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Gyódi, Kristóf

University of Warsaw

12 August 2021

Online at <https://mpra.ub.uni-muenchen.de/109333/>  
MPRA Paper No. 109333, posted 25 Aug 2021 04:34 UTC

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

Kristóf Gyódi<sup>1,\*</sup>

*University of Warsaw, Faculty of Economic Sciences  
Długa 44/50, 00-241, Warsaw, Poland*

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### Abstract

**Purpose:** The aim of this article is to examine the impact of the COVID-19 pandemic on the traditional hotel industry and Airbnb in 9 major European cities. We examine differences between the two business models and analyse various strategies of Airbnb hosts to cope with the crisis.

**Methodology:** A detailed empirical analysis is presented based on data from STR and Inside Airbnb for the period January 2018-September 2020. In order to assess the impact of the pandemic on the hotel industry, year-to-year changes in various performance metrics are presented. We also investigate the impact of the pandemic on Airbnb prices using 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 suggests that a significant share of hosts pivoted from short-term accommodation provision and utilized 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:** The article presents the impact of the pandemic on the hospitality sector in a wide sample of European cities, explores the adjustment

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\*Corresponding author

*Email address:* [kgyodi@wne.uw.edu.pl](mailto:kgyodi@wne.uw.edu.pl) (Kristóf Gyódi)

of hotels and Airbnb, and provides new evidence on the differences between the business models.

*Keywords:*

Airbnb, Tourism, COVID, Text-mining

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### **Acknowledgements**

This research was supported by National Science Centre, Poland: Project number 2017/27/N/HS4/00951. I wish to express gratitude for the helpful comments to Prof. dr hab. Katarzyna Śledziwska and my colleagues at DELab, especially: Łukasz Nawaro, Joanna Mazur and Michał Paliński. I would like to also thank the help of Duane Vinson and the STR Share Center. I am also grateful to Märtha Andersen for comments and suggestions.

### **Declaration of interest**

Declarations of interest: none.

## 1. Introduction

1 The ongoing COVID-19 pandemic has profound economic and social im-  
2 pact worldwide. Following the outbreak of the novel coronavirus in China,  
3 various European countries became the next hotspot areas in March 2020.  
4 Social distancing and lockdowns disrupted most economic activities, includ-  
5 ing the services sector. According to Eurocontrol (2020), flight numbers  
6 decreased by 88% in April relative to last year. Tourism also came to an al-  
7 most complete halt in Europe: occupancy in hotels decreased by 85% in April  
8 year-to-year, despite significant drops in hotel prices (STR, 2020). Similarly  
9 to the traditional hotel industry, the short-term home rental market was also  
10 significantly affected, with occupancy rates of Airbnb falling strongly below  
11 the levels of 2019 (AirDNA, 2020).

12 Without international travel, neither traditional hotels nor Airbnb hosts  
13 could operate within the previous rules of the game. However, there are signi-  
14 ficant differences between traditional hotels and short-term accommodation  
15 provision via Airbnb. Listings on Airbnb are based on the housing stock,  
16 therefore anyone can provide services with available property. In the absence  
17 of high entry costs, Airbnb hosts can decide whether to serve guests based  
18 on the current market prices and the marginal cost of providing service. On  
19 the other hand, hotels need to pay high entry costs that include the con-  
20 struction of the hotel and the hiring of staff. Therefore, unlike Airbnb hosts,  
21 hotels have a fixed capacity that cannot be expanded during periods of high-  
22 demand, and that is offered for guests during off-peak periods as well. This  
23 means Airbnb supply is more flexible and can better react to the fluctuation  
24 of demand (Einav et al., 2016). Farronato and Fradkin (2018) had confirmed  
25 that the supply elasticity of Airbnb is significantly greater than in the case  
26 of hotels, meaning that a share of Airbnb hosts serve guests only in case of  
27 higher prices and stop providing services below certain price levels. Zervas  
28 et al. (2017) also found that the supply of Airbnb listings increases during  
29 high demand periods.

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

- 33 1. To examine the impact of the pandemic on the traditional hotel in-  
34 dustry and short-term home rental.
- 35 2. To verify the different strategies of Airbnb hosts to cope with the crisis.

