

Airbnb and hotels during COVID-19: different strategies to survive

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Abstract

Purpose – *The purpose of this paper is to examine the impact of the COVID-19 pandemic on the traditional hotel industry and Airbnb in nine major European cities. The author examines differences between the two business models and analyses various strategies of Airbnb hosts to cope with the crisis.*

Design/methodology/approach – *A detailed empirical analysis is presented based on data from STR and Inside Airbnb for the period January 2018–September 2020. To assess the impact of the pandemic on the hotel industry, year-to-year changes in various performance metrics are presented. The author also investigates the impact of the pandemic on Airbnb prices with panel data regression analysis. Using text-mining methods, signs for new use-cases are explored, including renting flats for home-office or quarantine.*

Findings – *The results support that Airbnb supply is more flexible. While hotel supply quickly returned to a level close to 2019, the average number of Airbnb listings was lower by more than 15%. Furthermore, the price analysis showed that Airbnb rates decreased more moderately than hotel prices. These findings suggest that a significant share of hosts pivoted from short-term accommodation provision and used their property differently, e.g. rented on a long-term basis. The analysis of listing characteristics revealed that the role of longer stays increased; however, the results do not support a shift towards advertising listings for home-office or quarantine purposes.*

Originality/value – *This paper presents the impact of the pandemic on the hospitality sector in a wide sample of European cities, explores the adjustment of hotels and Airbnb and provides new evidence on the differences between the business models.*

Keywords *Tourism, Airbnb, Text-mining, COVID*

Paper type *Research paper*

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1. Introduction

The on-going COVID-19 pandemic has profound economic and social impact worldwide. Following the outbreak of the novel coronavirus in China, various European countries became the next hotspot areas in March 2020. Social distancing and lockdowns disrupted most economic activities, including the services sector. According to [Eurocontrol \(2020\)](#), flight numbers decreased by 88% in April relative to previous year. Tourism also came to an almost complete halt in Europe: occupancy in hotels decreased by 85% in April year-to-year, despite significant drops in hotel prices ([STR, 2020](#)). Similarly to the traditional hotel industry, the short-term home rental market was also significantly affected, with occupancy rates of Airbnb falling strongly below the levels of 2019 ([AirDNA, 2020](#)).

Without international travel, neither traditional hotels nor Airbnb hosts could operate within the previous rules of the game. However, there are significant differences between traditional hotels and short-term accommodation provision via Airbnb. Listings on Airbnb are based on the housing stock; therefore, anyone can provide services with available property. In the absence of high entry costs, Airbnb hosts can decide whether to serve guests based on the current market prices and the marginal cost of providing service. On the other hand, hotels need to pay high entry costs that include the construction of the hotel

and the hiring of staff. Therefore, unlike Airbnb hosts, hotels have a fixed capacity that cannot be expanded during periods of high-demand and that is offered for guests during off-peak periods as well. This means Airbnb supply is more flexible and can better react to the fluctuation of demand (Einav *et al.*, 2016). Farronato and Fradkin (2018) had confirmed that the supply elasticity of Airbnb is significantly greater than in the case of hotels, meaning that a share of Airbnb hosts serve guests only in case of higher prices and stop providing services below certain price levels. Zervas *et al.* (2017) also found that the supply of Airbnb listings increases during high demand periods.

The COVID-19 pandemic provides a unique opportunity to analyse the two business models during extreme market conditions. The aim of this paper is twofold:

1. to examine the impact of the pandemic on the traditional hotel industry and short-term home rental; and
2. to verify the different strategies of Airbnb hosts to cope with the crisis.

Based on their economic characteristics, we expect significant differences between the reaction of the traditional hotel industry and Airbnb hosts to the pandemic. We hypothesise that a significant share of Airbnb hosts suspended operation, while hotels continued to offer rooms within the framework of government restrictions. We also assume that the impact of the pandemic had been greater on hotel prices than in the case of Airbnb. While Airbnb hosts can decide to earn income in other ways during periods of low demand, hotels are forced to offer discounts to attract guests and minimise losses.

There are different potential strategies for Airbnb hosts during the pandemic. According to various reports, Airbnb listings began to re-appear on the long-term rental market (O'Sullivan, 2020). Moreover, hosts that decided to stay on Airbnb could also adjust services. In recent interviews, Airbnb CEO Brian Chesky summarised key changes in short-term accommodation provision during the pandemic. The main trends include the combination of travelling with distant working and longer stays (Recode Decode, 2020; Carville, 2020). With the surge of distant work, the usage of Airbnb listings for home-office may have gained popularity. Additionally, individuals that are living in shared households may need a second home, e.g. when self-isolation is required.

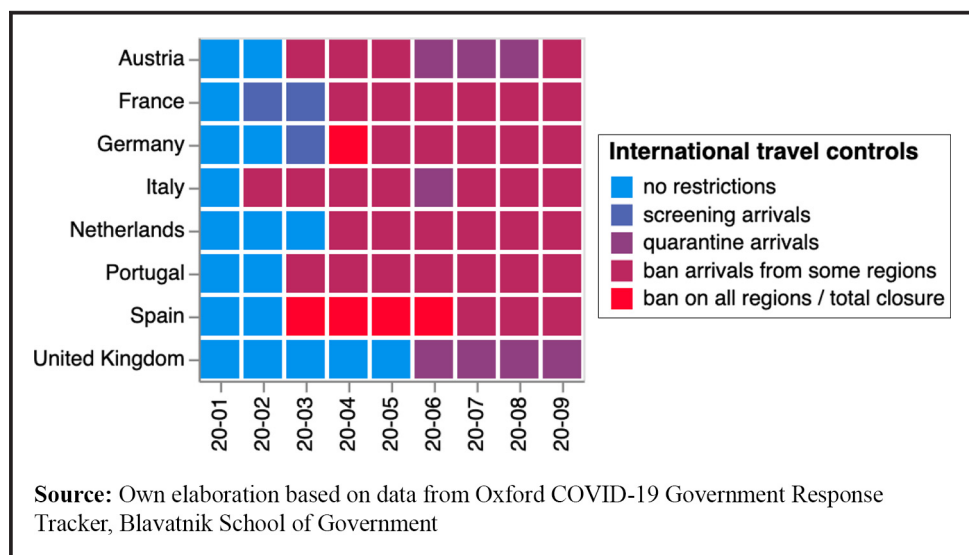
These research questions have a significant policy relevance. Firstly, tourism is a major contributor of jobs in the EU, heavily relying on workers that are often younger, low-skilled or have a migrant background (European Commission, 2020). A better understanding on the developments in the traditional hotel industry supports the planning of adequate measures to preserve these workplaces. Secondly, prior to the pandemic, Airbnb was on a strong growth trajectory, affecting neighbourhoods and local communities (Sherwood, 2019). With a rising share of housing supply devoted to tourists, rents and house prices have been on the rise (Horn and Merante, 2017; García-López *et al.*, 2020). An increasing number of cities implemented regulations to mitigate the negative effects of short-term home rentals (Nieuwland and van Melik, 2020). The exploration of changes in Airbnb services provides insights for urban planners in creating strategies for home-sharing in the post-COVID world.

To reach our research goals, a detailed empirical analysis is presented based on data from STR and Inside Airbnb. A total of nine major EU cities were selected, based on the number of tourist nights and number of Airbnb listings. While Rome and Prague are among the most visited historic cities, they were not included in the analysis due to data limitations for Airbnb.

Table 1 summarises the main metrics of the analysed cities. While all cities were affected by the pandemic, the degree and schedule of lockdown measures was different. Figure 1 provides a timeline on the restrictions of international travel based on the Oxford COVID-19 Government Response Tracker (Hale *et al.*, 2020).

