid. Compared to the prepandemic discount level, which was 3.33% for Madrid and 3.57% for Barcelona, during the pandemic period, the price discount increased in both cities, by 0.93 p.p. in Madrid and 0.51 p.p. in Barcelona. To put this effect in perspective, compared to the prepandemic average figures, it translates into an increase of almost 28% for Madrid and 15% for Barcelona. Particularly interesting is the large drop observed in the city of Barcelona, reaching a drop of 1.5 p.p., which translates to a decline of 42% in the price discount compared to the prepandemic period average of 3.57%. We believe that this result reflects a

¹⁹ After revision of the dissertations first version, we have changed the identification strategy and instead of analysing the COVID-19 impact on separates samples, we use interaction terms of the cities to detect the differential impact. See the results of the old version in Table A2 is Appendix.

higher scarcity of supply in the LTR market.

4.2 Impact on prices and discount: 5 phases

When we divide the pandemic period into five phases, the largest impact on prices appears during the third phase, which corresponds to the second state of emergency, with an average drop of 3.82% at the Spanish level—excluding Madrid and Barcelona— and a drop of approximately 12% in both the Madrilenian and the Barcelonian rental market (see Table 3).

However, during the recovery phase, the dropping trend disappears at the Spanish level, arriving at a 5.33% higher price compared to prepandemic values. For Madrid and Barcelona, the average price goes back to approximately the same size as before the pandemic. Overall, it can be said that the price decreasing effect of the pandemic was completely reversed after it in all cases, showing even higher prices in the recovery phase for Spain, including Madrid and Barcelona.

In regard to the outcome discount, we only find significant effects during the last three periods. During the period corresponding to the second state of emergency, the third phase, we find an increasing effect on discount equal to 1.36 p.p. in Madrid and 0.79 p.p. in Barcelona. This can be interpreted as a growth of 41% and 22%, respectively, compared to prepandemic discount values.

However, when analysing the recovery phase on discounts, the city of Barcelona shows to have had the largest drop, translated in a drop of 42% compared to the prepandemic figures, compared to the Madrilenian rental market facing a price decline of 10.5%. It is important to mention that during the rent cap period, after our results and the control of the rent cap, the drop was additionally 4.24% larger in the case of Catalonia. This outcome is in line with the two studies that have already analysed the impact of the regulation. Jofre-Monseny et al. (2023) couple the regulation with an average drop in rents of approximately 4 to 6% and no significant impact on supply. Meanwhile, a similar effect on prices is found in a study by Garcia Montalvo and Monrás (2022), who estimated that the cap led to an average price reduction of 5%, and the impact on supply is found to be negative.

Table 3. Effect of COVID-19 on price and discount: The pandemic in 5 phases

	(1) Ln(Price)	(2) Discount
1 st state of emergency	-0.0269*** (0.00858)	0.00956 (0.291)
In-between phase	-0.0144** (0.00625)	0.133 (0.212)
2 nd state of emergency	-0.0287*** (0.00697)	0.210 (0.237)
Soft regulation phase	-0.00183 (0.00760)	-0.258 (0.258)
Recovery phase	0.0533*** (0.00823)	-0.940*** (0.280)
1 st state of emergency*MAD	-0.0245* (0.0126)	0.00412 (0.428)
In-between phase*MAD	-0.0538*** (0.00694)	-0.0176 (0.236)
2 nd state of emergency*MAD	-0.0924*** (0.00606)	1.361*** (0.206)
Soft regulation phase*MAD	-0.0803*** (0.00479)	1.135*** (0.163)
Recovery phase*MAD	-0.0456*** (0.00769)	0.591** (0.261)
1 st state of emergency*BCN	-0.0271* (0.0162)	0.451 (0.549)
In-between phase*BCN	-0.0753*** (0.00952)	0.447 (0.323)
2 nd state of emergency*BCN	-0.0912*** (0.00947)	0.786** (0.322)
Soft regulation phase*BCN	-0.0893*** (0.00853)	0.246 (0.290)
Recovery phase*BCN	-0.0544*** (0.00990)	-0.556* (0.336)
Constant	2.946 (2,586)	0.872 (87,794)
Observations	33,489	33,489
R-squared	0.889	0.149
Tenants' charact	YES	YES
Dwelling charact	YES	YES
Postcode FE	YES	YES
Year FE	YES	YES
RentCap	YES	YES

Notes: The omitted outcome is the period before the pandemic. MAD stands for Madrid and BCN for Barcelona. The standard errors are in parentheses *** p<0.01, ** p<0.05, * p<0.1

In addition, we have to consider that after the Spanish regulation, once an LTR contract is signed and if the tenant does not decide otherwise, the dwelling is rented for at least 5 years. This could explain why the effect has remained even after the pandemic.

In addition to the one-bedroom units, the recovery equals back the prepandemic values or even surpasses them, following the rent increasing trend of the last years (see Figure 2).

4.3 Impact on prices by size, tenants', and dwellings' characteristics

To verify the existence of heterogeneous effects between dwellings of different sizes, we re-estimate Model 1 for 4 subsamples of dwellings according to their number of rooms. For Barcelona, the drop in prices in percentage terms is very similar between the different dwelling sizes, showing a drop of 8 to 9% in all cases (see Table 4). This differs from Madrid, where the smaller the flat is, the bigger the drop in prices. However, it is interesting to see that the recovery in prices after the pandemic happens for all sizes, but the one-bedroom dwellings, where the drop in prices compared to prepandemic values is still 7.9% and 9.6% lower in Barcelona and Madrid, respectively. Considering that most of the STR supplies are 1-bedroom units, these findings are in line with a recent study on Lisbon (Batalha et al., 2022). This study uncovers those landlords switched their STRs to the LTR market during the pandemic as a response to the dropping demand coming from tourists.

Table 4. Effect of COVID-19 on prices (in logs): by number of bedrooms

	(1) 1 bedroom	(2) 2 bedrooms	(3) 3 bedrooms	(4) 4+ bedrooms
Covid	-0.0200 (0.0178)	-0.00117 (0.00875)	-0.0132* (0.00742)	-0.0270 (0.0233)
Post Covid	0.0403 (0.0252)	0.0766*** (0.0116)	0.0510*** (0.00929)	0.0115 (0.0295)
MAD	0.300*** (0.0313)	0.223*** (0.0200)	0.328*** (0.0186)	0.270*** (0.0654)
Covid*MAD	-0.112*** (0.0121)	-0.0786*** (0.00593)	-0.0502*** (0.00552)	-0.0504** (0.0207)
Post Covid*MAD	-0.0955*** (0.0249)	-0.0522*** (0.0120)	-0.0170 (0.0118)	-0.0176 (0.0385)
BCN	0.0550 (0.147)	0.196*** (0.0426)	0.228*** (0.0282)	0.169 (0.110)
Covid*BCN	-0.0803*** (0.0221)	-0.0886*** (0.0108)	-0.0692*** (0.00844)	-0.0794*** (0.0212)
Post Covid*BCN	-0.0709** (0.0313)	-0.0749*** (0.0160)	-0.0521*** (0.0142)	-0.0158 (0.0392)
Constant	2.432*** (0.154)	3.121*** (0.124)	2.696*** (0.123)	2.597*** (0.204)
Observations	3,797	10,887	15,921	2,807
R-squared	0.879	0.896	0.883	0.889
Dwelling charact	YES	YES	YES	YES
Postcode FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
RentCap	YES	YES	YES	YES

Notes: The omitted outcome is the period before the pandemic. MAD stands for Madrid and BCN for Barcelona. The standard errors are in parentheses *** p<0.01, ** p<0.05, * p<0.1

Next, with the aim of explaining the impact of the pandemic on tenants' preferences in terms of dwelling characteristics, we review the interaction between several characteristics of the dwellings with the dummy variable of COVID-19 on rental prices. In general, during the pandemic, the preference for bigger dwellings with an exterior and a parking spot increased since we observe a smaller drop in prices. In percentage terms, during the pandemic, one extra room would translate into an additional increase in rent of 1.49%, having a parking lot in 1.33% and having an exterior in 2.96% (see Table 5).

On the other hand, for characteristics such as having an elevator or the number of bathrooms, we see a loss in interest due to the negative effect on rents. Our results are in line with previous findings that uncovered that during the pandemic, new tenants prioritized larger living spaces or outdoor areas (Tomal & Helbich, 2022, Tajani et al. 2021).

Table 5. Effect of COVID-19 on prices: by dwelling characteristics

	Ln(Price)
Covid-19	-0.110*** (0.00754)
Bedrooms* Covid-19	0.0149*** (0.00210)
Exterior* Covid-19	0.0296*** (0.00491)
Elevator* Covid-19	-0.0233*** (0.00343)
Bathrooms* Covid-19	-0.0125*** (0.00418)
Floor* Covid-19	-0.000697 (0.000803)
Parking* Covid-19	0.0133*** (0.00480)
Constant	2.207*** (0.132)
Observations	33,489
R-squared	0.885
Tenant's charact	YES
Dwelling charact	YES
Postcode FE	YES
Year FE	YES

Notes: The omitted outcome is the period before the pandemic. The standard errors are in parentheses *** p<0.01, ** p<0.05, * p<0.1

Finally, we review whether there was a heterogeneous effect between the personal characteristics of the tenant or, in other words, whether the tenant's profile was deterministic in regard to renting a dwelling at a lower price than before the pandemic. For this, we had access to characteristics such as gender, level of education, civil status, employment status and nationality²⁰. To reduce the length of the results in Table 6, we only include the variables that were shown to influence the rental price (you can find the complete table in the appendix, Table A3).

In our findings, we observe that during the pandemic, compared to tenants with higher education, tenants with lower education experienced a smaller drop in prices, with a positive difference of 2.5 p.p. for tenants with secondary education and an approximately 5 p.p. difference for those with primary or no education. This could be interpreted as a proxy of an unmeasured component, the income level. After our findings, during the pandemic, high earners, assuming a higher education level, had a higher chance of being selected as tenants than low-income earners by being offered a larger drop in prices.

Table 6. Effect of COVID-19 on prices: by tenants' demographics

	Ln (Price)
Covid-19	-0.0894*** (0.0131)
No education*Covid-19	0.0495*** (0.00861)
Primary education*Covid-19	0.0510*** (0.00427)
Secondary education*Covid-19	0.0246*** (0.00402)
EU nationality*Covid-19	-0.0342*** (0.00630)
Non-EU nationality*Covid-19	-0.000241 (0.00389)
Constant	2.208*** (0.132)
Observations	33,489
R-squared	0.885
Tenant's charact	YES
Dwelling charact	YES
Postcode FE	YES
Year FE	YES

²⁰ For the variable nationality, the outcomes were: Spanish, EU non-Spanish and others.

Notes: The omitted outcomes per tenants' characteristics are for education level: tertiary education and for nationality: Spanish nationality. For the covid variable, the omitted outcome is the period before the pandemic. The complete table is in Appendix A3. The standard errors are in parentheses *** p<0.01, ** p<0.05, * p<0.1

The second difference regards tenants' nationality. Compared to Spaniards, non-Spaniards tenants with EU nationality received a greater drop in prices, with a difference of 3.42%. After performing the same examination by dwelling size (see Table A3), we find that this difference is particularly observed for tenants renting 1 to 2-bedroom rentals.