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

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

56 These research questions have a significant policy relevance. First, tour-  
57 ism is a major contributor of jobs in the EU, heavily relying on workers that  
58 are often younger, low-skilled or have a migrant background (European Com-  
59 mission, 2020). A better understanding on the developments in the tradi-  
60 tional hotel industry supports the planning of adequate measures to preserve  
61 these workplaces. Second, prior to the pandemic, Airbnb was on a strong  
62 growth trajectory, affecting neighbourhoods and local communities (Sher-  
63 wood, 2019). With a rising share of housing supply devoted to tourists, rents  
64 and house prices have been on the rise (Horn and Merante, 2017; Garcia-  
65 López et al., 2019). An increasing number of cities implemented regulations  
66 to mitigate the negative effects of short-term home rentals (Nieuwland and  
67 van Melik, 2020). The exploration of changes in Airbnb services provides  
68 insights for urban planners in creating strategies for home-sharing in the  
69 post-COVID world.

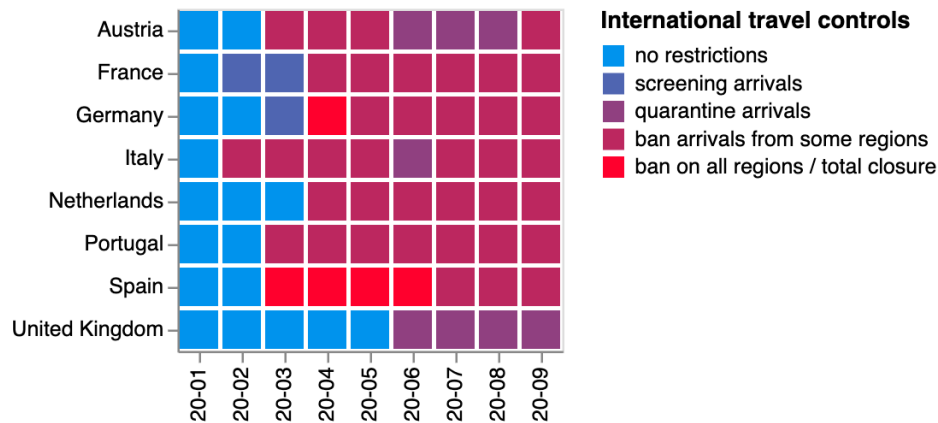
70 To reach our research goals, a detailed empirical analysis is presented  
71 based on data from STR and Inside Airbnb. 9 major EU cities were selected,  
72 based on the number of tourist nights and number of Airbnb listings. While  
73 Rome and Prague are among the most visited historic cities, they were not

74 included in the analysis due to data limitations for Airbnb.

Table 1: Analysed Cities

City	Number of tourist nights in 2017 (mln) <sup>1</sup>	Number of active Airbnb listings in 01.2020 <sup>2</sup>	Start date for Covid-19 Restrictions for the hospitality sector
Amsterdam	12.5 <sup>3</sup>	7538	15.03
Barcelona	20.4	15688	14.03
Berlin	31.2	10796	14.03
Lisbon	12.5	20187	18.03
London	114 <sup>4</sup>	51336	24.03
Milan	11.9	12623	8.03
Paris	63	28129	15.03
Venice	11.7	7661	8.03
Vienna	13.4 <sup>5</sup>	8680	14.03

Figure 1: Restrictions on international travel in time period 01.2020-09.2020



Source: Own elaboration based on data from Oxford COVID-19 Government Response Tracker, Blavatnik School of Government.

<sup>1</sup>Eurostat: Culture and tourism - cities and greater cities

<sup>2</sup>Based on data from Inside Airbnb

<sup>3</sup>2014

<sup>4</sup>visits by international visitors, data from data.london.gov.uk

<sup>5</sup>2014

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

80 North-Italian cities were the epicenter of the pandemic in Europe, with  
81 the whole region put into quarantine with very strict social distancing regime  
82 from the beginning of March (BBC News, 2020). Extraordinary measures  
83 were introduced a week later in Amsterdam (Government of the Netherlands,  
84 2020), Barcelona (Jones and Burgen, 2020), Lisbon (Visit Portugal, 2020),  
85 Paris (Bergo, 2020) and Vienna (DW, 2020a), controlling borders and lim-  
86 iting the functioning of restaurants and hotels. In London, restrictions were  
87 avoided longer, however, at the end of March a stricter regime was intro-  
88 duced (GOV UK, 2020). During the summer months, the tourism sector was  
89 gradually reopened across Europe (DW, 2020b). However, free movement  
90 was not entirely restored, with quarantine requirements and bans on certain  
91 regions.