Table 1 Analysed cities

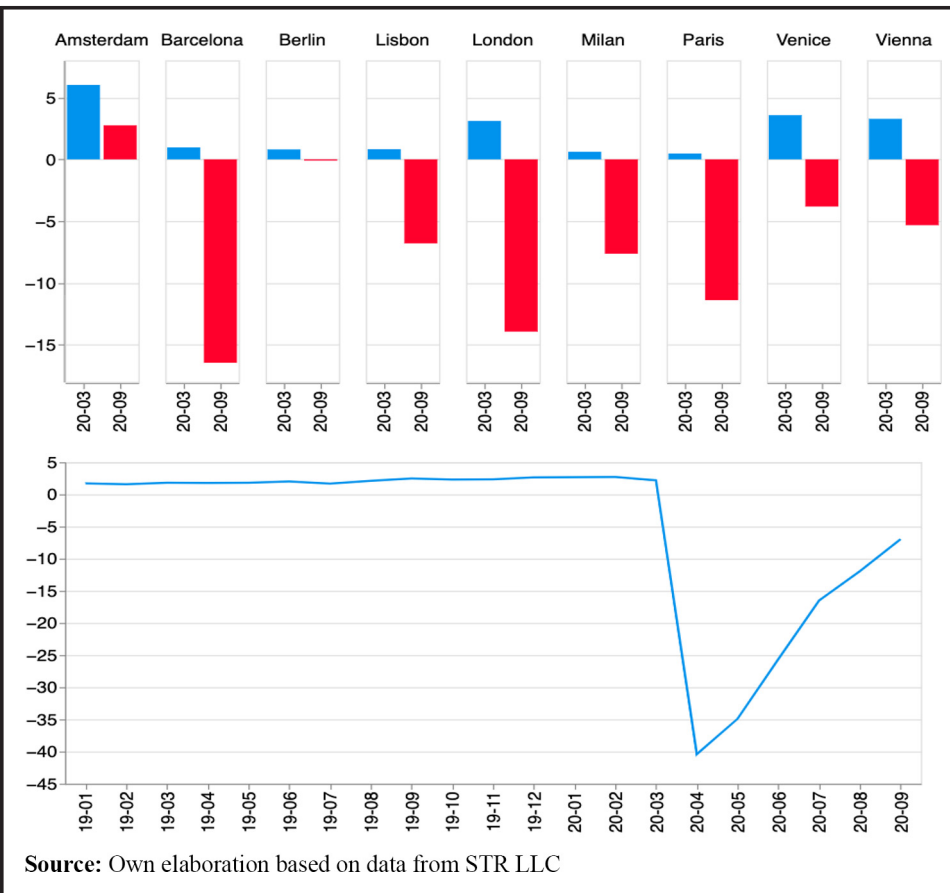
City	No. of tourist nights in 2017 (mln) ¹	No. of active Airbnb listings in 01.2020 ²	Start date for Covid-19 Restrictions for the hospitality sector
Amsterdam	12.5 ³	7,538	15.03
Barcelona	20.4	15,688	14.03
Berlin	31.2	10,796	14.03
Lisbon	12.5	20,187	18.03
London	114 ⁴	51,336	24.03
Milan	11.9	12,623	8.03
Paris	63	28,129	15.03
Venice	11.7	7,661	8.03
Vienna	13.4 ⁵	8,680	14.03

Figure 1 Restrictions on international travel in time period 01.2020–09.2020

North-Italian cities were the epicentre of the pandemic in Europe, with the whole region put into quarantine with very strict social distancing regime from the beginning of March (BBC News, 2020). Extraordinary measures were introduced a week later in Amsterdam (Government of The Netherlands, 2020), Barcelona (Jones and Burgen, 2020), Lisbon (Visit Portugal, 2020), Paris (Bergo, 2020) and Vienna (DW, 2020a), controlling borders and limiting the functioning of restaurants and hotels. In London, restrictions were avoided longer; however, at the end of March, a stricter regime was introduced (GOV UK, 2020). During the summer months, the tourism sector was gradually reopened across Europe (DW, 2020b). However, free movement was not entirely restored, with quarantine requirements and bans on certain regions.

To assess the impact of the pandemic on the hotel industry, year-to-year changes in various metrics are presented, including supply, demand, ADR (average daily rate) and RevPar (revenue per available room). While data on hotels enables us to calculate changes in performance variables, the analysis of web-scraped Airbnb data is more challenging. On one hand, the number of bookings is unknown and the identification of booked listings is imprecise. On the other hand, however, a data set of monthly observations on each listing

Figure 2 Hotel supply: percentage change from same month previous year (below: average across cities)



enables a deeper exploration of changes in Airbnb accommodation provision. Firstly, we estimate changes in supply and prices based on listing level data. Secondly, we provide more insights on the price changes of Airbnb listings using hedonic price regressions. Based on panel data analysis, the effect of the pandemic is isolated from other variables, such as seasonal price effects and listing attributes. Finally, to analyse the strategy of Airbnb hosts, the description of listings is examined with text-mining methods. The title and description of listings is processed in Python to identify changes and the occurrence of various keywords.

The structure of the paper is the following: first, relevant literature is briefly introduced, followed by the description of data and methods. Next, results are presented, and the analysis ends with conclusions.

2. Literature review

The hospitality management literature already includes first articles on the impact of COVID-19 on tourism. Gössling *et al.* (2021) provided an overview of the forecasted effects of the pandemic based on reports and analyses by various tourism organisations. The authors concluded that the pandemic serves as an opportunity to review the current growth-based tourism strategy in favour of one that is more oriented towards sustainable development. Hu and Lee (2020) analysed the initial phase of the pandemic in 97 Airbnb markets using Inside Airbnb datasets. Similarly to this analysis, the authors analysed changes in the

review numbers to proxy the number of bookings. The analysis presented the impact of the initial lockdown in Wuhan, as well as the effect of local lockdown measures. [Boros et al. \(2020\)](#) also used Inside Airbnb data and analysed changes in the calendar information of Airbnb listings in various major cities in the first phase of the pandemic. The authors concluded that while the number of bookings significantly decreased in all cities, the dynamics of changes were shaped by local characteristics and the number of COVID-19 cases. [Hossain \(2021\)](#) summarised the implications of the crisis for sharing economy platforms based on the analysis of media coverage. In the case of Airbnb, the main challenges were related to the financial situation of hosts, the reimbursement for cancelled bookings and the responsibility of the platform in managing the crisis. According to the observations of the author, the strategy of Airbnb to overcome the crisis included a greater emphasis of longer stays and the reduction of hotel-style listings.

While knowledge on the economic impact of the on-going pandemic is limited due to data constraints, the effects of previous health crises are well documented. [Kuo et al. \(2008\)](#) analysed the impact of SARS and Avian Flu on tourism demand in Asian countries and reported an average of 403 reduction of arrivals after every identified case. [Zeng et al. \(2005\)](#) summarised the effects of SARS for China and report a 35% decrease in foreign visitors after the first months of the pandemic relative to previous year. Other analyses focussing on the effects of SARS on Asian economies include [Dombey \(2004\)](#), [Cooper \(2006\)](#) and [Henderson and Ng \(2004\)](#). [Keogh-Brown et al. \(2010\)](#) found a GDP loss between 0.5% and 2% for selected European countries.

Relevant studies examining the relationship between Airbnb and the hotel industry include [Zervas et al. \(2017\)](#). The authors showed that Airbnb supply flexibly react to demand, decreasing the pricing power of hotels. [Farronato and Fradkin \(2018\)](#) showed that Airbnb supply is greater in cities where demand is highly varying, and the hotel industry has constrained room capacity. [Gunter et al. \(2020\)](#) concluded that Airbnb demand is price-inelastic and that Airbnb is a substitute of hotel services. [Blal et al. \(2018\)](#) found that the growth of Airbnb listing numbers did not affect hotel revenues, but higher Airbnb prices and lower guest ratings contribute to higher hotel revenues, signalling a substitution effect. The substitutability between the two models is also explored by [Gyódi \(2019\)](#), who found that while Airbnb and hotels provide a wide range of similar services, the price differences are greater at specific city locations. The competition between Airbnb and the hotel industry is also discussed by [Dogru et al. \(2019\)](#), [Benítez-Aurioles \(2019\)](#) and [Heo et al. \(2019\)](#).

Our analysis is also related to studies on Airbnb implementing text-mining methods. [Zhang \(2019\)](#) examined guest reviews with content analysis (term frequencies, sentiment) and topic modelling to examine preferences regarding hosts. [Cheng and Jin \(2019\)](#) also analysed reviews and identified the most relevant service attributes. [Tussyadiah and Zach \(2015\)](#) compared hotel and Airbnb reviews using co-occurrence analysis and found that Airbnb reviews focussed more on host hospitality and neighbourhoods characteristics. Finally, [Tussyadiah and Park \(2018\)](#) analysed host descriptions with cluster analysis and identified different types of self-presentation by hosts.

Research focussing on the titles and listing descriptions is very narrow. [Liang et al. \(2020\)](#) found that the length of descriptions have a positive impact on bookings. [Falk et al. \(2019\)](#) focussed on the relationship between price and keywords in the title.

The main contributions of this paper to the literature can be summarised in three points. Firstly, the impact of the COVID-19 pandemic is presented for the hotel industry and Airbnb in a wide sample of European cities. The study not only shows the overall trend but also the various paths in the specific cities. This study constitutes the first effort to estimate the impact of the crisis on the size of Airbnb markets and prices. Secondly, the paper explores the adjustment of hotels and Airbnb to the crisis and provides new evidence on the differences between the business models. Finally, various strategies of Airbnb hosts are

empirically verified based on the analysis of listing titles and descriptions with the use of text-mining methods.

3. Data and methodology

The empirical analysis is based on two data sources: STR and Inside Airbnb. STR (str.com) provides data analytics and insights for the hospitality industry and via the STR Share Center also for research purposes. All variables are available with monthly frequency between January 2018 and September 2020.

Inside Airbnb publishes web-scraped data on Airbnb listings in a large number of cities on a monthly basis. The data sets are publicly available on insideairbnb.com. For each analysed city, datasets for each month were downloaded between April 2018 and September 2020. The limitations of the data are discussed in subsection 3.1.

The analysed variables are summarised in Table 2. For hotels, the standard measures for the hospitality sector (supply, demand, RevPar and ADR) were provided by STR. For Airbnb, these measures were approximated based on the listing-level web-scraped data.