We interpreted these results as changes in the selection criteria of landlords towards tenants with a higher income profile.

5. Conclusion

Analysing the rental market of Spain and in particular the one from Barcelona and Madrid is interesting since the Spanish housing market, compared to the EU average, is characterized by a large proportion of homeowners compared to tenants. However, after the financial crisis, the share of tenants increased significantly, as did their prices. The rise in demand can be explained first as a response to banks reducing their lending and increasing the requirements for obtaining a loan. Second, due to changes in labour market conditions, young people face more difficulties in accessing mortgages. This growing demand can be translated into a rise in prices after the supply did not meet with a sufficient increase, however, and second, due to the shifts in LTR supply towards the STR market (Garcia-Lopez et al., 2020; Almagro & Dominguez-Iino, 2022), particularly in high-demand touristic cities such as Madrid and Barcelona.

During the pandemic, tourism dropped, so the supply of STRs decreased, and after the pandemic, inflation in Spain was above 10%, and interest rates increased. Therefore, in general terms, a drop in prices during the pandemic and a rise afterwards was expected. That is why the driving question of this study was to understand how the LTR market reacted during and after the pandemic and why these reactions could have induced changes in the rental market in terms of price, discount, tenants' preferences, and landlord selection.

This paper - performed using microdata on rental contracts- sheds light on the pandemic's impact on the urban long-term rental market, reviewing uneven effects across size, dwelling characteristics, and tenant profiles in Spain and particularly in the two most populated Spanish cities, Barcelona and Madrid. Considering it unique in its analysis, the focus is on rental discounts and tenants' characteristics.

In summary, we find that there was an average drop of 5.28% in Spanish rental prices during the complete restriction period, with a recovery rate of a 3.18% increase after restrictions were lifted. The strongest effect is found in Barcelona, with a drop of 10.9%, compared to a drop of 8.8% in Madrid. When we disaggregate the impact period into five phases, we find that the largest drop develops during the second state of emergency, with an average drop of 8% at the Spanish level and 14.7% and 12.4% in Barcelona and Madrid, respectively. In terms of size, we find that one-bedroom flats, which are more likely to be licenced as short-term rentals, experienced the largest price decline, especially in the city of Madrid. After testing whether there was a shift in preferences of tenants, we see that outdoor spaces, extra rooms, and parking lots lead to an increase in rental prices. Tenants with higher education experience a greater drop in prices than those with lower education, and non-Spaniards with EU nationality received a greater drop in prices compared to Spaniards.

For our second variable of interest, rental discounts, we uncover an average discount increase during the COVID-19 period of almost 28% in the Madrilenian market and 15% in the Barcelonian market, while no effect for the rest of Spain was identified. After the restrictions were lifted, the discount level fell by 42% in Barcelona, compared to the 22% drop observed in the Madrilenian LTR market. We believe that this result reflects a higher scarcity of supply in the LTR market of Barcelona.

As stated in the introduction, our findings are consistent with previous research on the impact of pandemic rental prices. Adding new information in terms of landlord preferences during economic shock in regard to tenants' demographics and in terms of market dynamics, we observe the behaviour of the price discount in LTRs.

Finally, we would like to state that future research should focus on the long-term impact of the pandemic on the housing rental market in relation to the changes in the labour market due to an increasing share of remote workers, as well as due to dropping demand in property owners. In addition, it is relevant to identify whether our findings regarding the changes in tenants' preferences and landlord selection will be long-lasting and can be applied during future pandemics.

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Appendix

Table A1. Control variables

Variables	Details
<i>Tenants' characteristics</i>	
Gender	
Age	Information was available in 4 intervals
Civil status	
Employment status	
Nationality	In addition to Spain, information is given at regional level
<i>Dwellings' characteristics</i>	
Post code	
Surface	
Number of bedrooms	
Number of bathrooms	
Parking	
Exterior	
Floor	
Elevator	
Number of tenants	

Table A2. Old version: Effect of COVID-19 on prices

	(1) Spain	(2) Barcelona city	(3) Madrid city
Covid-19	-0.0528*** (0.00529)	-0.109*** (0.0149)	-0.0879*** (0.00924)
Post Covid-19	0.0318*** (0.00640)	0.0256 (0.0175)	0.0163 (0.0113)
Constant	2.173*** (0.132)	3.065*** (0.127)	2.658*** (0.128)
Observations	33,489	5,378	9,698
R-squared	0.884	0.795	0.780
Tenants' charact	YES	YES	YES
Dwelling charact	YES	YES	YES
Postcode FE	YES	YES	YES
Year FE	YES	YES	YES

Notes: The omitted outcome is the period before the pandemic. The standard errors are in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Table A3. Effect of COVID-19 on prices: by tenants' demographics and size (complete table)

	All dwellings	0-1 room	2 rooms	3 rooms	4 rooms or more
Covid-19	-0.0894*** (0.0131)	-0.135*** (0.0458)	-0.0997*** (0.0227)	-0.0576*** (0.0184)	-0.0354 (0.0482)
Men*Covid-19	0.00256 (0.00329)	-0.00401 (0.0102)	0.00533 (0.00535)	0.000170 (0.00455)	-0.00276 (0.0142)
Age 25-44* Covid-19	0.00168 (0.00565)	0.0157 (0.0162)	0.00949 (0.00894)	-0.00429 (0.00834)	0.00265 (0.0249)
Age 45-54* Covid-19	0.00383 (0.00680)	0.0356 (0.0226)	0.0178 (0.0111)	-0.00781 (0.00956)	0.0149 (0.0296)
Age Older than 55* Covid-19	-0.00311 (0.0103)	0.0164 (0.0338)	0.0216 (0.0167)	-0.0128 (0.0143)	-0.0142 (0.0418)
No education*Covid-19	0.0510*** (0.00427)	0.0557*** (0.0136)	0.0475*** (0.00697)	0.0473*** (0.00602)	0.0303 (0.0189)
Primary education*Covid-19	0.0246*** (0.00402)	0.0311** (0.0122)	0.0252*** (0.00640)	0.0213*** (0.00582)	0.00359 (0.0170)
Secondary education*Covid-19	0.0495*** (0.00861)	0.0317 (0.0272)	0.0474*** (0.0149)	0.0393*** (0.0115)	0.0285 (0.0401)
Civil partner*Covid-19	-0.00280 (0.00396)	-0.00347 (0.0169)	0.00158 (0.00675)	-0.00531 (0.00519)	0.0158 (0.0158)
Married*Covid-19	-0.00640 (0.00522)	-0.00307 (0.0166)	-0.00105 (0.00825)	-0.00816 (0.00737)	0.0315 (0.0254)
Autonomous*Covid-19	-0.0133 (0.0131)	-0.00651 (0.0460)	-0.00817 (0.0225)	-0.00269 (0.0182)	-0.0613 (0.0466)
Indefinite contract*Covid-19	-0.00617 (0.0121)	0.0214 (0.0431)	0.00586 (0.0208)	-0.00325 (0.0168)	-0.0614 (0.0423)
Temporal contract*Covid-19	0.0201 (0.0135)	0.0518 (0.0465)	0.0302 (0.0229)	0.0123 (0.0187)	-0.0280 (0.0503)
Other work situation*Covid-19	-0.0145 (0.0130)	-0.0140 (0.0481)	-0.0169 (0.0229)	0.00652 (0.0176)	-0.0949** (0.0424)
Pensioner*Covid-19	-0.00141 (0.0158)	0.0238 (0.0543)	0.00425 (0.0265)	0.00105 (0.0220)	-0.0462 (0.0599)
EU nationality*Covid-19	-0.0342*** (0.00630)	-0.0502*** (0.0161)	-0.0494*** (0.0102)	-0.0157* (0.00924)	-0.0397 (0.0289)
Non-EU nationality*Covid-19	-0.000241 (0.00389)	-0.00409 (0.0141)	-0.00558 (0.00638)	0.00380 (0.00519)	-0.00977 (0.0169)
N° of tenants signing contract*Covid-19	-0.00174 (0.00218)	0.00108 (0.0109)	-0.00965** (0.00463)	-0.0116*** (0.00298)	0.00558 (0.00779)
Constant	2.208*** (0.132)	2.829*** (0.0565)	3.276*** (0.123)	2.227*** (0.122)	2.482*** (0.0578)
Observations	33,489	3,807	10,900	15,964	2,735
R-squared	0.885	0.873	0.893	0.879	0.888
Tenant's charact	YES	YES	YES	YES	YES
Dwelling charact	YES	YES	YES	YES	YES
Postcode FE	YES	YES	YES	YES	YES

4. General conclusion

This section provides a comprehensive summary of the findings presented in this dissertation. Firstly, specific conclusions for each research paper are outlined. Then, a broader, overarching conclusion related to the main aim of this thesis is drawn. Finally, the major limitations of this research are highlighted, and the direction for future studies is set.

Based on the findings of the first paper, the drop in tourism affected the STR market unevenly in terms of prices, occupancy, and minimum stay. The results indicate that the pandemic led to a decrease in both prices and occupancy rates, with a more pronounced effect observed for entire dwellings and the professionalized supply segment. Furthermore, all types of accommodations experienced an increase in minimum stay requirements, with the professionalized segment showing the largest change. These findings suggest that professionalized hosts adapted to a declining demand by offering lower prices and longer stays. Moreover, the third article confirms that this shift in the market had a relieving effect on long-term housing prices.

In the second article, it is observed that the pandemic led to an average 9.1% increase in daily fees for MTR accommodations, equivalent to approximately €8, with the most significant growth occurring during the second state of alarm in Spain at a rate of 37.2%. Additionally, the findings reveal that the negative impact over occupancy was more pronounced for STRs compared to MTRs.

Although both segments experienced decreased occupancy rates during the first half of the pandemic, they nearly fully recovered during the second and third quarters of 2022.

In addition, this study reveals that the probability of offering a dwelling in Airbnb as MTR, and not as STR, is affected negatively by the number of bedrooms, ADR, occupancy rate and being close to the airbus station and the beach.

Moreover, in terms of MTR supply, a 27.7% increase per neighborhood was uncovered, while STRs experienced a 55.1% decline. One could argue that there has been a transition of STRs to MTRs; however, this shift is not comprehensive, as the loss of STRs listed on Airbnb is three to five times bigger than the gain of MTRs listed on Airbnb. Possible explanations for this difference include that some STR units shifted to other platforms than Airbnb that offer exclusively MTRs, or they may have been listed as LTR. Nonetheless, the available data only allowed the identification of a drop in prices as a signal of increased supply.