92 In order to assess the impact of the pandemic on the hotel industry, year-  
93 to-year changes in various metrics are presented, including supply, demand,  
94 ADR (average daily rate) and RevPar (revenue per available room). While  
95 data on hotels enable us to calculate changes in performance variables, the  
96 analysis of web-scraped Airbnb data is more challenging. On one hand, the  
97 number of bookings is unknown and the identification of booked listings is  
98 imprecise. On the other hand, however, a dataset of monthly observations on  
99 each listing enables a deeper exploration of changes in Airbnb accommodation  
100 provision. First, we estimate changes in supply and prices based on listing  
101 level data. Second, we provide more insights on the price changes of Airbnb  
102 listings using hedonic price regressions. Based on panel data analysis, the  
103 effect of the pandemic is isolated from other variables, such as seasonal price  
104 effects and listing attributes. Finally, to analyse the strategy of Airbnb hosts,  
105 the description of listings is examined with text-mining methods. The title  
106 and description of listings is processed in Python to identify changes and the  
107 occurrence of various keywords.

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

## 111 2. Literature review

112 The hospitality management literature already includes first articles on  
113 the impact of COVID-19 on tourism. Gössling et al. (2021) provided an over-  
114 view of the forecasted effects of the pandemic based on reports and analyses  
115 by various tourism organisations. The authors concluded that the pandemic  
116 serves as an opportunity to review the current growth-based tourism strategy  
117 in favour of one that is more oriented towards sustainable development. Hu  
118 and Lee (2020) analysed the initial phase of the pandemic in 97 Airbnb mar-  
119 kets using Inside Airbnb datasets. Similarly to this analysis, the authors  
120 analysed changes in the review numbers to proxy the number of bookings.  
121 The analysis presented the impact of the initial lockdown in Wuhan, as well  
122 as the the effect of local lockdown measures. Boros et al. (2020) also used In-  
123 side Airbnb data and analysed changes in the calendar information of Airbnb  
124 listings in various major cities in the first phase of the pandemic. The au-  
125 thors concluded that while the number of bookings significantly decreased  
126 in all cities, the dynamics of changes were shaped by local characteristics  
127 and the number of COVID-19 cases. Hossain (2021) summarised the im-  
128 plications of the crisis for sharing economy platforms based on the analysis  
129 of media coverage. In the case of Airbnb, the main challenges were related  
130 to the financial situation of hosts, the reimbursement for cancelled bookings  
131 and the responsibility of the platform in managing the crisis. According to  
132 the observations of the author, the strategy of Airbnb to overcome the crisis  
133 included a greater emphasis of longer stays and the reduction of hotel-style  
134 listings.

135 While knowledge on the economic impact of the ongoing pandemic is  
136 limited due to data constraints, the effects of previous health crises are well  
137 documented. Kuo et al. (2008) analysed the impact of SARS and Avian Flu  
138 on tourism demand in Asian countries and report an average of 40% reduction  
139 of arrivals after every identified case. Zeng et al. (2005) summarised the  
140 effects of SARS for China and report a 35% decrease in foreign visitors after  
141 the first months of the pandemic relative to previous year. Other analyses  
142 focusing on the effects of SARS on Asian economies include Dombey (2004),  
143 Cooper (2013) and Henderson and Ng (2004). Keogh-Brown et al. (2010)  
144 find a GDP loss between 0.5 and 2% for selected European countries.

145 Relevant studies examining the relationship between Airbnb and the hotel  
146 industry include Zervas et al. (2017). The authors showed that Airbnb supply  
147 flexibly react to demand, decreasing the pricing power of hotels. Farronato



148 and Fradkin (2018) showed that Airbnb supply is greater in cities where  
149 demand is highly varying, and the hotel industry has constrained room ca-  
150 pacity. Gunter et al. (2020) concluded that Airbnb demand is price-inelastic  
151 and that Airbnb is a substitute of hotel services. Blal et al. (2018) found that  
152 the growth of Airbnb listing numbers did not affect hotel revenues, but higher  
153 Airbnb prices and lower guest ratings contribute to higher hotel revenues, sig-  
154 nalling a substitution effect. The substitutability between the two models  
155 is also explored by Gyódi (2019), who found that while Airbnb and hotels  
156 provide a wide range of similar services, the price differences are greater at  
157 specific city locations. The competition between Airbnb and the hotel in-  
158 dustry is also discussed by Dogru et al. (2019), Benítez-Aurioles (2019) and  
159 Heo et al. (2019).