To measure the supply of Airbnb accommodation, the number of active offers was estimated, using the calendar information of listings. We define active offers as those listings which could be booked at least for one night in the following 60 days at the moment of scraping. The analysis was restricted to active listings throughout the analysis.

Next, the average price was calculated for each city and month, based on the nightly price of available listings. To eliminate outlier observations, the top 2% percentile of offers was not taken into consideration. In the remaining analyses, the entire sample was used.

Table 2 Analysed variables

	<i>Description</i> ⁶	<i>Measure</i>
Hotel supply	Number of rooms available multiplied by the number of days	% change by year
Hotel demand	Number of rooms sold	% change by year
Hotel RevPar	Total room revenue in local currency divided by the total number of available rooms	% change by year
Hotel ADR	Average rate paid for rooms sold, calculated by dividing room revenue by rooms sold.	% change by year
Airbnb listings	Number of Airbnb listings on the platform	% change by year
Active listings	Number of offers with at least one night available in next 60 days	% change by year
Average price	Average price per night in local currency for active listings	% change by year
New reviews	Number of new reviews posted for active offers	average per month
Long stays	Active offers for stays of minimum 14 nights	share of active offers
Office	Active offers with the word <i>office</i> or language equivalent in the description or name	share of active offers
Quarantine	Active offers with the word <i>quarantine</i> or language equivalent in the description or name	share of active offers
COVID-19	Active offers with the word <i>covid</i> in the description or name	share of active offers

Table 3 Variables used in the regression analysis

<i>Name</i>	<i>Description</i>	<i>Type</i>
private	private room	dummy
shared	shared room	dummy
review_score	overall guest rating	scale 0-100
review_cleanliness	cleanliness rating	scale 0-10
superhost	superhost status of the host	dummy
2018, 2019	year of observation	dummy
January - November	month of observation	dummy
covid	time period of pandemic	dummy
rev_covid	listing that received a review during the pandemic	dummy

In the absence of information on the number of bookings or revenue, the number of reviews was analysed: the number of new reviews was calculated for every active listing. From these numbers, a monthly average was calculated.

To examine the changes in the strategy of hosts, the name and description of listings was analysed using text-mining methods in Python (variables: “description” and “name”). First, the text was turned lower-case. Using the *langdetect* package⁷, the language of the name and description was identified. The occurrence of the terms *office* and *quarantine* was examined in the title and description. The following languages were taken into consideration: English, German, Spanish, Portuguese, Swedish, French and Italian. As an example, if the language of the summary was German, the corresponding terms were *büro* and *quarantäne* (see Table A2). Finally, also the occurrence of the word *COVID* was identified. The presented figures were prepared with Altair (VanderPlas *et al.*, 2018).

Besides the analysis of descriptive statistics, the determinants of Airbnb prices are examined using panel data regression method. Similarly to Falk *et al.* (2019), we implement the random effects model that enables the inclusion of time-invariant variables, such as the type of the listing or city of location.

The following model is calculated:

$$\ln Y_{i,t} = \alpha_0 + \beta_k X_{k,i,t} + \theta_l D_{l,t} + \lambda covid_t + \iota_n C_n + \epsilon_{i,t} \quad (1)$$

where $\ln Y_{i,t}$ is the logarithm of nightly price for listing i in time t , $X_{k,i,t}$ is a vector with the attributes of listings, $D_{l,t}$ is a set of month and year dummies, $covid_t$ is a dummy variable for the time period of the pandemic, and C_n include dummy variables for the cities. Following the Airbnb hedonic price literature (Gyódi and Nawaro, 2021; Tang *et al.*, 2019; Falk *et al.*, 2019; Wang and Nicolau, 2017), the dependent variable is the logarithm of nightly price. The log-transformation is not only necessary due to the distribution of observations but also facilitates an easier interpretation of the coefficients that represent semi-elasticities (Wang and Nicolau, 2017). As an example, the percentage change of price caused by the pandemic can be calculated as $e^\lambda - 1$.

The used variables are summarised in Table 3. The Airbnb attributes are selected based on the literature (Gyódi and Nawaro, 2021; Wang and Nicolau, 2017; Deboosere *et al.*, 2019; Lawani *et al.*, 2019). Besides the month and year dummies, a dummy variable for each city (except to Paris) is included in the model. The time period of the pandemic (*covid*) is determined based on the start dates of restrictions summarised in Table 1.

Finally, we consider an alternative model specification. While we are able to exclude listings that were not available for booking, a share of the remaining sample is constituted by listings that were not updated for longer periods of time. As the price of these listings remained constant during the pandemic, the actual effect of the crisis may be undervalued in our analysis. For this reason, we also include a dummy variable signalling if a listing received a review during the pandemic. As guests have two weeks to submit a review following their stay, the threshold date follows the *COVID* dummy by 14 days. We will test if the prices of listings that were actually booked during the pandemic differ from the rest of the sample. Moreover, using an interaction with *COVID*, we will identify whether the impact of the crisis was different for this group.

3.1 Data limitations

The main limitation of Airbnb data is the lack of insights on the number of bookings. This prevents us from the precise calculation of revenue and the estimation of demand. Zervas *et al.* (2017) argued that review data can be used to identify active listings. We will implement this approach in the regression analysis to control for offers that were active during the pandemic. We will also use the review numbers to track the fluctuation of

demand. While this approach is not perfect, as it assumes that the share of travellers leaving a review is steady over time, the literature provides relevant examples to approximate booking numbers based on reviews (Chen *et al.*, 2020).

A further limitation is related to missing data. Data from Inside Airbnb is incomplete for July 2020; therefore, this month is not included in the analysis. Additionally, listings across cities were not scraped at the same time that can cause discrepancies in the comparability of values between cities. Similarly, the data suggests that the data collection process took several days for each city and these periods can differ between the analysed years. More details on missing Airbnb data and dates of scraping are included in Table A1.

In the case of hotel data, there are some missing observations for the analysis of the specific hotel classes for a number of cities (Venice – Economy, Lisbon – Economy, Luxury and Paris – Economy).

4. Results

4.1 Hotel industry

The hotel industry has been gradually growing before the pandemic, with around 2% annual increase of supply. The statistics for March do not show the signs of the pandemic, despite the introduction of strict restrictions for the hospitality sector (Table 1). This may be explained by the data reporting guidelines of STR for temporary hotel closures.⁸

April reveals the impact of lockdowns: on average, hotel room supply decreased by 40% relative to 2019 (Figure 2). Hotels reopened during the summer months, and by September there were only around 7% less rooms supplied than a year ago. The changes in the number of rooms significantly differed across the analysed cities: while in Amsterdam and Berlin supply returned to the 2019 levels (in Amsterdam it even grew), in Barcelona and London it remained around 15% lower.

Demand already started to fall in February (Figure 3). By March, demand has decreased in all cities by at least 50% relative to previous year (most in Milan and Venice), reaching 90% lower levels in April. While the vast majority of hotels were back in business by the summer, demand did not follow this trend: on average, 70% less rooms were sold.

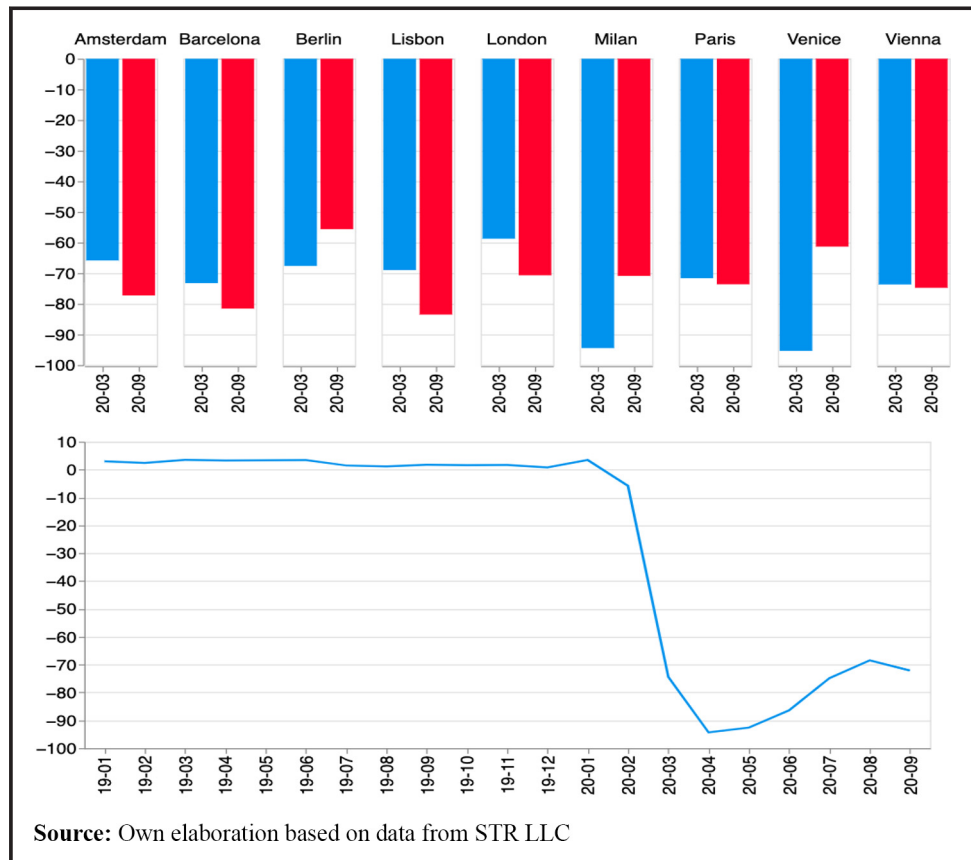
Changes in RevPar followed the collapse of demand. The hospitality sector came to a complete halt in April, with revenues falling by more than 90% in all of the analysed cities. As expected, revenues remained by more than 70% lower during the summer as well. The statistics are presented in the Appendix (Figure A1).