The final study, focused on LTRs, discloses an average 1.3% drop in Spanish LTR prices - excluding Madrid and Barcelona- during the complete restriction period. A stronger effect is displayed for Madrid and Barcelona with an average drop of 9%. After disaggregating the pandemic period into four different phases, the strongest drop is presented during the second state of alarm, with an average 12% drop in Barcelona and Madrid, and a 3.82% drop in the rest of Spain. However, during the recovery phase, prices at the national level increased to 5.33% higher than pre-pandemic levels, compared to the cities of Madrid and Barcelona where prices are set back to their pre-pandemic figures. In terms of size, it is found that in Barcelona, the percentage drop in prices was similar for different dwelling sizes, with declines of 8-9% in all cases. In contrast, Madrid showed that the smaller the flat, the bigger the drop in prices. Furthermore, is noteworthy that the recovery in prices happens for all sizes, but for the one-bedroom accommodations, which are more likely to be licensed as short-term rentals and experienced the most substantial price decline. These one-bedroom accommodations remained 7.9% and 9.6% lower in price compared to pre-pandemic values in Barcelona and Madrid, respectively. The study also identified shifts in tenant preferences, revealing that outdoor spaces, an additional room, and parking spaces led to increased rental prices, while tenants with higher education levels and non-Spanish tenants with EU nationality experienced greater price drops. Additionally, changes in housing market dynamics related to rental discounts were identified, uncovering a discount increase during the COVID-19 period of almost 28% in Madrid and 15% in Barcelona, while no effect for the rest of Spain was identified. After the restrictions were lifted, the discount level fell, by 42% in Barcelona and 22% in Madrid, compared to preacademic figures. The variation in discount decline may be attributed to the introduction and removal of rental caps in Barcelona during the pandemic or the increase in STRs or MTRs following the easing of travel restrictions.

If this dissertation has one general message, is that each of the three urban rental markets was impacted differently by the pandemic. It shows that the prices dropped for STRs and LTRs, while the MTRs were more resilient, experiencing a growth in prices and supply during the pandemic. Furthermore, results reveal that STR professionalized hosts reacted stronger to the demand drop than STR hosts that offered their extra spare room or second residence for extra income. In addition, new findings are added regarding LTR landlords' preferences when facing economic shocks, particularly in regard to tenants' demographics.

The dissertation makes a unique contribution to the existing literature, by being the first to empirically analyze the dynamics of an MTR market and the pandemic's influence on price

discounts in the LTR market. Furthermore, it sheds light on the interdependence of the different rental markets in terms of supply transfers in a context of housing supply inadequacies and remote work expansion.

Regarding the limitations of this research, a primary focus is on data availability. Future research on market transitions would greatly benefit from a detailed analysis of market transitions to better comprehend the interdependence between the three co-living rental markets. Such an analysis would require an accurately determined geo-location and the in-time market status of each existing dwelling. Additionally, there is room for improvement in the data used to identify MTRs, as the analysis was limited to the supply listed on the Airbnb platform. Moreover, the impact of the pandemic on the STR and MTR markets was limited to the timeframe during which the first and second research were conducted. Consequently, forthcoming research should address mid-term and long-term recoveries, as well as the evolving dynamics of the three urban rental markets. Additionally, future studies are encouraged to delve into the lasting impact of the pandemic on the housing rental market concerning changes in the labor market resulting from the growing prevalence of remote work, associated changes in preferences within the LTR market, and the potential increase in demand for MTR.

Annex 1: The effect of COVID-19 on the peer-to-peer rental market (published version)

The effect of COVID-19 on the peer-to-peer rental market

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Abstract

Based on fine-grained data on short-term accommodations for the city of Barcelona, we review the uneven impact of the pandemic on the short-term market, differentiating the supply by type of accommodation: single room versus entire flat/house, and type of host: professionalized versus non-professionalized. Using a fixed effects approach at property level, we estimate an average decrease in prices of 11.3% in entire flat/house and 4.7% in single rooms. For professionalized supply, the effect arrived to 13.6% and 9.8%, respectively. Finally, a growth in minimum stay was experienced by all types, but with a stronger effect on professionalized accommodations. We suggest that the supply adaptation strategy to accommodate the decreasing demand, especially by professionalized hosts, was to attract a more stable demand coupled with lower prices and longer stays. In addition, the type of short-term supply that experienced the strongest drop in occupancy was the non-professionalized segment, losing around 41% of their bookings between April 2020 and January 2021.

Keywords

COVID-19, tourism, sharing market economy, Airbnb

Introduction

While prior to COVID-19, the industry had been grappling with concerns about over-tourism, the pandemic suddenly catapulted tourism towards collapse. Early evidence on impacts on air travel, cruises and accommodations reveals devastating effects on the industry. In 2020, global tourism suffered its record-worst year, with a drop in international arrivals of 74% according to the World Tourism Organization ([UNWTO, 2020](https://www.unwto.org/)). To date, with regard to the relationship between the pandemic and tourism, researchers have focussed on three questions. First, there is the question of

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the impact of COVID-19 on the tourism industry (Karim et al., 2020; Samarathunga, 2020; Hoque et al., 2020; Gossling et al., 2020; Skare et al., 2021; Qiu et al., 2020; Brouder, 2020; Zheng et al., 2021; Hall et al., 2020). For example, Zheng et al. (2021) found that the Chinese hotel industry dropped by 89% in two weeks between January 14 and 28 and subsequently remained at approximately 10% until the end of February. Second, the question of constraints has focussed on the potential of COVID-19 to transform tourism demand. Several studies have shown that the pandemic could serve as an opportunity for the tourism industry to reorient itself more towards local demand and to introduce a more social and ecological strategy of travel activity (Higgins-Desbiolles, 2020; Ioannides and Gyimothy, 2020; Sigala, 2020; Wen et al., 2020). The third question considers an inverse relationship, that is, the impact of tourism on the COVID-19 outbreak. Farnzanegan et al. (2021) find that a 1% higher level of inbound and outbound tourism is associated with an increase of 1.2% and 1.4% in confirmed COVID-19 cases and deaths, respectively. In addition, they reveal that countries with a higher level of socioeconomic globalization were/are more exposed to the COVID-19 outbreak. However, it is important to state that most confirmed COVID-19 deaths are explained by cross-country differences in health infrastructure and demographic structure, not by socioeconomic globalization.

Furthermore, in addition to over-tourism, another controversial topic of the tourism industry in pre-COVID times was the booming peer-to-peer (P2P) short-term housing (Nieuwland and Van Melik, 2020). On the one hand, it is argued that the sharing economy obtains positive effects by fostering competition and cultural exchange, reducing excessive tourist accommodation prices and creating additional revenue for families with economic difficulties. However, on the other hand, the P2P business model has been particularly criticized for creating a more lucrative way for landlords and property managers to offer housing units in comparison with long-term rentals that meets local demand. The P2P business model generates an economic incentive to transform long-term rentable units into short-term units, that are managed year-round through the P2P platforms such as Airbnb. Hence, the most controversial effect of this new form of tourist accommodation supply is a reduction in the long-term supply coupled with rising housing rentals and property prices (Lagonigro et al., 2020). Several studies have investigated the effects of this sharing economy on the housing market. While most of these studies analyze the impact on the US housing market (Horn and Merante, 2017; Koster et al., 2021; Lee, 2016; Sheppard and Udell, 2016; Valentin, 2020), a few have addressed European markets (Ayouba et al., 2020; Duso et al., 2020; Garcia-Lopez et al., 2020; Rodriguez-Perez De Arenaza, et al., 2019) and one reviews the impact on the housing market in Taiwan (Chang, 2020). In addition to the increasing effect on housing prices, other studies discuss how the negative aftermath of the short-term rental includes an increasing low-quality tourism, which has ignited urban conflicts with a particular impact on locals (Nieuwland and Van Melik, 2020). Another negative aftermath involves disloyal competition within the hospitality industry that has an adverse impact on hotels' financial performance, especially those in the low-price range (Zervas et al., 2017). However, contrary to this last effect, another study found that employment in the hotel sector increases with increased Airbnb listings (Dogru et al., 2020a). Despite this extensive literature, there is scarce evidence regarding the effect of COVID-19 on the P2P market. Only a few studies have reviewed similar research questions such as the impact of COVID-19 on host perceptions and responses (Farmaki et al., 2020), the effects of COVID-19 on investors (Dolnicar and Zare, 2020) and the influence of COVID-19 on tourist types and destination attributes (Jang et al., 2021). Finally, other authors have made forecasts and provided early descriptive statistics about the evolution of the P2P market during the pandemic (see the section Expected Effects of COVID-19 on the Short-Term Rental Market). That said, our work contributes by being the first paper that

measures the impact of the COVID-19 pandemic on the P2P business in general and the introduction of the state of alarm in particular.

Using fine-grained data at the listing and property levels provided by the AirDNA platform, identification of the effects on short-term rentals for this study were carried out for the second most relevant Spanish city: Barcelona. First, using listings from the city of Barcelona, we apply a fixed effect approach at the property level to reveal the impact of the pandemic on four outcome variables: price, revenue, occupancy rate and minimum renting length (in days) fixed by the host. In all cases, the type of accommodation is differentiated by single room versus entire apartment/house and by professional versus non-professional managed accommodations to capture heterogeneous effects between the four segments.

We find that, due to the pandemic, including the period from March 2020¹ until January 2021,² the short-term housing market confronted decreasing prices, especially the entire lodgings managed by professional hosts with a drop of 13,6%. Another finding was the decreasing occupancy shown for all types of short-term supply, suffering the strongest effect the non-professionalized supply, with a drop of 41.2% in entire units and 40.8% in single rooms. As a result of these downward trends in prices and occupancy, a negative impact on revenue was also evidenced, with this impact being stronger for entire and professionalized accommodations, following to some extent the same heterogeneous pattern of the fall in prices. Finally, in terms of minimum days of rent, as expected, an increase for all four segments was uncovered, with the professionalized short-term rentals being the segment that on average increased the most with an increase of over 2.5 for single rooms and 2.6 for entire units.

To provide robustness of our results and provide evidence of the lockdown experienced in Spain in 2020 from March 14th until June 21st, we use a second dataset at the European level to create a synthetic control unit of the city of Barcelona. We find that synthetic Barcelona, where no state of alarm was introduced, shows slightly smaller drops in prices but nevertheless similar to actual Barcelona. By comparison, the minimum stay showed a significant increase in Barcelona compares to its synthetic, especially in entire units. Meaning that the effect of the first lockdown introduced during the second quarter of 2020 has an increasing impact on minimum stay, but not on prices. In sum, our results suggest that hosts were/are looking for more stable demand, that is, coupled with lower prices and longer stays, thereby competing more directly with the long-term housing market.

After this introduction, the article is organized as follows: the second section reviews the studies foreseeing the effect of the pandemic on the short-term rental market after covering the general effect on the Spanish economy caused by the pandemic. The third section provides an overview of our baseline dataset, some descriptive statistics and the statistical methodology used. The fourth section presents the effects of the COVID-19 over the P2P market, while the fifth section presents the specific effects during the lockdown period. Finally, the last section offers a summary of the main findings, concluding with some thoughts regarding the possible relevance of the exposed changes on the tourist activity and the local housing market.