160 Our analysis is also related to studies on Airbnb implementing text-  
161 mining methods. Zhang (2019) examined guest reviews with content analysis  
162 (term frequencies, sentiment) and topic modelling to examine preferences re-  
163 garding hosts. Cheng and Jin (2019) also analysed reviews and identified  
164 the most relevant service attributes. Tussyadiah and Zach (2015) compared  
165 hotel and Airbnb reviews using co-occurrence analysis and found that Airbnb  
166 reviews focused more on host hospitality and neighbourhoods characteristics.  
167 Finally, Tussyadiah and Park (2018) analysed host descriptions with cluster  
168 analysis and identified different types of self-presentation by hosts.

169 Research focusing on the titles and listing descriptions is very narrow.  
170 Liang et al. (2020) found that the length of descriptions have a positive  
171 impact on bookings. Falk et al. (2019) focused on the relationship between  
172 price and keywords in the title.

173 The main contributions of this article to the literature can be summarised  
174 in three points. First, the impact of the COVID-19 pandemic is presented  
175 for the hotel industry and Airbnb in a wide sample of European cities. The  
176 study not only shows the overall trend, but also the various paths in the  
177 specific cities. This study constitutes the first effort to estimate the impact  
178 of the crisis on the size of Airbnb markets and prices. Second, the article  
179 explores the adjustment of hotels and Airbnb to the crisis and provides new  
180 evidence on the differences between the business models. Finally, various  
181 strategies of Airbnb hosts are empirically verified based on the analysis of  
182 listing titles and descriptions with the use of text-mining methods.

### 183 3. Data and Methodology

184 The empirical analysis is based on two data sources: STR and Inside  
185 Airbnb. STR ([str.com](https://str.com)) provides data analytics and insights for the hospi-  
186 tality industry, and via the STR Share Center also for research purposes. All  
187 variables are available with monthly frequency between the period January  
188 2018 - September 2020.

189 Inside Airbnb publishes web-scraped data on Airbnb listings in a large  
190 number of cities on a monthly basis. The datasets are publicly available  
191 on [insideairbnb.com](https://insideairbnb.com). For each analysed city, datasets for each month were  
192 downloaded between the period April 2018 - September 2020. The limitations  
193 of the data is discussed in Section 3.1.

194 The analysed variables are summarised in Table 3. For hotels, the stand-  
195 ard measures for the hospitality sector (supply, demand, RevPar and ADR)  
196 were provided by STR. For Airbnb, these measures were approximated based  
197 on the listing-level web-scraped data.

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

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

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

211 To examine the changes in the strategy of hosts, the name and descrip-  
212 tion of listings was analysed using text-mining methods in Python (variables:  
213 “description” and “name”). First, the text was turned lower-case. Using the  
214 *langdetect* package <sup>7</sup>, the language of the name and description was identi-  
215 fied. The occurrence of the terms *office* and *quarantine* was examined in the

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<sup>6</sup>Hotel variable description from STR Glossary, available at <https://str.com/data-insights/resources/glossary>

<sup>7</sup>available at <https://pypi.org/project/langdetect/>

Table 2: Analysed Variables

	Description <sup>6</sup>	Measure
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

216 title and description. The following languages were taken into consideration:  
 217 English, German, Spanish, Portuguese, Swedish, French and Italian. As an  
 218 example, if the language of the summary was German, the corresponding  
 219 terms were *büro* and *quarantäne* (see Appendix A). Finally, also the occur-  
 220 rence of the word *covid* was identified. The presented figures were prepared  
 221 with Altair (VanderPlas et al., 2018).

222 Besides the analysis of descriptive statistics, the determinants of Airbnb  
 223 prices is examined using panel data regression method. Similarly to Falk et al.  
 224 (2019), we implement the random effects model that enables the inclusion of  
 225 time-invariant variables, such as the type of the listing or city of location.

226 The following model is calculated:

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

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

238 The used variables are summarised in Table 3. The Airbnb attributes are  
 239 selected based on the literature (Gyódi and Nawaro, 2021; Wang and Nicolau,  
 240 2017; Deboosere et al., 2019; Lawani et al., 2019). Besides the month and  
 241 year dummies, a dummy variable for each city (except to Paris) is included  
 242 in the model. The time period of the pandemic (*covid*) is determined based  
 243 on the start dates of restrictions summarised in Table 1.