Based on changes in ADR, hotels tried to attract tourists by substantially decreasing price (Figure 4). In March, rates dropped on average by 11%, in April by 41% and in May by 51% relative to 2019. With the slight increase of demand during the summer, prices also rose, although still remained 20% below the 2019 values.

Finally, we examine the average changes across different hotel classes in the analysed cities. Figure 5 shows the changes in supply, while Figure 6 presents the changes in ADR with division for different hotel classes. The data shows that room supplies returned to the pre-pandemic levels only in the economy class, whereas a greater share of hotels remained closed in the luxury and upper midscale segments. In the case of prices, the smallest changes were recorded in case of luxury hotels, while the remaining segments all heavily dropped rates, with no significant differences between economy and premium classes.

To conclude, the situation of the hotel industry has become dramatic by April in all cities, with virtually no demand for hospitality services. Hotels were forced to cut supply and significantly decrease prices. While the sector reopened for the holiday season, demand remained at a significantly lower level.

Figure 3 Hotel demand: percentage change from same month previous year (below: average across cities)



4.2 Airbnb

Airbnb was on a dynamic growth path with a rising number of active listings prior the pandemic (Figure 7). Even in March 2020, on average 8% more active offers were available in the analysed cities, although the decline of offers already began in Milan and Venice. However, data for April shows that the crisis became visible also in the remaining cities, and by August the size of the market had shrunk on average by almost 17%. The greatest falls occurred in Lisbon, London and Amsterdam, where around one fourth of active listings were withdrawn from the platform. The only city where the size of the market did not fall relative to the previous year was Paris.

In the absence of information on the actual bookings, the number of reviews is used as a proxy to analyse changes in demand. Figure A2 in the Appendix presents the average number of new reviews across time. Prior to the pandemic, active listings received 1.4–2.3 reviews per month. In March, this value dropped to 1.17, whereas by May there were virtually no new reviews. The second half of summer marked a temporary rise in travelling, as the numbers of new reviews rose again although to a level around 50% lower than in 2019 (1.14 in September 2020 vs 2.07 in September 2019).

Unlike hotels, Airbnb hosts did not decrease prices immediately: the rates for accommodation had been above the 2019 levels until the summer (Figure 8). By September, however, prices had dropped on average by around 9%. Similarly to hotels,

Figure 4 Hotel ADR: percentage change from same month previous year (below: average across cities)

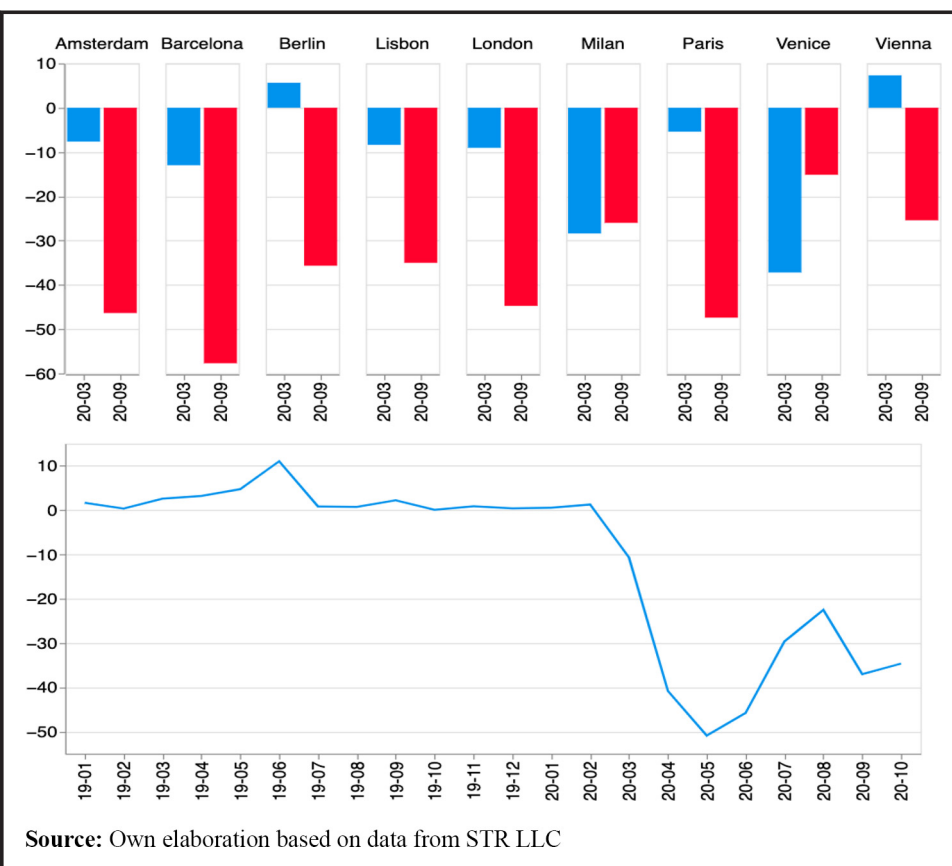


Figure 5 Hotel supply: percentage change from same month previous year across various hotel classes

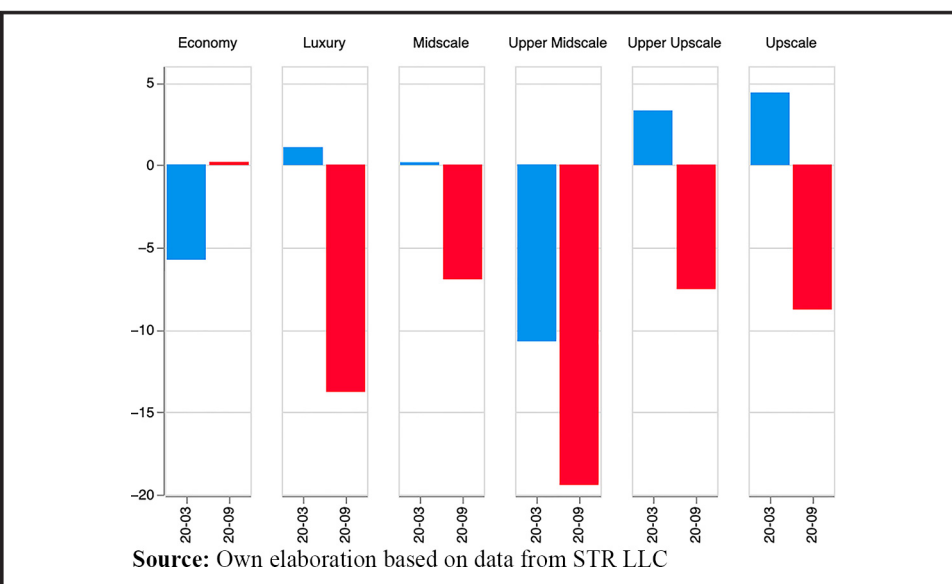
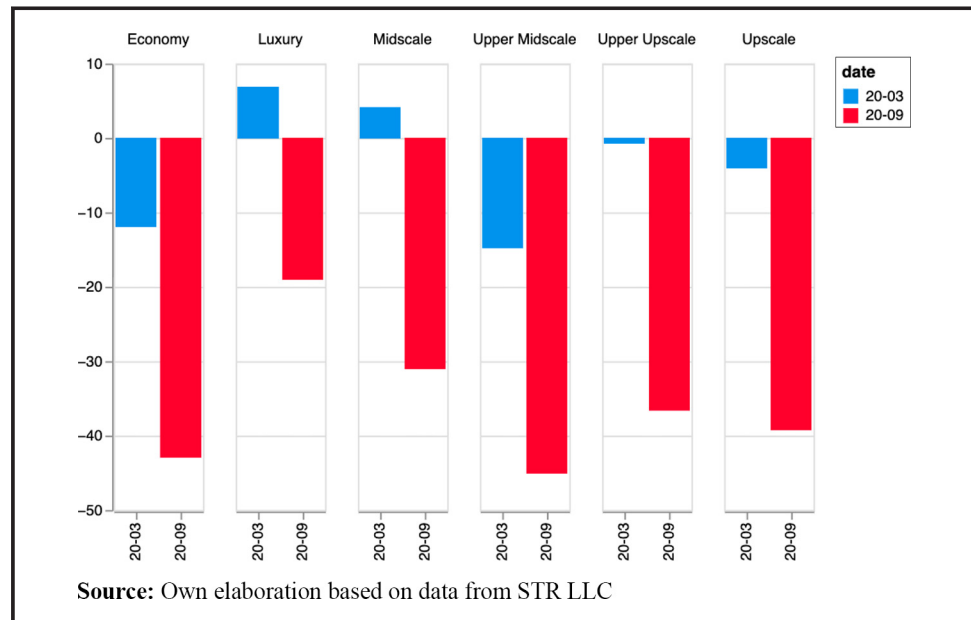


Figure 6 Hotel ADR: percentage change from same month previous year across various hotel classes



prices decreased the most in Barcelona (more than 25%). On the other hand, prices remained at the 2019 level in Berlin.