Background

Effects of COVID-19 on the Spanish economy

By March 13, 2020, COVID-19 cases were confirmed in all 50 provinces of Spain. By March 14th, the state of alarm was activated, and a national lockdown was imposed. The country had the highest death rate on March 30th, with 6001 deaths within a 7-day period (WHO, 2021). After the state of alarm ended on 21 June, the number of cases increased again in July, which led to the imposition of new restrictions but not to a second national lockdown.

Spain is a tourism-oriented economy. In 2019, tourism's contribution was 12.3% of the total GDP while tourism-related employment was 13% (National Statistics Office, 2019).

In regard to the economic impact of COVID-19, this tourism-oriented economy has been one of most affected EU countries, suffering a negative growth of 10.8% compared to an average negative rate of 5.9% at the EU-27 level (Eurostat, 2021).

Figure 1 shows the quarterly evolution of the GDP in Spain between 2019 and 2020. The drop in the first and second quarters of 2020 is notable. By the end of the first semester of 2020, Spanish GDP fell by almost 23% with respect to the last quarter of 2019.

If we compare the monthly arrival of tourist visitors in Spain between 2019 and 2020, the impact is clear (see Figure 2). During January and February, the numbers are almost identical between both years at over 4 million visitors per month (see Figure 2). Afterwards, the number of visitors drops significantly in 2020 compared to the values observed for 2019.

Under the channels of the reduction in Spanish incoming tourists, we find travel restrictions and travel bans, local destination restrictions, such as lockdowns, and travellers who became fearful after learning about traumatic COVID-19 tourism experiences experienced by relatives or strangers through media communications or user-generated content.

Expected effects of COVID-19 on the short-term rental market

Before the pandemic, the short-term rental market was becoming increasingly professionalized. For example, in Barcelona, the proportion of Airbnb owners who rented out more than one room or apartment was approximately 27%, while 22% of the rooms or apartments were rented out by landlords offering more than five accommodations (Gutiérrez et al., 2017). Converting the original P2P market into a business activity driven by new real estate investment opportunities and an easy form of renting is attractive to private investors and landlords. This is a concept that is far from the original sharing economy, where the main purpose was that the host could earn extra income by

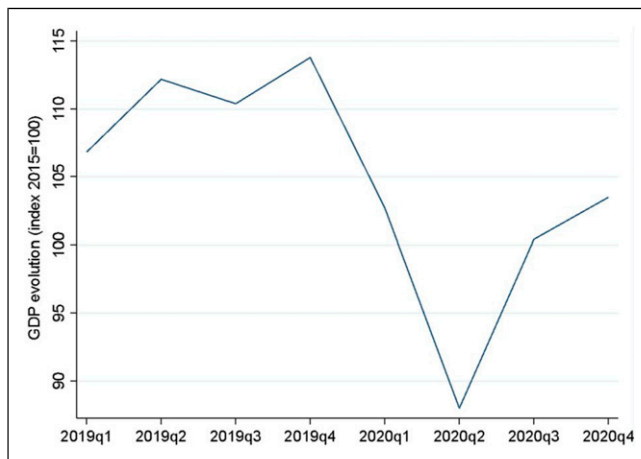


Figure 1. Evolution of the Spanish GDP 2019–2020 (Index 2015 = 100). Note: Gross domestic product values are given at market prices with reference year 2015 (not adjusted for seasonality). Source: Spanish Statistic Bureau, 2021.

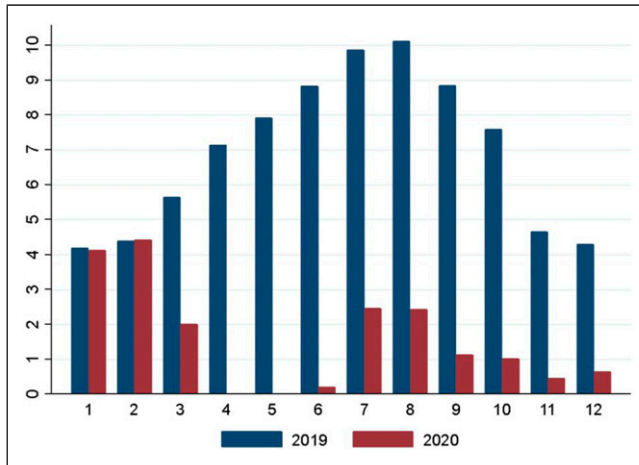


Figure 2. Monthly arrivals foreign tourist (in millions). Note: The figure compares the monthly evolution of the total number of tourist arrivals (in millions) between 2019 and 2020. Source: Frontur. INE, 2021.

offering an underutilized owned capacity such as a spare room or a second residence (Dogru et al., 2020b; Cocola-Gan and Gago, 2019).

In regard to the effect of the COVID-19 pandemic on the short-term rental market, after the latest data were published by the Spanish Statistical Bureau (2021), between August 2020 and February 2021, touristic flats fell by 14.8%, and uneven effects on different types of suppliers and different types of accommodations were expected. Dolnicar and Zare (2020) and Gerwe (2021) forecasted that professionalized accommodation would suffer a stronger decreasing effect in supplied units than in lodgings managed by non-professional hosts. The reasoning behind this uneven impact was that professionalized hosts with large portfolios of short-term rentals would suffer a stronger budget constraint during the pandemic than private hosts, for example, by facing mortgage payments with empty flats. This uneven budget constraint translates into a stronger incentive for professionalized hosts compared to hosts that offer their extra spare room or second residence for extra income, to sell their properties, put them back into the long-term market, or keep them listed on the same platform while seeking to attract longer staying tenants by offering lower prices. Instead, private suppliers tend to turn underutilized capacity listed accommodations into a space of personal use, for example, transforming a spare room into a home office (Gerwe, 2021).

Dolnicar and Zare (2020) argue that this potential structural change in platform-traded spaces may imply 'a return to the original Airbnb ethos: the sharing of spaces among ordinary people'. As Brian Chesky, Airbnb's CEO stated, 'This crisis has sharpened our focus to get back to our roots, back to the basics' (Airbnb, 2020), where the roots are defined as a peer-to-peer market with accommodation providers who are ordinary citizens looking for additional income by offering an underutilized capacity. In summary, a decrease in offered units and host revenue is expected for all types of accommodation and hosts, but a stronger decrease is expected in terms of prices and market shifts for professionalized hosts due to the budget constraints they face compared to private hosts.

Supporting the expected reduction in short-term supply in Barcelona is a strong increase in long-term rental agreements that the city experienced during the second episode of the pandemic (see Graph 1A in Appendix). Even after the economic shock and after the introduction of the urban leasing law to control rental prices, the number of rental agreements in January 2021 surpassed any

value seen during the last eight years. The literature on control in rental prices predicts that a rental control translates into a shift of long-term rental units into property units, an increase in the units in the unregulated segment of the long-term rental market and a reduction in the regulated rental market (Andersson and Sodeberg, 2021; Autor et al., 2014; Diamond et al., 2019). These results were expected, especially for a city such as Barcelona, which is characterized by a scarcity of land and thus of new supply. However, the recovery of rental contracts was so strong that it overcame the pre-COVID trends, with 14,399 contracts signed during the first quarter of 2021, while the first quarter of 2019 (pre-COVID) registered 12,832 agreements (Incasol, 2021).

In terms of demand, Gerwe (2021) projects that future bookings will be led by a more local demand for affordable long period stays, and, according to Airbnb, almost 60% of customers now book listings not more than 300 km away from home compared to 33% in pre-COVID times (Airbnb, 2021). In addition, the demand for sanitized spaces following all COVID-19 hygienic measures is directly linked to a stronger reduction in demand for single rooms as well as a stronger reduction in non-professionalized units. Similarly, Jang et al. (2021), at an early state of the pandemic, stated that, in regard to low perceived threat, the consumption of P2P accommodation was lower for leisure tourists than for business tourists.

Data and methods

Data description and evolution of the short-term rental market in Barcelona

The data provided by *AirDNA* cover the monthly data from November 2014 to January 2021 (both months included). The representative sample of the short-term accommodations used is available at the listing level for the city of Barcelona and provides detailed information on two major collaborative economy accommodation platforms, *Airbnb* and *Homeaway*, including details on accommodation characteristics such as bedrooms, bathrooms, rental prices, reservations, availability, minimum stay and number of reviews (Table A1 in the Appendix provides detailed descriptions of all the variables used in the study). Excluded from the analyzed panel data were the listings with the bottom and top 0.1% of prices to avoid outliers that could hinder the quality of the analysis. As a result, after deleting the corresponding observations, the minimum rental price per night arrived at €11 and the maximum arrived at €1035, reducing the original dataset of 2,612,525 to 2,610,519 observations (listings).³ By exclusively observing the effects on active listings, out of the 2,610,519 just 1,339,313 were finally analyzed. Being "active" listings defined as vacation rentals that had at least one calendar day classified as reserved or available during the reporting month.

As mentioned above, the main purpose of this article is to uncover whether the effects between the type of host and the type of accommodation were uneven. To this end, we will focus on the impact on the two main accommodation types that together make up 98,72% of all listings: 'Entire unit (flat/house)' and 'Single room', each of which has 756,329 and 561,850 active listings. To uncover if the effects differ by type of host, these two accommodation segments will be grouped into 'professional' and 'non-professional' managed accommodations, where 'professional' are all listings that are managed by a host that manages three listings or more, and non-professional listings managed by hosts that listed one or two accommodations on the platforms. These differentiations leave us with four segments: entire units (professionalized), entire units (non-professionalized), single rooms (professionalized) and single rooms (non-professionalized). For further study, this differentiation is crucial since the impact on long-term housing prices is mainly driven by entire units managed by professional hosts in which there is no primary occupant (tenant or owner) living in the unit year-round (Wachsmuth and Weisler, 2018).

Figure 3 plots the evolution of active listings for each of the four segments listed on Airbnb and HomeAway for the studied period (2014.11–2021.01). A steadily increasing trend of supply was clear for the four combinations until the beginning of 2017. Afterwards, the entire units offered by professionalized hosts were strongly preferred compared to the rest of the listing types. An evolution supported by the studies of Dogru et al. (2020b) and Cocola-Gant and Gago (2019) describes the professionalization process experienced by the peer-to-peer market.

However, at the end of 2017, the City Council began demanding tourist licences for all short-term rental hosts, and the increasing trends stabilized, with only seasonal oscillations remaining.

Finally, and as expected, in line with the drop in Spanish GDP and tourist arrivals (see the section Effects of COVID-19 on the Spanish Economy), the supply for all four segments dropped strongly as an effect of the dropping demand of short-term accommodations. Most units were lost from the 'entire unit (professionalized)' segment. In July 2020, this segment had 5261 active listed accommodations, compared to 9367 units offered for the same month in 2019, which was a drop of 43.83%, a percentage that comes to 57.42% when we compare the monthly values of our latest accessed value, January 2021, versus January 2020. However, all segments show significant losses, even though they had less to lose than the 2017 picked professionalized supply of entire flat/house short-term rentals.