244 Finally, we consider an alternative model specification. While we are  
 245 able to exclude listings that were not available for booking, a share of the  
 246 remaining sample is constituted by listings that were not updated for longer  
 247 periods of time. As the price of these listings remained constant during the  
 248 pandemic, the actual effect of the crisis may be undervalued in our analysis.  
 249 For this reason, we also include a dummy variable signalling if a listing re-  
 250 ceived a review during the pandemic. As guests have two weeks to submit

251 a review following their stay, the threshold date follows the *covid* dummy  
 252 by 14 days. We will test if the prices of listings that were actually booked  
 253 during the pandemic differ from the rest of the sample. Moreover, using an  
 254 interaction with *covid*, we will identify whether the impact of the crisis was  
 255 different for this group.

Table 3: Variables used in the regression analysis

Name	Description	Type
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
1-11	month of observation	dummy
covid	time period of pandemic	dummy
rev_covid	listing that received a review during the pandemic	dummy

### 256 3.1. Data Limitations

257 The main limitation of Airbnb data is the lack of insights on the number  
 258 of bookings. This prevents us from the precise calculation of revenue and  
 259 the estimation of demand. Zervas et al. (2017) argued that review data can  
 260 be used to identify active listings. We will implement this approach in the  
 261 regression analysis to control for offers that were active during the pandemic.  
 262 We will also use the review numbers to track the fluctuation of demand.  
 263 While this approach is not perfect, as it assumes that the share of travellers  
 264 leaving a review is steady over time, the literature provides relevant examples  
 265 to approximate booking numbers based on reviews (Chen et al., 2020).

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

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

## 276 4. Results

### 277 4.1. The hotel industry

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

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

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

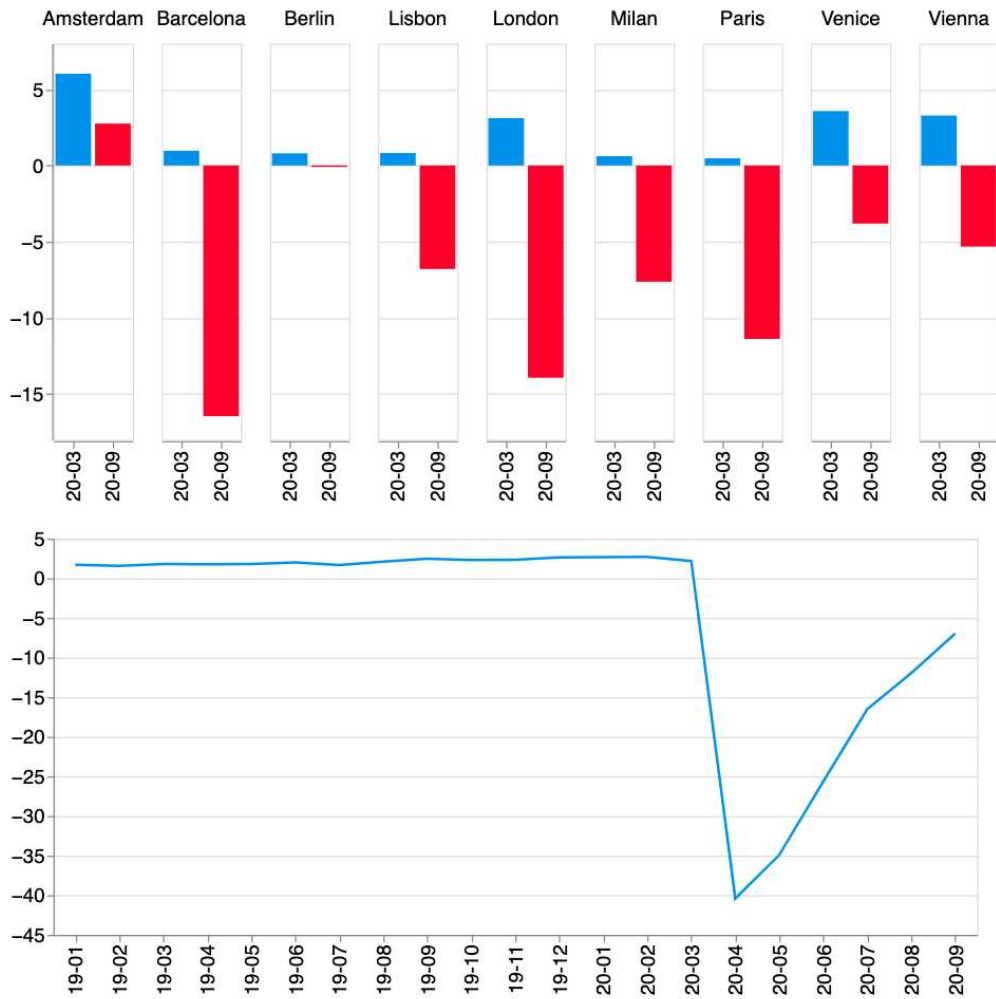
295 Changes in RevPar followed the collapse of demand. The hospitality  
296 sector came to a complete halt in April, with revenues falling by more than  
297 90% in all of the analysed cities. As expected, revenues remained by more  
298 than 70% lower during the summer as well. The statistics are presented in  
299 the Appendix (Figure B.12).