To conclude, Airbnb hosts faced the same collapse of demand as hotels. A greater share of listings became inactive than in the case of hotels, suggesting a greater elasticity of supply. In addition, the overall change in price has been significantly lower than in the case of hotels.

4.3 Airbnb prices: regression analysis

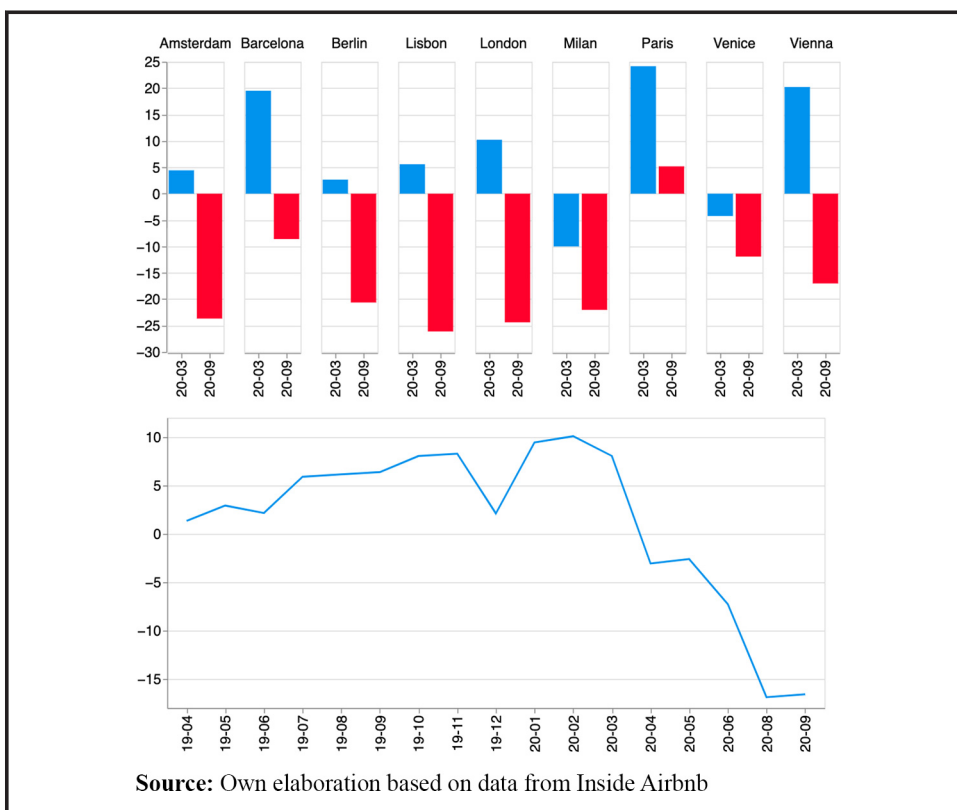
To investigate deeper the changes in price, a panel data regression analysis is prepared. Using the random effects model, we can control for the attributes of individual listings and isolate the impact of the pandemic from other effects.

The results (Table 4) support that various size and quality attributes of listings have a statistically significant impact on price. Listings with more space and better ratings have been more expensive, as well as listings offered by superhosts.

The city dummies reveal significant price differences between the various cities (Table A3). Relative to Paris, most cities are significantly cheaper (Berlin is the cheapest, with on average 33% lower prices), only Amsterdam is even more expensive (by 58%).

While these results provide new insights for the hedonic price literature, the most important aspect of this exercise is to identify the effect of the pandemic on prices. Firstly, the year dummies support our previous findings on the upward trend prior the crisis: prices on average had been lower by 2.6% in 2019 and 5% in 2018 relative to 2020. Secondly, the dummy variables for the specific months reveal which months had been more expensive relative to December (October, November and June). Most importantly, *COVID* is significant and shows that prices had been lower by 4.4% during the pandemic. Therefore,

Figure 7 Number of active Airbnb listings: percentage change from same month previous year (below: average across cities)



controlling for the listing attributes and specific time of the year, hosts on average decreased prices by such amount.

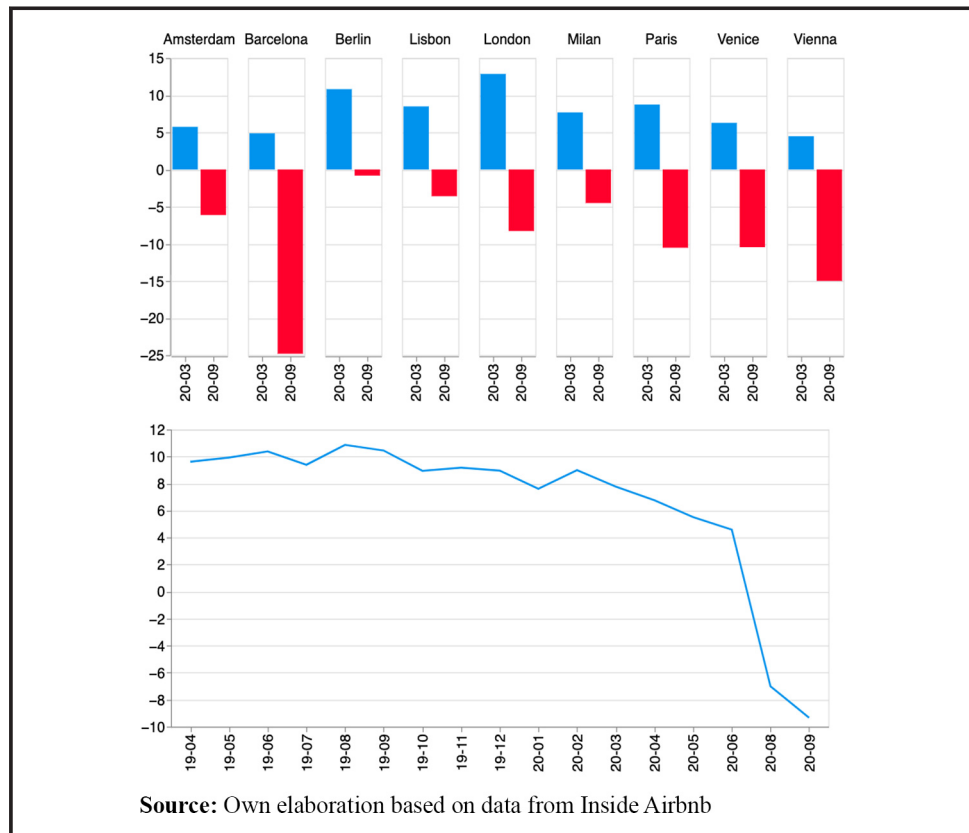
However, this result may underestimate the decrease of price in case of listings that were actually booked during the pandemic. The analysed sample includes listings that were available but remained unadjusted on the platform. To account for this heterogeneity, we include *rev_covid* for listings that received new reviews during the pandemic and an interaction with *covid* as well. Therefore, we can evaluate to what extent the price was adjusted for listings that were booked following the introduction of restrictions. The coefficient *rev_covid* is significant and positive: on average, these offers were 5.9% more expensive than the remaining sample. The coefficients for *covid* and its interaction with *rev_covid* show an interesting scenario: while prices decreased in the entire sample by 2.4%, in case of the reviewed listings, this decrease of price was greater – 7%. This suggests that hosts serving guests had to decrease prices by a greater extent than the overall population of offers. However, this discount is still significantly lower than the levels observed for the traditional hotel industry.

To summarise, the regression analysis supports that prices decreased during the pandemic. However, the decrease of price had been significantly less than in the case of the hotel industry, even in the case of listings that were actually booked during the pandemic.

4.4 Changing characteristics of Airbnb listings during COVID-19

Unlike hotels, Airbnb hosts can pivot from short-term accommodation provision during low demand periods. The previous results showed that a significant share of Airbnb hosts

Figure 8 Airbnb average price: percentage change from same month previous year (below: average across cities)



stopped accepting new bookings during the pandemic. This supports that an increasing number of listings returned to the long-term rental market.