To review an overall picture of the pandemic's effect on the short-term rental market in more detail, we analyze the impact of the pandemic on each short-term rental segment defined in terms of prices, occupancy, revenue and minimum stay length demanded by the host. The first three variables are observed at the listing level and analyzed at the property level. Meanwhile, the fourth variable, minimum stay, is analyzed at the neighbourhood level, since the data are given at property level (one observation per property) since the monthly variability is very low compared to the other three variables that are at the listing level (one observation per month).

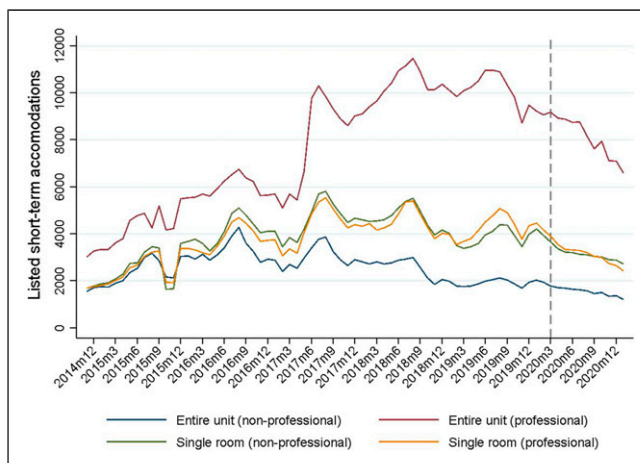


Figure 3. Listed short-term accommodations 2014–2021 by type of lodging and type of host. Note: The figure shows the monthly evolution of the total number of accommodations listed during the period 2014.11–2021.01. The type of host is defined as "professional" listing if it managed by a hosts that has three or more accommodations listed on the short-term platform, and "non-professional" if otherwise. The vertical line marks the introduction of the state of alarm in Spain. Source: AirDNA, 2021.

Table 1 compares the average values of the four variables presented before and after the declaration of Spain's state of alarm as well as the average value between 2014 and 2021. We define the pre-COVID period between January 2018 and March 2020 and the COVID period between April 2020 and January 2021. By comparing the mean values, it can be seen that the price per night dropped during the COVID period, especially for professionalized accommodations, where the mean price before the pandemic was approximately €159.63 per night for entire units and €52.57 for single rooms, falling to €147.7 and 48.11, respectively. A similar pattern is shown in terms of revenue; however, the drop is strong for the four segments, which is supported by the decrease in occupancy rate that falls on average 16 p.p. in the case of entire units and 17 p.p. for single rooms on average.

When we consider the values of the minimum stay, a condition that fixes the host in terms of minimum days of reservation, we see that the average change is stronger for entire accommodations than for single rooms, with an increase of two days versus one day, respectively. If we analyze this aspect by type of host, the largest change is shown for entire non-professionalized accommodations with an average minimum stay of 14 days during the pandemic.

Econometric strategy

The first identification strategy exploits the differential impact of the COVID-19 pandemic on short-term rentals using price, revenue and occupancy rate as dependent variables at the property level. Hence, we estimate the following econometric model for our three outcomes of interest Y at property p in time (month/year) t

$$Y_{pt} = \alpha + \beta_1 \cdot Covid_t + \delta_p + \theta_t + \varepsilon_{pt} \quad (1)$$

Table 1. Descriptive statistics: mean values by type of short-term rental and type of host.

	All	Entire flat/house			Single room		
		All	Prof.	Non-prof.	All	Prof.	Non-prof.
Price	Total	147.70	158.57	121.23	48.02	49.28	204.21
	Pre-COVID	159.63	168.19	132.09	50.61	52.57	48.47
	COVID	143.75	147.70	126.26	48.16	48.11	48.22
Revenue	Total	981.32	1117.30	382.84	256.81	296.51	652.78
	Pre-COVID	1143.87	1334.67	734.63	296.86	345.66	253.25
	COVID	330.86	362.87	233.74	66.6	81.50	53.56
Occupancy rate	Total	0.27	0.273	0.275	0.23	0.252	0.207
	Pre-COVID	0.27	0.278	0.223	0.23	0.259	0.209
	COVID	0.11	0.109	0.092	0.06	0.079	0.051
Minimum stay	Total	8.31	8.41	8.07	4.68	5.55	3.92
	Pre-COVID	9.56	9.32	10.25	5.15	6.00	4.38
	COVID	11.60	11.01	14.09	6.16	7.11	5.31

Note: The overall mean for each variable in terms of the type of accommodation and type of host was calculated for the period 2014.11–2021.02, while the pre-COVID means were computed for the period 2018.01–2020.03 and the COVID means for the period 2020.04–2021.02. 'Prof.' stands for professionalized units, defining a professional host as a host that has listed three or more accommodations. While 'Non-prof.' stands for non-professional managed accommodations, defined as managed by a host that has listed two or fewer listings. Source: AirDNA.

Here, $Covid_t$ β_1 is a dummy for the treatment period (\geq April 2020), the coefficient that captures the impact of COVID-19 on our variables of interest. All time invariant characteristics of the property are encapsulated by property level fixed effects δ_p . Any other significant factor that could have impacted the outcome variables over time is captured by the month-year fixed effects θ_t . In addition, it is relevant to clarify that the panel data used in this study is unbalanced. Since each property has no information for every point of time during the studied period, it could have been listed on the platform after the beginning of the studied period, stopped being listed before the end of the studied period, or been posted and blocked at different points in time during the studied period. Just to give a numerical example, out of the original 114,148 listed accommodations, only 1763 have values for all the 76 months, while 50% of the accommodations were actively listed on the short-term accommodation platform during a period of 18 months or less. Therefore, a multi-collinearity estimation issues between time fixed effects and the coefficient that captures the impact of COVID-19 is avoided.

Our second model reviews the effect of the pandemic on the minimum days of reservation fixed by the host S_{nt} at the neighbourhood level

$$S_{nt} = \alpha + \beta_1 \cdot Covid_t + \delta_n + \theta_t + \gamma_{nt} + \varepsilon_{nt} \quad (2)$$

In this case, using data collated at neighbourhood level⁴ n by year and month t , there are no property fixed effects to include in [equation \(2\)](#) that could control the different characteristics of the property since there is one observation per year per property. Instead, several control variables γ_{nt} are included in the model.⁵ The control variables are, first, several available property characteristics such as the platform where the accommodation is offered (Airbnb or HomeAway); the number of bedrooms and bathrooms; the maximum stay; the response rate of the host; if the host is a ‘super host’; the overall rating of the accommodation as well as security deposit, cleaning fee, and extra person fee; if pets are allowed and if the accommodation has a licence. Second, following [Lagonigro et al. \(2020\)](#), who use data at the census track level to show a positive correlation of the number of tourist spots in Barcelona with the ratio of Airbnb accommodations, we include the distances of each accommodation to the 10 places most visited by tourists in 2019⁶ as well the distance to the nearest beach,⁷ to the nearest metro station and to the nearest airbus bus station as buses are exclusively used to connect the city with the airport. In addition, fixed effects at the month-time level θ_t and neighbourhood fixed effects δ_n are included to capture any time invariant characteristics not controlled by the accommodation’s characteristics and tourist attractions.

First, the average impact on both types of accommodations is analyzed, and then the effect is reviewed by typology. As discussed in the section Expected Effects of COVID-19 on the Short-Term Rental Market and based on the descriptives summarized in [Table 1](#), heterogeneous.

Baseline results: Effect of COVID-19 on short-term rentals in Barcelona City

[Tables 2–4](#) present the results of [equation \(1\)](#) for our first three outcomes, revenue, prices and occupancy rate, while [Table 5](#) presents the results of [equation \(2\)](#) for the variable minimum stay.

Table 2. Effect of COVID-19 on prices (in logs).

	Entire units			Single rooms		
	(1)	(2)	(3)	(4)	(5)	(6)
	Total	Prof.	Non-prof.	Total	Prof.	Non-prof.
COVID-19	-0.113*** (0.00791)	-0.136*** (0.00899)	-0.0353** (0.0160)	-0.0469*** (0.0175)	-0.0978*** (0.0271)	0.00858 (0.0206)
Constant	4.917*** (0.00301)	4.970*** (0.00348)	4.771*** (0.00581)	3.901*** (0.00446)	3.912*** (0.00635)	3.885*** (0.00598)
Observations	141,867	104,039	37,828	46,155	26,328	19,827
R-squared	0.012	0.016	0.003	0.002	0.005	0.002
N° of properties	5090	3701	1389	2480	1462	1018
Property FE	YES	YES	YES	YES	YES	YES
Year and month FE	YES	YES	YES	YES	YES	YES

Note: Each column corresponds to a different dataset of the active listings. Models 1, 2 and 3 analyze the data corresponding to entire flats/houses, while Models 4, 5 and 6 include data from single rooms. In addition, Models 1 and 4 include all units, while Models 2 and 5 analyze only professionalized units, defining a 'professional host' as a host that has listed three or more accommodations. Models 3 and 6 analyze only the listings of 'non-professional hosts', defined as having hosts with two or fewer listings. Source: AirDNA, 2021.

Robust standard errors in parentheses. *** $p < 0.05$, ** $p < 0.05$, * $p < 0.1$.

Table 3. Effect of COVID-19 on occupancy.

	Entire units			Single rooms		
	(1)	(2)	(3)	(4)	(5)	(6)
	Total	Prof.	Non-prof.	Total	Prof.	Non-prof.
COVID-19	-0.337*** (0.00490)	-0.314*** (0.00541)	-0.412*** (0.0103)	-0.390*** (0.00813)	-0.376*** (0.0101)	-0.408*** (0.0130)
Constant	0.564*** (0.000536)	0.539*** (0.000614)	0.637*** (0.00101)	0.539*** (0.000689)	0.542*** (0.000822)	0.536*** (0.00117)
Observations	169,895	126,379	43,516	57,772	32,652	25,120
R-squared	0.112	0.102	0.146	0.104	0.094	0.116
N° of properties	5125	3728	1397	2495	1469	1026
Property FE	YES	YES	YES	YES	YES	YES
Year and month FE	YES	YES	YES	YES	YES	YES

Note: Each column corresponds to a different dataset of the active listings. Models 1, 2 and 3 analyze the data corresponding to entire flats/houses, while Models 4, 5 and 6 include data from single rooms. In addition, Models 1 and 4 include all units, while Models 2 and 5 analyze only professionalized units, defining a 'professional host' as a host that has listed three or more accommodations. Models 3 and 6 only analyze the listings of 'non-professional hosts', defined as having hosts with two or fewer listings. Source: AirDNA, 2021.

Robust standard errors in parentheses. *** $p < 0.05$, ** $p < 0.05$, * $p < 0.1$. A full table including all control variables and their coefficient is shown in [Table A2 in the Appendix](#).

Table 4. Effect of COVID-19 on revenue (in logs).