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

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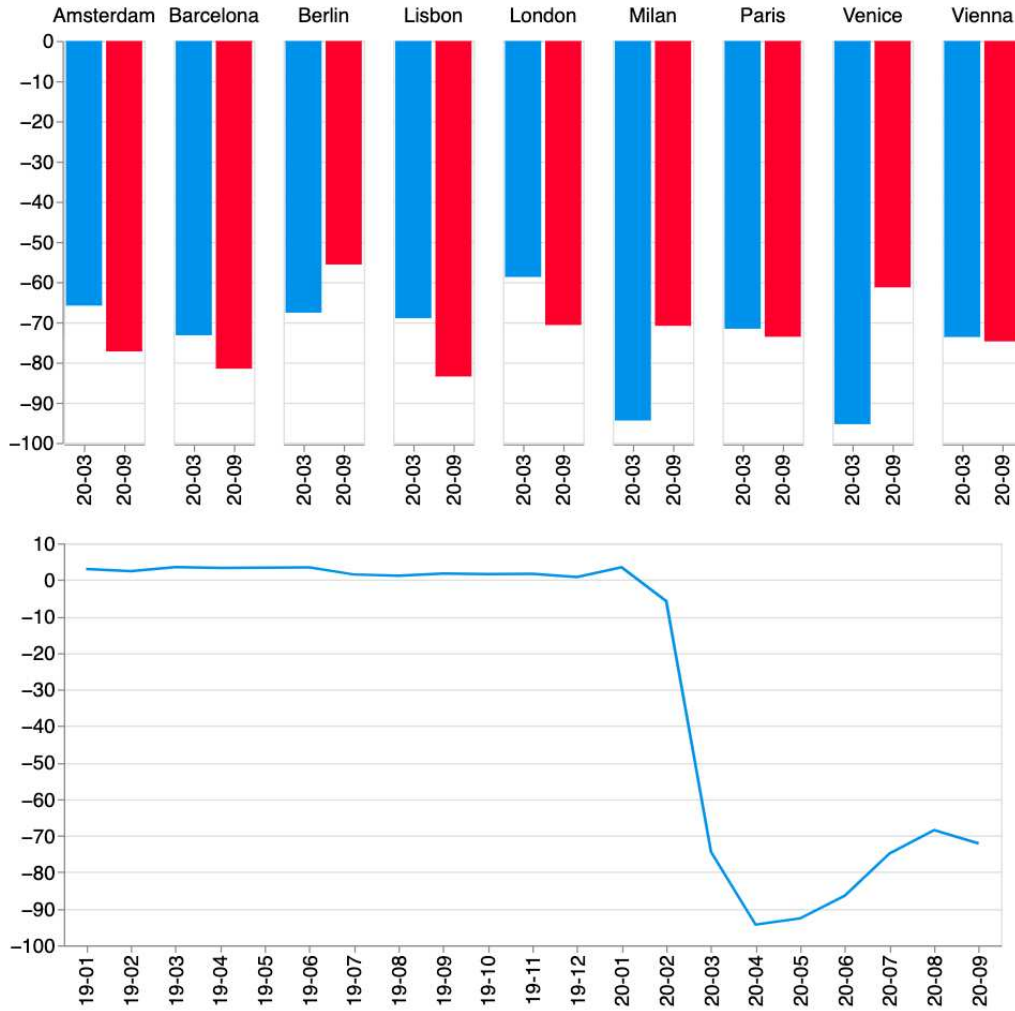
<sup>8</sup>Available at: <https://str.com/sites/default/files/STR-COVID-19-FAQs-Updated-7-October-2020.pdf>