On the other hand, the hosts that remained on the platform could also adjust their services to the changing circumstances. The fact that hosts decreased prices to a much lower extent than hotels suggests that hosts could offer new value propositions for guests.

New use-cases may include the rental of second homes for local residents, who are in need of flats for distant work or self-isolation. The length of such stays should be longer than the usual short-term trips but shorter than a long-term lease.

Therefore, we should see an increase in the share of Airbnb listings offered for longer time periods. The data supports that such process was taking place: before the pandemic, the average share of active offers with minimum 14 night stays had been between 5% and 6% and has increased to 7% by April and around 8% by May. The share of such offers remained at a similar level during the summer months. Between March and September, the share of such offers has risen in all of the analysed cities, the most in Barcelona (Figure 9).

Secondly, we examine the summary information of Airbnb listings. Firstly, we verify if the share of Airbnb listings advertised for home-office increased (Figure 10). The average share of offers with the word *office* (in the language corresponding to that of the description and title) has been fairly constant around 2% level in the analysed cities until June 2020. The data suggests that the share of such offers did not increase during the pandemic. In fact, the role of such listings had slightly decreased in most of the analysed cities.

Table 4 Results of the random effects panel data regression

	Dependent variable: <i>log_price</i>	
	(1)	(2)
private	−0.246*** (0.001)	−0.246*** (0.001)
shared	−0.371*** (0.003)	−0.370*** (0.003)
superhost	0.004*** (0.0004)	0.005*** (0.0004)
review_score	0.00002 (0.00004)	0.00005 (0.00004)
review_cleanliness	0.006*** (0.0003)	0.006*** (0.0003)
covid	−0.045*** (0.001)	−0.024*** (0.001)
rev_covid		0.057*** (0.003)
covid:rev_covid		−0.073*** (0.001)
2019	−0.026*** (0.0004)	−0.026*** (0.0004)
2018	−0.052*** (0.001)	−0.053*** (0.001)
Constant	4.495*** (0.004)	4.490*** (0.004)
Observations	3,615,800	3,615,800
R ²	0.537	0.538
Adjusted R ²	0.537	0.538
F Statistic	4,174,265.000***	4,207,295.000***

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Thirdly, the number of listings mentioning *covid* or *quarantine* is identified with the same methodology. Figure 11 reveals that a growing number of listings included the term “covid” although their average share did not exceed 2%. Finally, the number of listings that included the term “quarantine” remained insignificant during the pandemic (Figure A3 in the Appendix).

To conclude, the results do not indicate significant changes in the characteristics of Airbnb offers. An increase in the role of longer stays was observed; however, the analysis of descriptions do not support that hosts modify their listings on a major scale during the COVID-19 crisis.

5. Conclusions

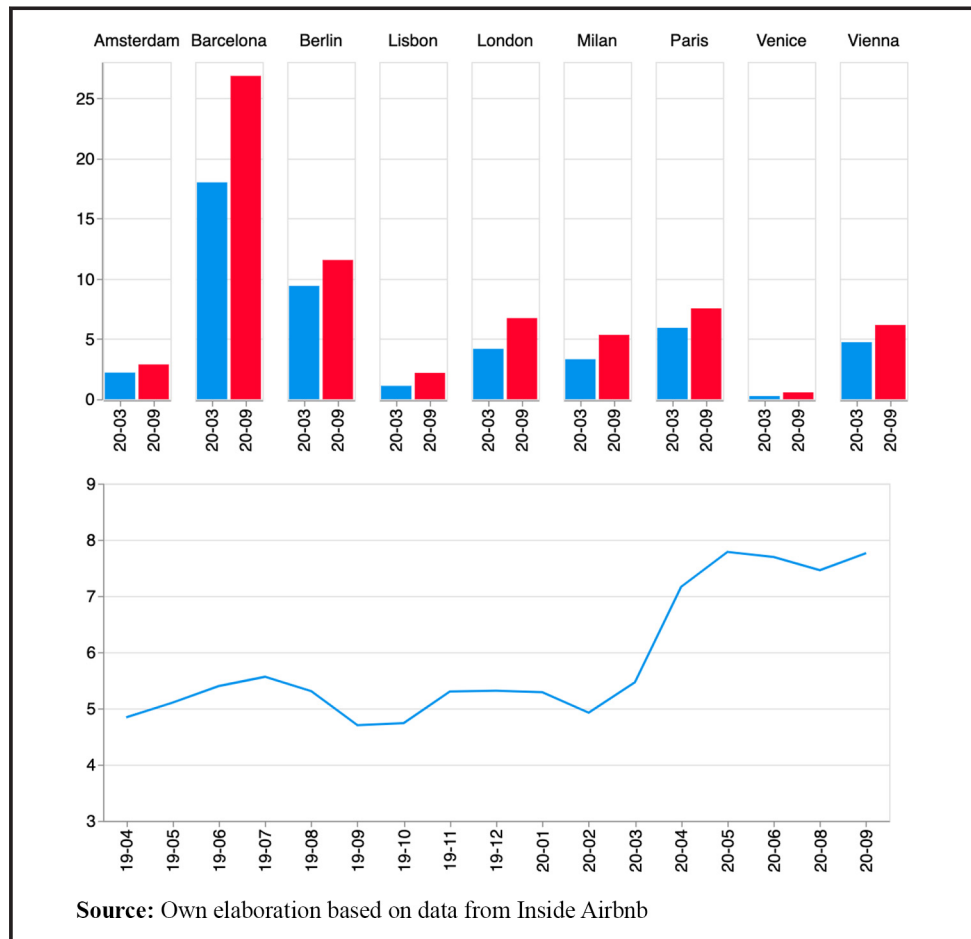
5.1 Key insights

The empirical analysis revealed the dramatic impact of the pandemic on both the traditional hotel industry and Airbnb in nine major European cities. Between March and May 2020, there was virtually no demand for accommodation, whereas the summer peak period also brought only minor improvement.

The results presented significant differences between the hotel industry and Airbnb. While hotels were initially forced to close due to restrictions, they had been reopened during the summer, and by September hotel supply returned to a level close to the pre-pandemic levels. Moreover, hotels aggressively cut prices throughout the pandemic that remained 20%–40% lower during the summer peak period as well. This trend was not only visible in the economy segment but also among upscale hotels.

In the case of Airbnb, listing numbers and prices were on a downward trend, with most of the decline occurring during the summer months. This may suggest that hosts were not forced to react immediately to the pandemic, but waited for the developments on the market. The significant decline of active listing numbers at the end of the observed time period supports our hypothesis that Airbnb supply is more flexible than that of hotels. In numerous cities listing numbers decreased by more than 20% relative to 2019 which may indicate that a large share of Airbnb hosts pivoted from short-term accommodation provision.

Figure 9 Share of Airbnb listings with minimum two week stays (below: average across cities)

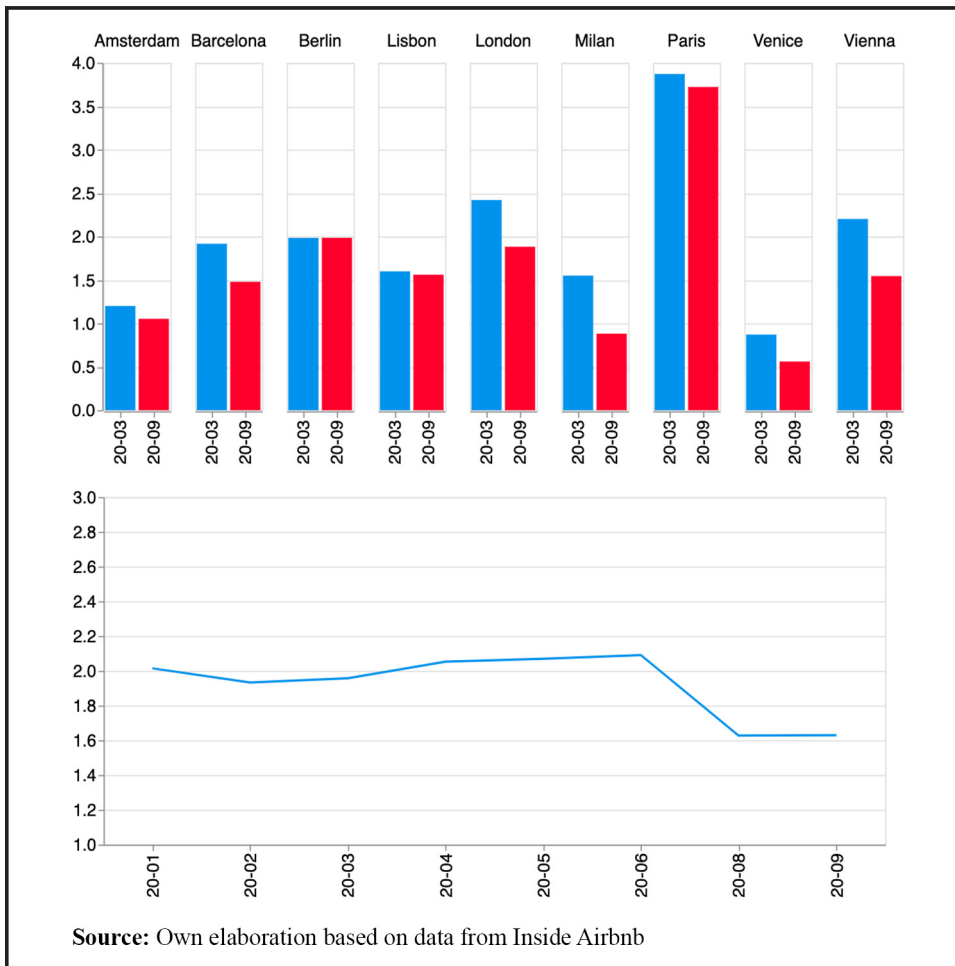


As expected, the price reaction of Airbnb hosts had been significantly lower than in the case of hotels. On average, prices declined by 9% year-to-year. The panel data regression analysis suggests that the pandemic reduced prices by 4.4%, whereas in case of listings that were reviewed during the pandemic the price decline was slightly higher – 7%. These results support that Airbnb hosts did not have to provide services at lower price points and could use their property for other purposes than short-term accommodation. In the absence of huge entry costs and other fixed costs, hosts can easily switch from serving tourists to making use of their property in other ways, such as renting it for local residents on the long-term rental market.