	Entire units			Single rooms		
	(1)	(2)	(3)	(4)	(5)	(6)
	Total	Prof.	Non-prof.	Total	Prof.	Non-prof.
COVID-19	-0.495*** (0.0117)	-0.507*** (0.0130)	-0.456*** (0.0257)	-0.395*** (0.0238)	-0.440*** (0.0340)	-0.349*** (0.0327)
Constant	6.059*** (0.00623)	6.100*** (0.00711)	5.952*** (0.0128)	4.977*** (0.00950)	4.985*** (0.0126)	4.966*** (0.0145)
Observations	141,867	104,039	37,828	46,155	26,328	19,827
R-squared	0.593	0.600	0.571	0.569	0.564	0.576
N° of properties	5090	3701	1389	2480	1462	1018
Property FE	YES	YES	YES	YES	YES	YES
Year and month FE	YES	YES	YES	YES	YES	YES

Note: Each column corresponds to a different dataset of the active listings. Models 1, 2 and 3 analyze the data corresponding to entire flats/houses, while Models 4, 5 and 6 include data from single rooms. In addition, Models 1 and 4 include all units, while 2 and 5 analyze only professionalized units, defining a 'professional host' as a host that has listed three or more accommodations. Models 3 and 6 only analyze the listings of 'non-professional hosts', defined as having hosts with two or fewer listings. Source: AirDNA, 2021.

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 5. Effect of COVID-19 on minimum stay.

	Entire units			Single rooms		
	(1)	(2)	(3)	(4)	(5)	(6)
	Total	Prof.	Non-prof.	Total	Prof.	Non-prof.
COVID-19	2.151*** (0.505)	2.633*** (0.528)	2.081*** (0.452)	2.794*** (0.641)	2.524*** (0.362)	2.094*** (0.700)
Constant	-35.65 (45.69)	-2.810 (24.63)	-39.61 (25.98)	-17.68 (29.92)	24.80 (16.33)	-15.22 (21.47)
Observations	4391	3968	3878	4612	3961	4096
N° of neighbourhoods	0.268	0.329	0.292	0.274	0.300	0.160
R-squared	71	64	67	70	65	67
Distances control var.	YES	YES	YES	YES	YES	YES
Neighbourhood FE	YES	YES	YES	YES	YES	YES
Year and month FE	YES	YES	YES	YES	YES	YES

Note: Each column corresponds to a different dataset of the active listings. Models 1, 2 and 3 analyze the data corresponding to entire flats/houses, while Models 4, 5 and 6 include data from single rooms. In addition, Models 1 and 4 include all units, while Models 2 and 5 analyze only professionalized units, defining a 'professional host' as a host that has listed three or more accommodations. Models 3 and 6 only analyze the listings of 'non-professional hosts', defined as having hosts with two or fewer listings. Source: AirDNA, 2021.

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. A full table including all control variables and their coefficients is shown in [Table A3 in the Appendix](#).

Effect on prices, occupancy and revenue

Table 2 shows how the short-term rental market suffered in terms of prices due to COVID-19. Overall, we find a significant effect on prices for both accommodation types. Nevertheless, for entire units, it is more than double that for single rooms, falling the first 11.3% (Column 1), while the second falls by only 4.7% (Column 4). When we split the listings by type of host, the effect is stronger for listings managed by professional hosts, with a negative effect on prices of 13.6% for entire units (Column 2) and 9.8% for single rooms (Column 5), compared to the non-professional managed listings, where the drop on prices is 3.5% for entire units, while for the single rooms no significant effect is found. These last findings follow the expected, a lower budget constrain compared to professional hosts that translates into a non-radical price adaptation, especially when it comes to the single room supply.

In sum, there is a stronger effect on professionalized short-term accommodations, especially on entire units. These differences follow the idea that professionalized hosts, compared to non-professionalized hosts, had to adapt faster to the market due to the budget constraint they faced.

In regard to occupancy, we find a similar effect on the different typologies, showing a slightly stronger effect for the accommodations managed by non-professionalized hosts, with a drop of 41.2% for entire units (Column 3) and 40.8% for single rooms (Column 6) compared to 31.4% (Column 2) and 37.6% (Column 5), respectively. These dissimilarities could be explained by the uneven introduction of COVID-19 sanitation measures on one side and cancellation flexibility on the other. Since both actions were imposed stronger by professional hosts. The decreasing effect on occupancy is stronger, and the decreasing effect on prices is weaker, for single rooms.

Finally, in Table 4, we observe the effect on revenue, a variable explained by both of the previous variables: price and occupancy.

As expected, the drop in revenue is almost a perfect result of the decline in price and occupancy. After the coefficients, we find that the segment that suffered the most in terms of revenue was the professionalized entire units' segment, with a drop of 50.7% (Column 2), followed by the entire units offered by non-professional hosts (45.6%, Column 3) and single rooms offered by professionalized hosts (44%, Column 5). The segment with the lowest drop in revenue were the single rooms offered by non-professional hosts with 34.9%, a result strongly influenced by non-significant change over prices.

Effect on minimum stay

In addition to the price, another modification in the requirements that are fixed by the supply is the minimum length of stay where a requirement of a longer minimum stay at a lower price translates into attracting a more stable demand. In other words, a longer minimum stay could partially transform the short-term market into a mid-term market, allowing it to compete more closely with the rental housing demanded by locals or long-term staying foreigners. This was the case for both types of accommodation, single rooms and entire houses/apartments. That said, Table 5 shows the results of equation (2) for the variable minimum stay. In the case of entire houses/apartments, the average effect is an increase of 2.2 days (Column 1) and 2.8 days in the case of single rooms (Column 4). This shift indicates that during the pandemic, the hosts of short-term rentals began to look for more stable tenants. The tenant profile could be a more professional one who carries out a relatively long business stay in the city or a traditional tenant, thus driving the short-term rentals towards a traditional rental model. In fact, in September 2020, more than 35% of rentals had a minimum stay of one month. Heterogeneous reaction by type host can also be observed, increasing

professional managed listings 2.6 days and 2.5 days for entire units and single rooms, while the increase in non-professional accommodations was smaller with an increase of 2 and 2.1 days, respectively.

In summary, the pandemic effects found on the short-term housing market in this study were decreasing prices, especially for entire and professionalized units (13.6%); decreasing occupancy due to the decrease in demand during the pandemic, an effect that was suffered by all segments with an average fall over 30% but stronger for non-professionalized supply (41.2% in entire units and 40.8% in single rooms). As a result of these downward trends in prices and occupancy, a negative impact on revenue was also evidenced, with this impact being stronger for entire and professionalized accommodations, to some extent following the same heterogeneous pattern of the fall in prices. Finally, in terms of minimum days of rent, as expected, an increase for all four segments was found, with the professionalized short-term rentals being the segment that on average increased the most, with an increase over 2.5 for single rooms and 2.6 for entire units.

Heterogeneity: the effect of the COVID-19 lockdown

To test whether there were stronger effects on prices and minimum stay exclusively as a consequence of the lockdown introduced in Spain between March and June of 2020, we use an extended difference-in-difference formulation, the synthetic control method (SCM).⁸ The SCM estimates the effect of an intervention by comparing the evolution of an outcome variable of the affected unit with the evolution of the same outcome variable for a synthetic control group. The methodology is similar to a difference-in-difference approach; however, instead of using a control unit, a weighted combination of control units is used to predict what would have been observed for the affected unit in the absence of the intervention (counterfactual(see [Abadie et al., 2014](#))). We create a synthetic counterfactual of the city of Barcelona for the period of interest combining the evolution of EU cities that did not introduce a state of alarm during the second quarter of 2020 using data from Inside Airbnb (see [Table A4 in the Appendix](#)).

Based on information provided by Barcelona Centre for International Affairs detailing the countries that declared a state of alarm or similar after March 2020 (see [Table A5 in the Appendix](#)), there were nine donor EU cities, that is, untreated units that were not affected by the introduction of a

Table 6. Synthetic Barcelona donor weights.

	Entire house/apartment		Single room	
	(1)	(2)	(3)	(4)
	Effect on price (in logs)	Effect on minimum stay (in nights)	Effect on price (in logs)	Effect on minimum stay (in nights)
Atenas	0	0	0	0.250
Berlin	0	0	0.083	0
Brussels	0.657	0.966	0.015	0
Stockholm	0	0.034	0.903	0.535
Munich	0.343	0	0	0
Vienna	0	0	0	0.216

Note: Author's calculation using the *Synth* package. For a more detailed table including all control units that were not included in the synthetic control unit, see [Table A7 in the Appendix](#).

state of alarm or similar: Amsterdam, Atenas, Berlin, Brussels, Stockholm, Munich, Paris, Prague and Vienna (the complete EU cities that had data available can be found at [Table A6 in Appendix](#)). [Table 6](#) lists the donor states selected for the synthetic control unit and their associated weights.

As [Table 6](#) shows, the weights vary between the type of accommodation and the outcome variable. Of the nine cities selected, between 2 and 3 were included in each of the control units. Brussels had the greatest weight for entire accommodations (65.7% in prices and 96.6% in min. stay), and Stockholm did so in the case of single rooms (90.3% in prices and 53.5% in min. stay).

Effect on price

In [Figures 4\(a\) and \(b\)](#), the largest change in prices can be observed during the April, with a stronger drop compared to the synthetic Barcelona. This effect is more recognizable for single rooms during the first month. However, the synthetic Barcelona for single rooms drops one month later and even stronger than the actual Barcelona, which recovers in June from the impact of the first COVID-19 wave. Compared to the entire unit, the drop of the actual Barcelona is stronger, but very similar to the drop of its synthetic counterfactual, which did not suffer from the lockdown consequences during the second quarter of 2020. Both recover almost completely in July.

Effect on minimum stay

When we analyze the impact of the lockdown in terms of minimum stay in days, the effect is clearer. [Figures 5\(a\) and \(b\)](#) show that, for Barcelona, compared to its synthetic counterfactual, the entire unit suffered a higher impact on minimum stay in both types of accommodations, but there is similarity in terms of price as it recovers in July. In the case of single units, there is no effect since synthetic Barcelona shows the same evolution as actual Barcelona.

In sum, the figures show that the effect on actual Barcelona (treated unit) during lockdown was stronger than that of synthetic Barcelona (control unit), first in terms of price in regard to single rooms, and second, in terms of minimum stay in regard to entire units.

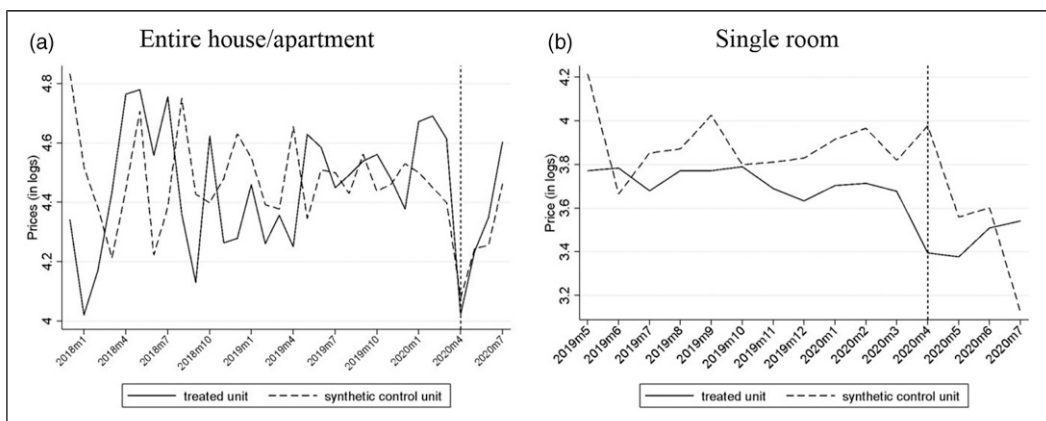


Figure 4. (a, b) Evolution of prices (in logs) for actual BCN and synthetic BCN. Note: Author's calculation using the *Synth* package. For a more detailed table including all control units that were not included in the synthetic control unit, see [Table A6 in the Appendix](#). BCN is acronym for Barcelona.