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



Source: Own elaboration based on data from STR LLC

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

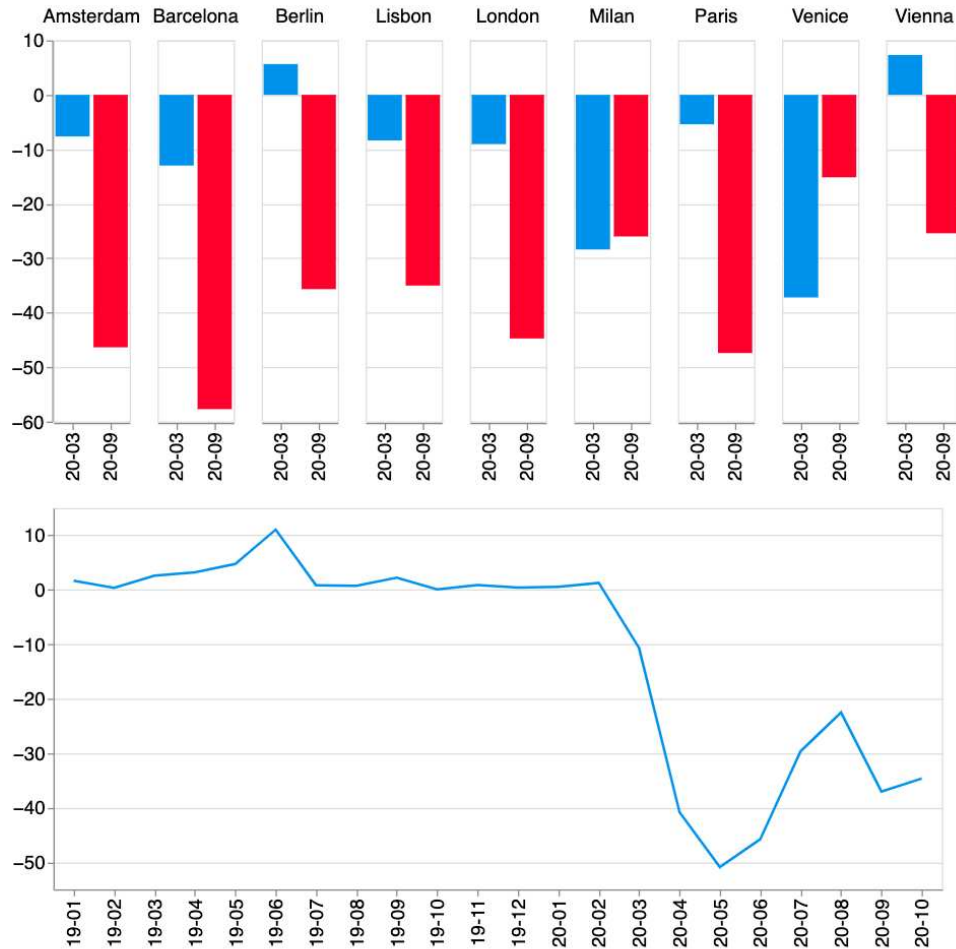


Source: Own elaboration based on data from STR LLC

305 Finally, we examine the average changes across different hotel classes in  
 306 the analysed cities. Figure 5 shows the changes in supply, while Figure 6  
 307 presents the changes in ADR with division for different hotel classes. The  
 308 data shows that room supplies returned to the pre-pandemic levels only in the  
 309 economy class, while a greater share of hotels remained closed in the luxury