The analysis also investigated possible strategies of Airbnb hosts that remained active on the platform. The results suggest that a possible strategy of Airbnb hosts was to focus on longer stays. The share of offers with a minimum two week rental period increased in all of the cities. However, the text-mining analysis of descriptions did not support a robust emergence of such use-cases as renting homes for home-office or self-isolation in the examined time period.

The results support the necessity of financial help for the traditional hospitality sector to preserve workplaces. The data suggests that hotels across all segments adopted strong measures to stay in business, significantly decreasing profit margins. In the case of Airbnb hosts, such public support is not justified, as they can earn income based on their property without tourists as well.

Figure 10 Share of Airbnb listings that include the word office in the name or description



The analysis also provides insights for cities and urban planners. The current crisis provides an opportunity to review existing regulations and shift short-term home rental to a more sustainable path. During the current period of low demand, it may be easier to create incentives for professional hosts to rent their property on a long-term basis for local residents and to implement limits on the number of short-term offers.

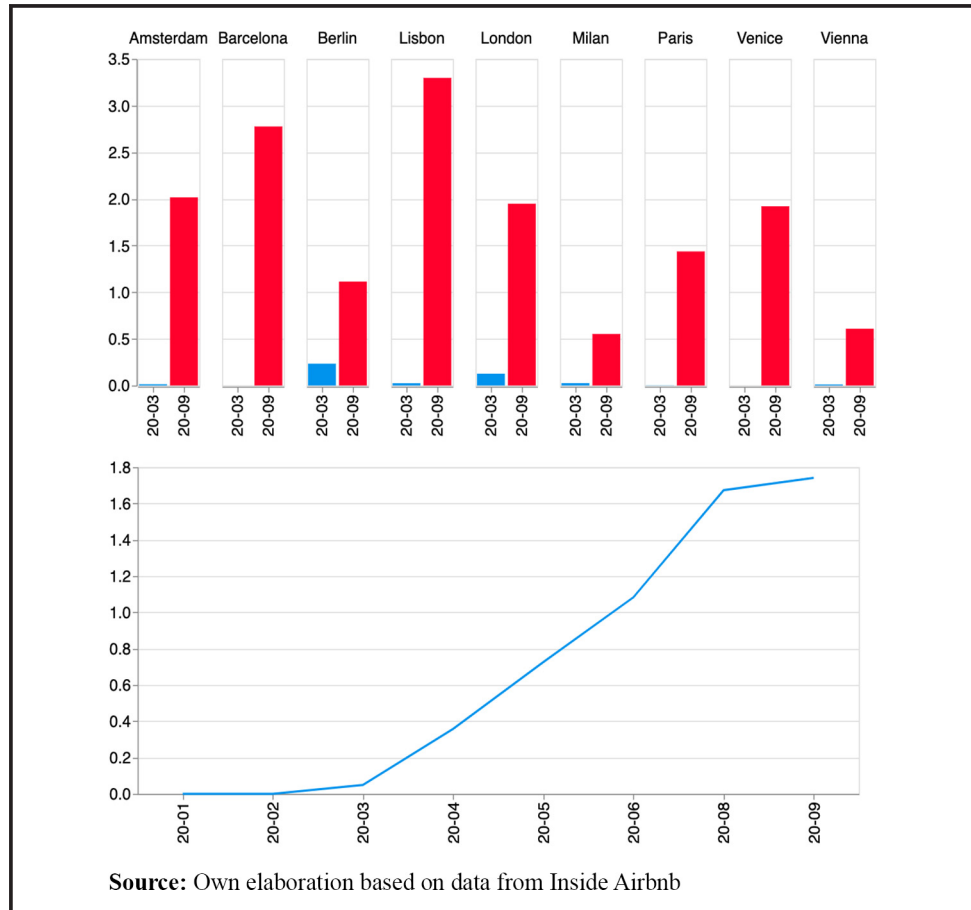
5.2 Limitations and further research

An important limitation of the study stems from the lack of information on actual Airbnb bookings. Therefore, the presented estimations based on the review numbers provided only an approximation of the changes in the demand for Airbnb. Similarly, the price indices for Airbnb did not contain information on bookings, whereas hotel ADR was calculated from sold rooms.

A further difficulty is related to the calculation of Airbnb supply. While the scraped data showed which listings were available for booking, in practice a share of these offers may have been inactive and not accept guests. These data limitations make the comparisons between Airbnb and hotels less accurate.

The analysis also provides insights on novel research gaps. As an example, the results showed significant differences between the analysed cities in key metrics, such as changes

Figure 11 Share of Airbnb listings that include the word covid in the name or description



in hotel supply. Future research could explore these divergent measures and evaluate which cities managed the crisis more effectively. Moreover, next efforts could analyse the different strategies of hotels in greater detail and analyse the main drivers of hotel performance during the pandemic.

The analysis highlights new research areas for Airbnb as well. An interesting research topic is the identification of hosts that were successful in managing the pandemic and the exploration of their strategies. In addition, new research could evaluate the overall changes in the characteristics of the Airbnb market and examine the differences between listings that remained on the market and the ones that were withdrawn.

Notes

1. Eurostat: Culture and tourism - cities and greater cities
2. Based on data from Inside Airbnb
3. 2014
4. Visits by international visitors, data from data.london.gov.uk
5. 2014
6. Hotel variable description from STR Glossary, available at: <https://str.com/data-insights/resources/glossary>

7. Available at: <https://pypi.org/project/langdetect/>
8. Available at: <https://str.com/sites/default/files/STR-COVID-19-FAQs-Updated-7-October-2020.pdf>
9. Date with the highest number of scraped listings

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Appendix 1 Dataset and Methods

Table A1 Date of scraping in September 2020 and missing data

<i>City</i>	<i>Date of Scraping in September 2020 and 2019⁹</i>	<i>Missing month</i>
Amsterdam	2020-09-09, 2019-09-14	07.2020
Barcelona	2020-09-13, 2019-09-17	07.2020
Berlin	2020-09-24, 2019-09-19	07.2020
Lisbon	2020-09-24, 2019-09-27	06.2018, 07.2020
London	2020-09-17, 2019-09-15	06.2018, 07.2020
Milan	2020-09-25, 2019-09-20	07.2020
Paris	2020-09-12, 2019-09-17	07.2020
Venice	2020-09-09, 2019-09-17	07.2020
Vienna	2020-09-15, 2019-09-21	07.2020

Table A2 Terms searched in name/description by language

<i>English</i>	<i>Office</i>	<i>Quarantine</i>
Dutch	Bureau	Quarantaine
French	Bureau	Quarantaine
German	Büro	Quarantäne
Italian	Ufficio	Quarantena
Portuguese	Escritório	Quarentena
Spanish	Oficina	Cuarentena
Swedish	Kontor	Karantän