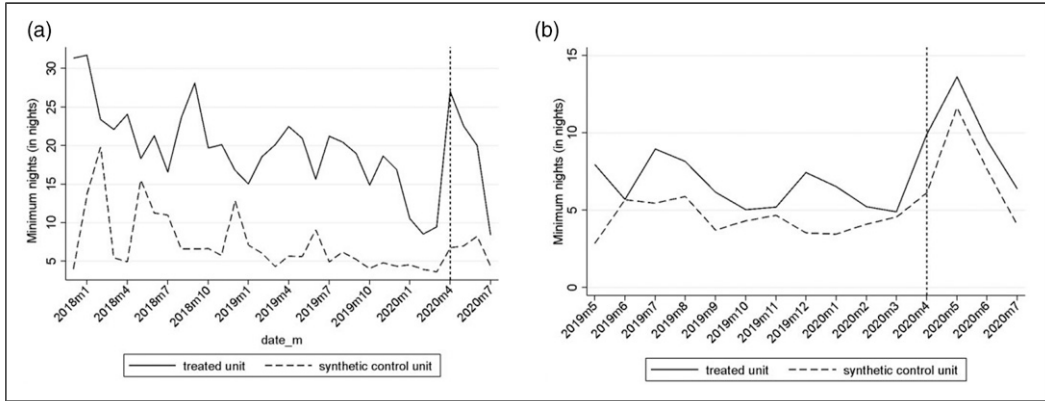


Figure 5. (a, b) Evolution of minimum stay length for actual BCN and synthetic BCN¹¹. Note: Author's calculation using the *Synth* package. For a more detailed table including all control units that were not included in the synthetic control unit, see [Table A6 in the Appendix](#). BCN is acronym for Barcelona.

It is important to mention that this test exclusively reviews the impact of the lockdown itself versus the pandemic effect without lockdown effects. In addition, it presents another limitation due to the short period time that can be reviewed to obtain an applicable control unit since all EU cities were affected by the pandemic. In addition, the effect of summer tourism in Barcelona, which attracted a high volume of tourists after the first wave, results in a fast recovery of the drops suffered in the months of April and May.

Conclusion

Although the impacts of the pandemic on tourism and destinations have been well documented in the literature, there is no research that measures the impact of COVID-19 on the short-term housing market. In this article, we use fine-grained data from Barcelona and Europe to study the impacts of the COVID-19 pandemic on the short-term housing market, a market directly affected by the strong drop of touristic activity during the period. We focus on the impact of the pandemic, differentiating accommodations by entire flats/houses versus single rooms and professional versus non-professional managed accommodations. Analyzing four variables price, revenue, occupancy rate and minimum renting length (in days) at monthly listing level, by using a fixed effect approach at property level. In sum, we find that due to the pandemic, counting for period after March 2020⁹ until January 2021,¹⁰ the short-term housing market experienced decreasing prices, especially entire and professionalized units (13.6%), decreasing occupancy due to the drop in demand, with an average fall over 30%, suffering the strongest effect the non-professionalized supply, with a drop in utilization of 41.2% in entire units and 40.8% in single rooms. As a result of these downward trends in prices and occupancy, a negative impact on revenue was evidenced as well, with this impact being stronger for entire and professionalized accommodations. Finally, also in the baseline results an increase for all four segments in the minimum booking length was corroborated, with the professionalized short-term rentals being the segment that on average increased the most, with an increase over 2.5 for single rooms and 2.6 for entire units. These heterogeneous findings closely follow the predicted impact on the short-term accommodation supply (Gerwe, 2021; Dolnicar and Zare, 2020; Jang et al., 2021). Professional hosts with large portfolios of short-term rentals were

expected to suffer stronger budget constraints during the pandemic than private hosts, for example, by facing mortgage payments with empty flats. This uneven budget constraint translates into a stronger incentive for professionalized hosts, compared to hosts that offer their extra spare room or second residence for extra income, to sell their properties, put them back into the long-term market or keep them listed on the same platform while they seek to attract longer staying tenants by offering lower prices. Instead, private suppliers turn partially underutilized listed accommodations into a space of personal use, for example, by transforming a spare room into a home office (ibid.).

Later, to provide evidence of the effect of the lockdown experienced in Spain in 2020 from March 14th until June 21st, we use a second dataset at the European level to create a synthetic control unit of the city of Barcelona. The aim of this section was to identify whether the effect on price and minimum stay during the second quarter of 2020 was stronger in cities where a state of alarm was activated and a lockdown introduced, than in those where it was not. In sum, synthetic Barcelona, where no state of alarm was introduced, shows a slightly stronger response than synthetic Barcelona in some segments. First, in terms of price in regard to single rooms, and second, in terms of minimum stay in regard to entire units. In addition, it shows that the effect of summer tourism in Barcelona attracting a high volume of tourists after the first wave results in a fast recovery of the drops suffered in the months of April and May.

Given the evidence shown in this article and the expected results reported in the literature on the uneven impact of the pandemic on the short-term rental market, a partial market shift of the short-term supply is suggested. Since the most affected segment was professionalized accommodations, a transfer of housing units to the long-term rental market as well as price competition of the remaining short-term listings with the long-term rental market is expected. In addition, in response to this market shift, relief over the increasing effect on long-term housing prices could occur (Cocola-Gant and Lopez-Gay, 2020). However, due to the limitation of the accessed data, we provide evidence on the impact of COVID-19 on the short-term P2P housing market by segments, but we do not explore the impact that this effect could have had on the local housing market. In this sense, future research should focus on the effect that the uneven impact of the P2P rental market could have had on the supply and prices of the long-term housing market. Lastly, the impact on the P2P rental market reviewed is short-term using only the period during the pandemic. Therefore, mid-term and long-term recoveries, as well as market adaptations should be discussed in further research.

Declaration of conflicting interests

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Notes

1. Months in which several European countries introduced a national state of alarm; thus, it could be defined as the cut in time between pre-COVID and the time when the pandemic began to have a stronger effect on the European economy in European countries.
2. Last month with data available.
3. These listings are from 7659 different short-term rental properties/rooms based in Barcelona.
4. Barcelona has 73 neighbourhoods.
5. We compute for all control variables the mean values at the neighbourhood level.
6. Barcelona's most visited tourist attractions 2019. Published by A. Díaz in Statista (19.05.2021). URL: <https://www.statista.com/statistics/457335/barcelona-s-most-visited-tourist-attractions-spain/>
7. Calculated with ArcGIS
8. For this purpose, the STATA command synth and synth_runner were applied.
9. For more detailed information on the exact effects of the state of alarm in the City of Barcelona, where the effect is the difference between the values for actual Barcelona and the value of its synthetic control unit, its counterfactual, see [Table A5 in the Appendix](#).
10. Months in which several European countries introduced a national state of alarm; therefore, it could be defined as the cut in time between pre-COVID and the time when the pandemic began to have a stronger effect on the European economy in European countries.
11. Last month with data available.

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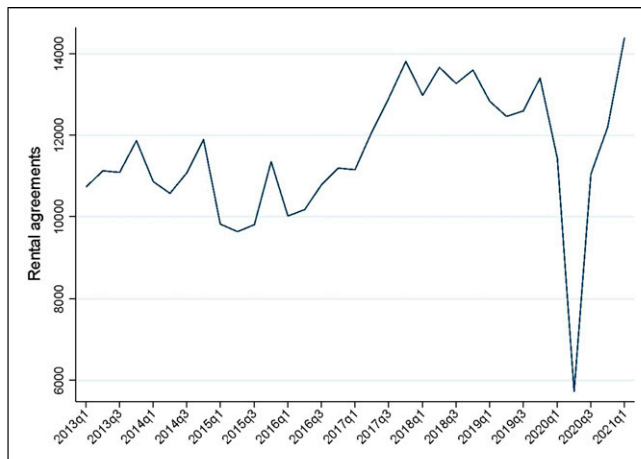
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Author biographies

Catalina Llana Hesse is a PhD Candidate in Economics at the University of Girona and Adjunct Lecturer at the Faculty of Economics and Business at Pompeu Fabra University. She is an applied economist specialized in quantitative methods analysis, currently researching housing and health economics. Additionally, she participates as impact evaluator of a housing project pursued by Urban Innovative Actions. Holding a Master's in Economics and Public Policy from the Autonomous University of Barcelona and a Bachelor's in Economics and Political Science from the University of Münster, she already has a refereed publication in the *Journal of Social Science and Medicine*.

Josep Maria Raya Vilchez is a Professor at TecnoCampus, Pompeu Fabra University. Currently, he is the Director of the Business School of TecnoCampus, as well as of the Chair of ‘Habitatge i Futur’, APCE-UPF. Holding a PhD degree in Economics since 2005, his main topics of research are housing economics and tourism economics. He has published in more than 30 Journals of the JCR such as *Journal of Housing Economics*, *Regional Science and Urban Economics*, *Papers in Regional Science*, *Urban Studies*, *Regional Studies*, and *Tourism Economics*, among others. For the period 2014–2016 he won the prize of best article published in *SERIEs*.

Appendix



Graph A1. Rental contracts 2013–2021. Source: [Incasol \(2021\)](#).

Table A1. Variable description.

Variable	Description	Listing level	Property level
COVID-19	Dummy variable being 0 any month before April 2020, and 1 if otherwise	X	
Price	Available or booked nightly rate in euros	X	
Revenue	Total revenue earned during the reporting period. Includes the advertised price from the time of booking, as well as cleaning fees	X	
Occupancy rate	Total booked days/(total booked days + total available days). Calculation only includes vacation rentals with at least one booked night	X	
Reserved days	Total number of listing calendar days that were classified as reserved during the reporting period (month)	X	
Minimum stay	Minimum reservation of short-term stay fixed by host in days		X
Bedrooms	Number of rooms per accommodation	X	X
Available days	Days available for rent per month	X	X
Bathrooms	Number of bedrooms per accommodation	X	X
Max. guests	Maximum number of guests the vacation rental property can accommodate		X
Response rate	The percentage of new inquiries and reservation requests a host responds to (by either accepting/pre-approving or declining) within 24 h		X
Security deposit	Security deposit		X
Cleaning fee	Cost of cleaning service in euros		X
Extra people fee	Cost of extra guests in euros		X
Licence	Dummy variable being 1 if the accommodation has a tourist licence to rent the flat in Barcelona and 0 otherwise		X
Super host	Dummy variable being 1 if the accommodation host has the Airbnb title of 'Super host' and 0 otherwise		X
Pets	Dummy variable being 1 if the accommodation allows pets and 0 otherwise		X
Airbnb/ Homeaway	Dummy variable being 1 if the accommodation is listed through Airbnb and 0 if listed at HomeAway	X	X
Overall rating	Property = average guest rating of the property out of 5. Ext property = average guest rating of the property out of 100		X

Note: The variables that were not at the listing level were given at the property level. Source: AirDNA.