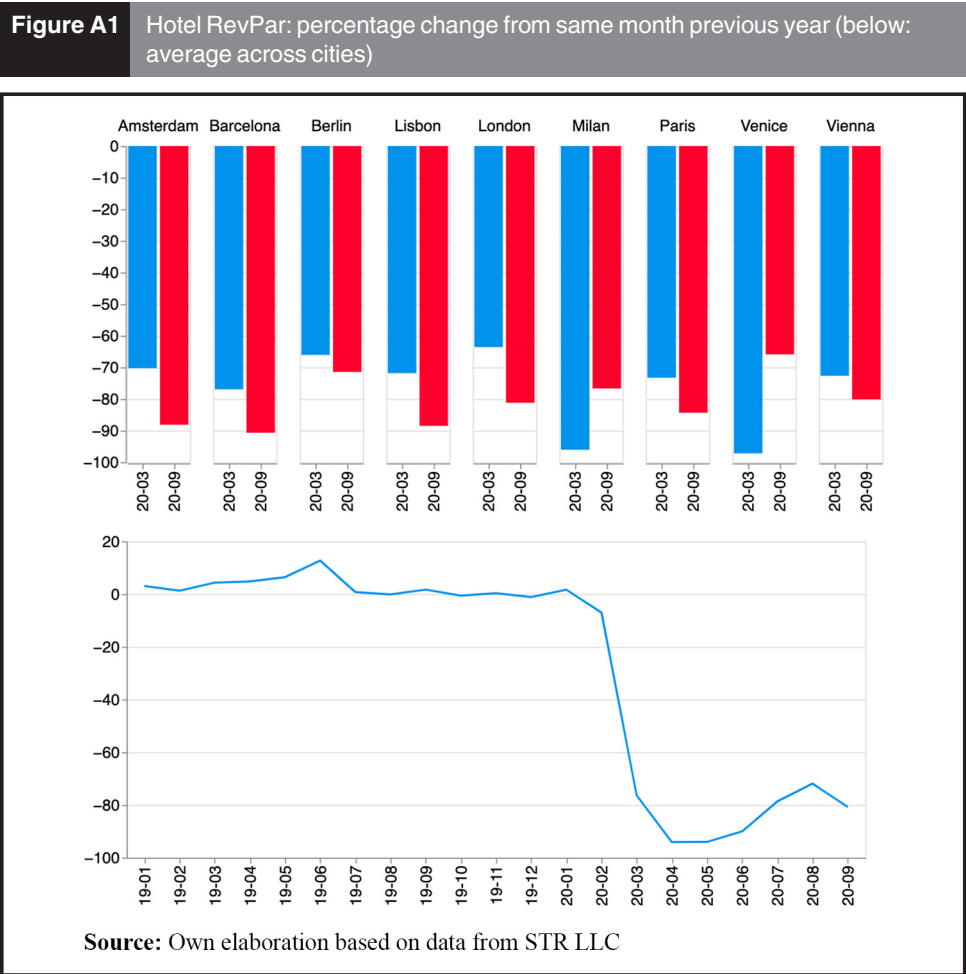
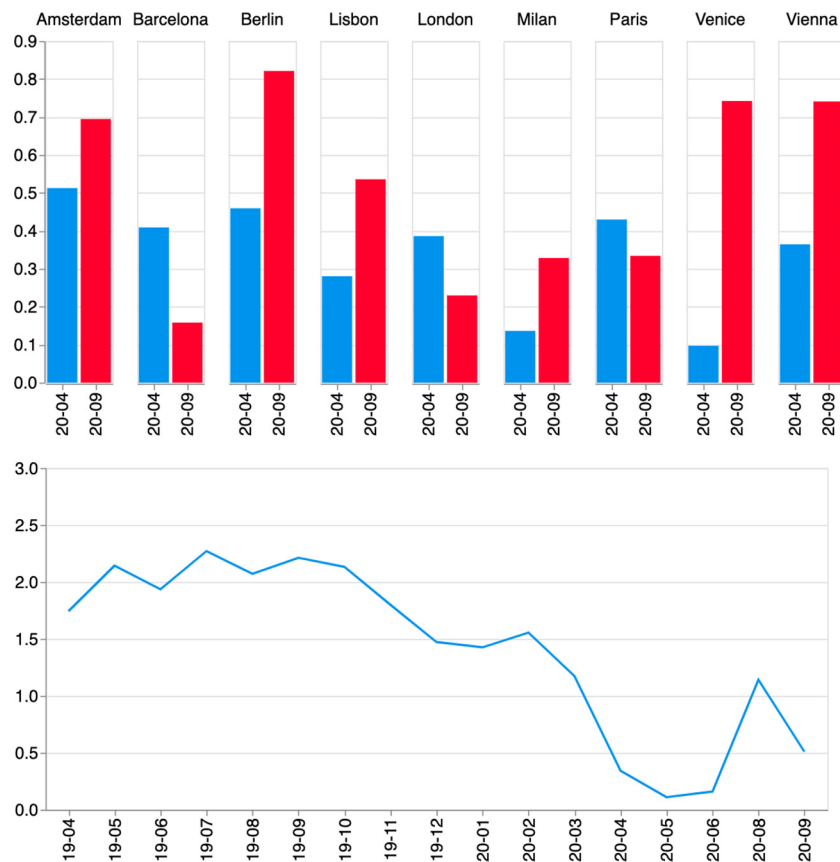


Table A3 Results of the random effects panel data regression: city and month dummies

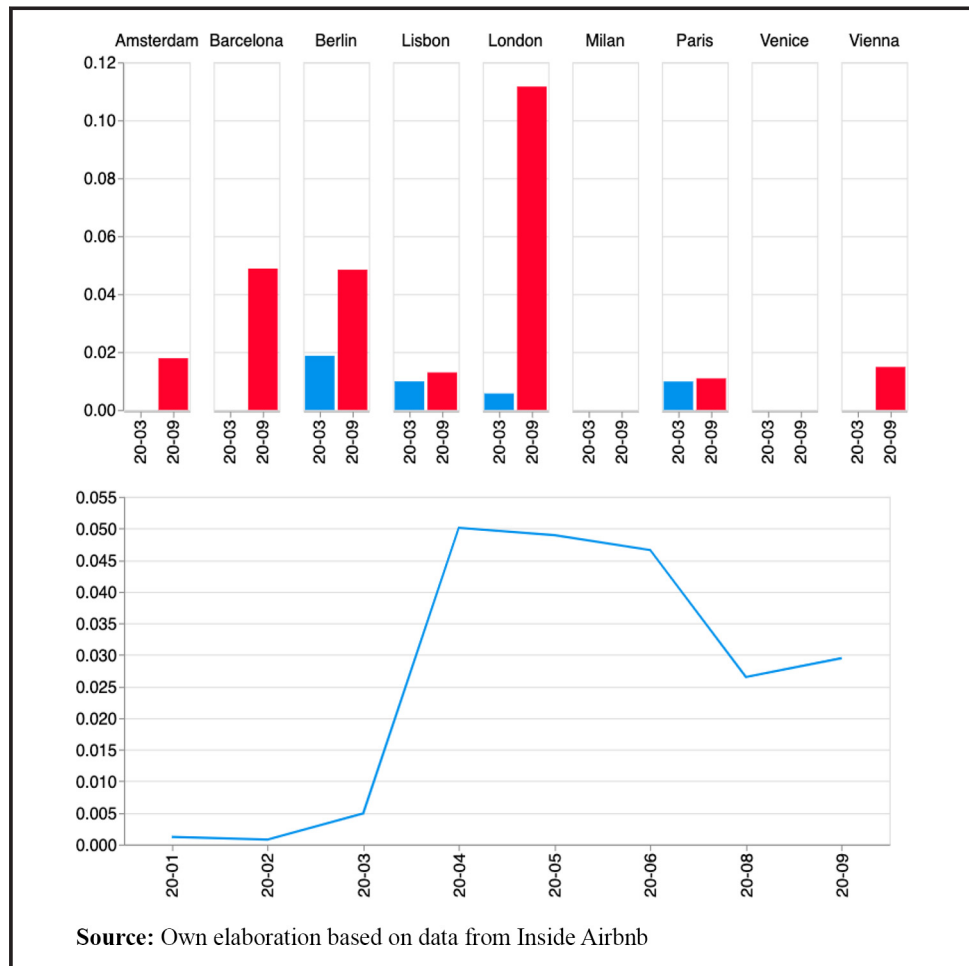
	Dependent variable <i>log_price</i>	
	(1)	(2)
Amsterdam	0.460*** (0.004)	0.460*** (0.004)
Barcelona	-0.239** (0.004)	-0.240** (0.004)
Berlin	-0.406*** (0.004)	-0.408*** (0.004)
Lisbon	-0.294*** (0.004)	-0.299*** (0.004)
London	0.003 (0.003)	0.004 (0.003)
Milan	-0.139*** (0.004)	-0.140*** (0.004)
Venice	0.176*** (0.006)	0.170*** (0.006)
Vienna	-0.366*** (0.005)	-0.370*** (0.005)
January	-0.026*** (0.001)	-0.026*** (0.001)
February	-0.023*** (0.001)	-0.023*** (0.001)
March	-0.005*** (0.001)	-0.005*** (0.0005)
April	-0.004*** (0.0005)	-0.004*** (0.0005)
May	-0.001** (0.0005)	-0.002*** (0.0004)
June	0.004*** (0.0005)	0.003*** (0.0005)
July	-0.002*** (0.0005)	-0.002*** (0.0005)
August	-0.020*** (0.0004)	-0.020*** (0.0004)
September	-0.021*** (0.0004)	-0.020*** (0.0004)
October	0.003*** (0.0005)	0.003*** (0.0005)
November	0.001** (0.0005)	0.001** (0.0005)
Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$		

Figure A2 Average number of new Airbnb reviews (below: average across cities)



Source: Own elaboration based on data from Inside Airbnb

Figure A3 Share of Airbnb listings that include the word quarantine in the name or description



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