Table A2. Complete table of COVID-19 effect on minimum stay.

	Entire units			Single rooms		
	(1)	(2)	(3)	(4)	(5)	(6)
	Total	Prof.	Non-prof.	Total	Prof.	Non-prof.
COVID-19	2.151*** (0.505)	2.633*** (0.528)	2.081*** (0.452)	2.794*** (0.641)	2.524*** (0.362)	2.094*** (0.700)
Bedrooms	2.944** (1.371)	1.300 (1.184)	3.401*** (1.216)	6.306** (2.925)	5.993*** (1.684)	2.758 (3.516)
Available days	0.0875** (0.0394)	0.0618 (0.0404)	-0.00455 (0.0187)	-0.0132 (0.0127)	-0.00286 (0.0114)	-0.0431*** (0.0151)
Bathrooms	-1.911 (1.397)	0.414 (1.664)	-0.348 (1.860)	3.033 (2.266)	1.942* (1.046)	0.173 (1.775)
Max. guests	-1.384* (0.736)	-1.123 (0.682)	-2.284*** (0.742)	-2.752** (1.178)	-1.755** (0.676)	-1.288 (0.887)
Response rate	-0.0510 (0.0309)	-0.0804 (0.0509)	-0.143*** (0.0460)	0.0386 (0.0347)	-0.00334 (0.0171)	0.00489 (0.0293)
Security deposit	0.00251 (0.00232)	0.00669*** (0.00226)	0.00495*** (0.00143)	0.00496 (0.00371)	0.00358** (0.00172)	0.00238 (0.00262)
Cleaning fee	0.0728** (0.0314)	0.0302** (0.0140)	0.0978*** (0.0306)	-0.0173 (0.0282)	0.0142 (0.0167)	-0.0317 (0.0291)
Extra people fee	-0.0212 (0.0263)	-0.0263 (0.0199)	-0.0367* (0.0195)	0.0230 (0.0242)	-0.0232** (0.00898)	-0.0240 (0.0372)
Licence	1.556 (1.321)	-0.991 (1.419)	3.126** (1.205)	2.634*** (0.702)	1.470** (0.606)	2.918*** (0.511)
Super host	-11.26** (5.447)	-4.648** (2.298)	5.768* (2.892)	-1.101 (2.316)	1.691 (1.444)	-1.559 (1.551)
Pets	1.406 (3.220)	-1.705 (2.629)	0.934 (2.594)	4.081 (3.105)	4.217 (3.434)	-1.829 (2.202)
Airbnb/Homeaway	-5.608*** (1.546)	-2.994** (1.208)	1.937 (4.843)			
Overall rating	0.275* (0.154)	0.220*** (0.0609)	0.178** (0.0809)	-0.00595 (0.0674)	0.0201 (0.0508)	0.0138 (0.0560)
Dist. Coast	-0.0148 0.0104)	-0.0126* (0.00690)	0.00527 (0.00415)	-0.00159 (0.00409)	-0.00351 (0.00309)	0.00124 (0.00399)
Dist. Nearest Airbus	0.00572 (0.0202)	-0.00745 (0.0154)	-0.00276 (0.0111)	0.0233* (0.0119)	0.00228 (0.00854)	0.00615 (0.00953)
Dist. Nearest metro	-0.0147** (0.00680)	-0.0159*** (0.00592)	-0.00452 (0.00397)	0.00694 (0.00725)	0.00138 (0.00450)	0.00753 (0.00514)
Dist. Picasso M.	-0.368 (0.257)	-0.377 (0.271)	0.000609 (0.155)	-0.0365 (0.0355)	-0.00386 (0.0260)	0.0435 (0.0529)
Dist. Cosmocaixa	0.00479 (0.00578)	0.00558 (0.00584)	0.00176 (0.00429)	0.000255 (0.00598)	-8.98 × 10 ⁻⁵ (0.00302)	-0.00114 (0.00639)
Dist. El Born	0.440* (0.241)	0.486 (0.293)	0.0100 (0.144)	-0.00175 (0.0332)	-0.00441 (0.0212)	-0.0739* (0.0441)

(continued)

Table A2. (continued)

	Entire units		Single rooms			
	(1)	(2)	(3)	(4)	(5)	(6)
Total	Total	Prof.	Non-prof.	Total	Prof.	Non-prof.
Dist. Poble Espanyol	0.000334 (0.0134)	0.0298* (0.0164)	0.00325 (0.00709)	-0.0117 (0.0124)	0.0101 (0.00889)	-0.00586 (0.00888)
Dist. Aquarium	-0.0370 (0.0357)	-0.0922** (0.0376)	0.00536 (0.0156)	0.0346** (0.0169)	-0.00344 (0.00820)	0.0237* (0.0136)
Dist. Parc Guell	0.00229 (0.0123)	-0.00266 (0.0105)	0.00996 (0.00642)	0.00787 (0.00766)	-0.00411 (0.00483)	0.00453 (0.00614)
Dist. Camp Nou	0.00152 (0.00666)	-0.0106 (0.0103)	-0.000948 (0.00521)	0.00593 (0.00525)	-0.0101* (0.00576)	0.00498 (0.00469)
Dist. Casa Batllo	0.00777 (0.0166)	0.0191 (0.0173)	-0.00914 (0.0147)	-0.0358*** (0.0117)	-0.00431 (0.00687)	-0.0156*** (0.00571)
Dist. Sagrada Familia	-0.0412** (0.0196)	-0.0408* (0.0225)	-0.0182 (0.0116)	0.0174* (0.00935)	0.0161** (0.00681)	0.0164*** (0.00468)
Constant	-35.65 (45.69)	-2.810 (24.63)	-39.61 (25.98)	-17.68 (29.92)	24.80 (16.33)	-15.22 (21.47)
Observations	4391	3968	3878	4612	3961	4096
R-squared	0.268	0.329	0.292	0.274	0.300	0.160
Number of neighbourhoods	71	64	67	70	65	67
Neighbourhood FE	YES	YES	YES	YES	YES	YES
Year and month FE	YES	YES	YES	YES	YES	YES
Distance control var.	YES	YES	YES	YES	YES	YES

Note: Each column corresponds to a different regression and a different dataset. Models 1 and 2 only analyze the data corresponding to entire flat/apartments, while Models 3 and 4 include data from single rooms. In addition, Models 1 and 3 exclude listings with zero reservation days per month, while Models 2 and 4 include all the listings, including those with occupancy rate zeros.

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Source: AirDNA.

Table A3. Data from inside Airbnb.

Variable	Description
COVID	Dummy variable being 0 any month or quarter before April 2020, and 1 otherwise
Reviews per month	Reviews of the listing per month
Days available	Days available per month
Price	Daily price of stay in euros
Minimum stay	Minimum reservation of short-term stay fixed by host in days

Source: AirDNA.

Comment: for the analysis observations bottom and top 1% of prices were excluded.

Table A4. State of alarm in EU countries.

Countries	State of alarm/emergency	Assigned dummy
Germany	No	0
Austria	No	0
Belgium	No	0
Denmark	Yes, special emergency law	1
Spain	Yes, state of alarm	1
Greece	No	0
United Kingdom	Yes, national emergency	1
Ireland	No	0
Italy	Yes, state of alarm	1
Netherland	No	0
Portugal	Yes, state of alarm and others	1
Czechia (Rep.)	No	0
Sweden	No	0
France	Yes, state of alarm	1
Switzerland	Yes, state of emergency	1

Note: Even though each European country had different timings, the listed countries were under a state for alarm (or similar) that lasted at least between 01.04.2020 and 30.06.2020. Source: CIDOB. Note: CIDOB: Barcelona Centre for International Affairs

Table A5. EU cities chosen as control units.

City	Control unit
Amsterdam	Yes
Atenas	Yes
Berlin	Yes
Brussels	Yes
Copenhagen	No
Dublin	No
Edinburg	No
Stockholm	Yes
Lisbon	No
London	No
Milan	No
Munich	Yes
Oporto	No
Paris	Yes
Prague	Yes
Roma	No
Vienna	Yes
Zurich	No

Table A6. Synthetic Barcelona donor weights (complete version).

	Entire house/apartment		Single room	
	(1)	(2)	(3)	(4)
	Effect on price (in logs)	Effect on minimum stay (in nights)	Effect on price (in logs)	Effect on minimum stay (in nights)
Amsterdam	0	0	X	X
Atenas	0	0	0	0.250
Berlin	0	0	0.083	0
Brussels	0.657	0.966	0.015	0
Stockholm	0	0.034	0.903	0.535
Munich	0.343	0	0	0
Paris	0	0	0	0
Prague	0	0	X	X
Vienna	0	0	0	0.216

Note: data on a single room were not available for each time (month/year) for the reviewed period in the case of Amsterdam and Prague, so they were excluded.

Table A7. Effect of COVID-19 on prices and minimum stay.

	Entire house/apartment		Single room	
	(1)	(2)	(3)	(4)
	Effect on price (in logs)	Effect on minimum stay (in nights)	Effect on price (in logs)	Effect on minimum stay (in nights)
April	-0.0556	20.28	-0.5838	4.06
May	-0.0088	15.57	-0.1835	2.58
June	0.0930	11.76	-0.0924	2.29
July	0.1423	3.97	0.41646	2.38

Note: The effect is equal to the differential between the values for actual Barcelona and the value of its synthetic control unit, its counterfactual. Author's calculation using the *Synth* package.

Annex 2: Journal Submission Letters

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by Catalina Llaneza Hesse; Josep Maria Raya Vilchéz; Toni Rodón
Research paper

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I accept that Ms. Catalina Llaneza Hesse submits this article as the main author and as a part of her doctoral thesis, and that therefore the article will not be part of any other doctoral thesis.

In order for it to be duly recorded and have the appropriate effects, I hereby sign this document.

Dr. JOSEP MARIA RAYA VÍLCHEZ as coauthor of the following three articles:

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- *Llaneza Hesse, C., Raya Vílchez JM. & Rodon, T. (2023). The resilience of the medium-term rental and the boom of digital nomads. Submitted to the Journal of Urban Economics*
- *Llaneza Hesse, C. & Raya Vílchez, JM. (2022). The effect of COVID-19 on the peer-to-peer rental market. Tourism Economics: 28(1) 222–247*
<https://doi.org/10.1177/13548166211044229>

I accept that Ms. Catalina Llaneza Hesse submits these articles as the main author and as a part of her doctoral thesis, and that therefore these articles will not be part of any other doctoral thesis.

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Barcelona, 08.05.2023