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



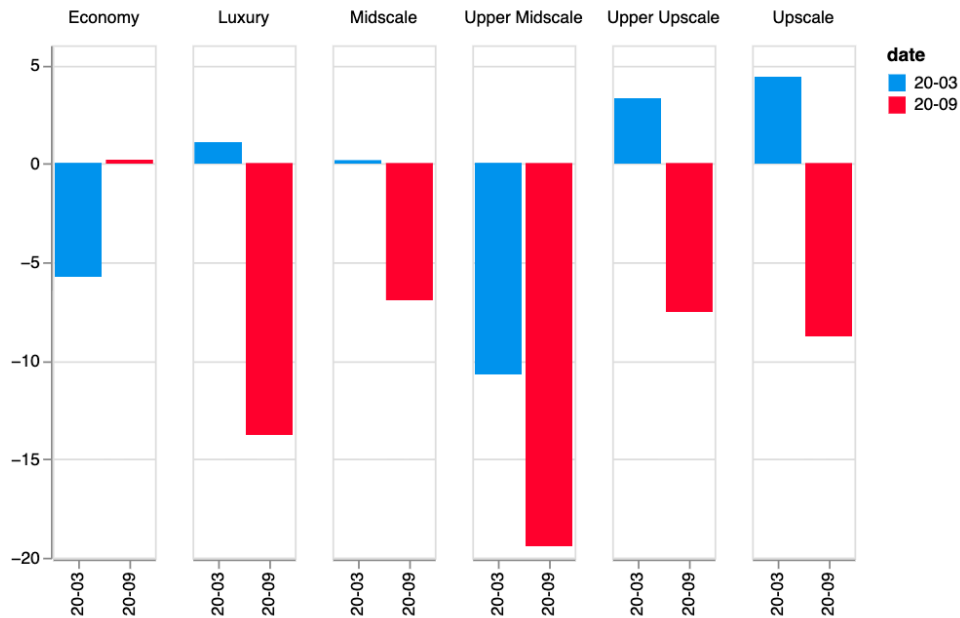
Source: Own elaboration based on data from STR LLC

310 and upper midscale segments. In the case of prices, the smallest changes were  
 311 recorded in case of luxury hotels, while the remaining segments all heavily  
 312 dropped rates, with no significant differences between economy and premium  
 313 classes.

314 To conclude, the situation of the hotel industry has become dramatic by  
 315 April in all cities, with virtually no demand for hospitality services. Hotels

316 were forced to cut supply and significantly decrease prices. While the sector  
 317 reopened for the holiday season, demand remained at a significantly lower  
 318 level.

Figure 5: Hotel Supply: Percentage change from same month previous year across various hotel classes

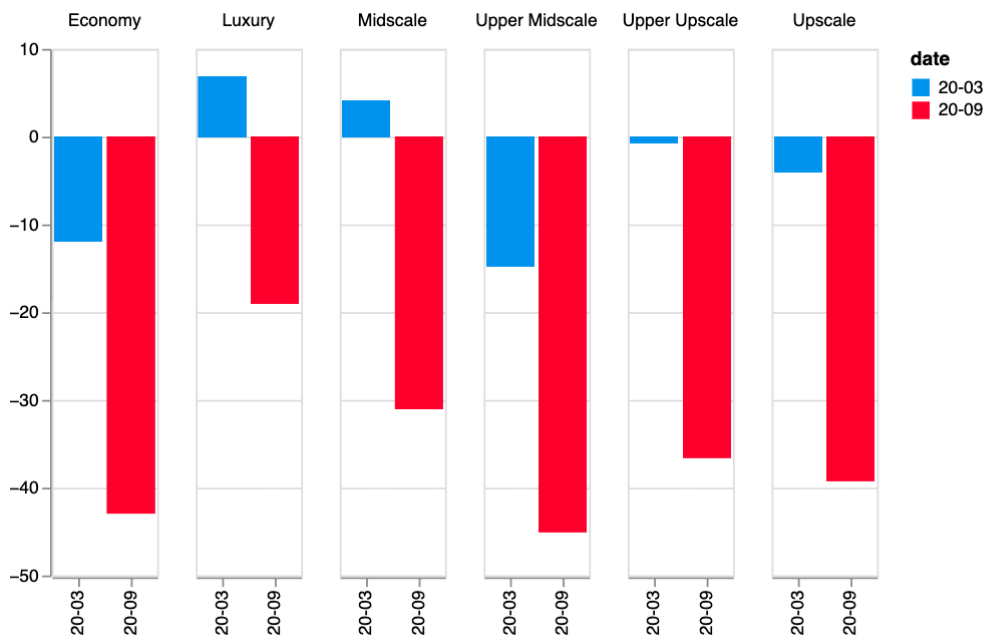


Source: Own elaboration based on data from STR LLC

#### 319 4.2. Airbnb

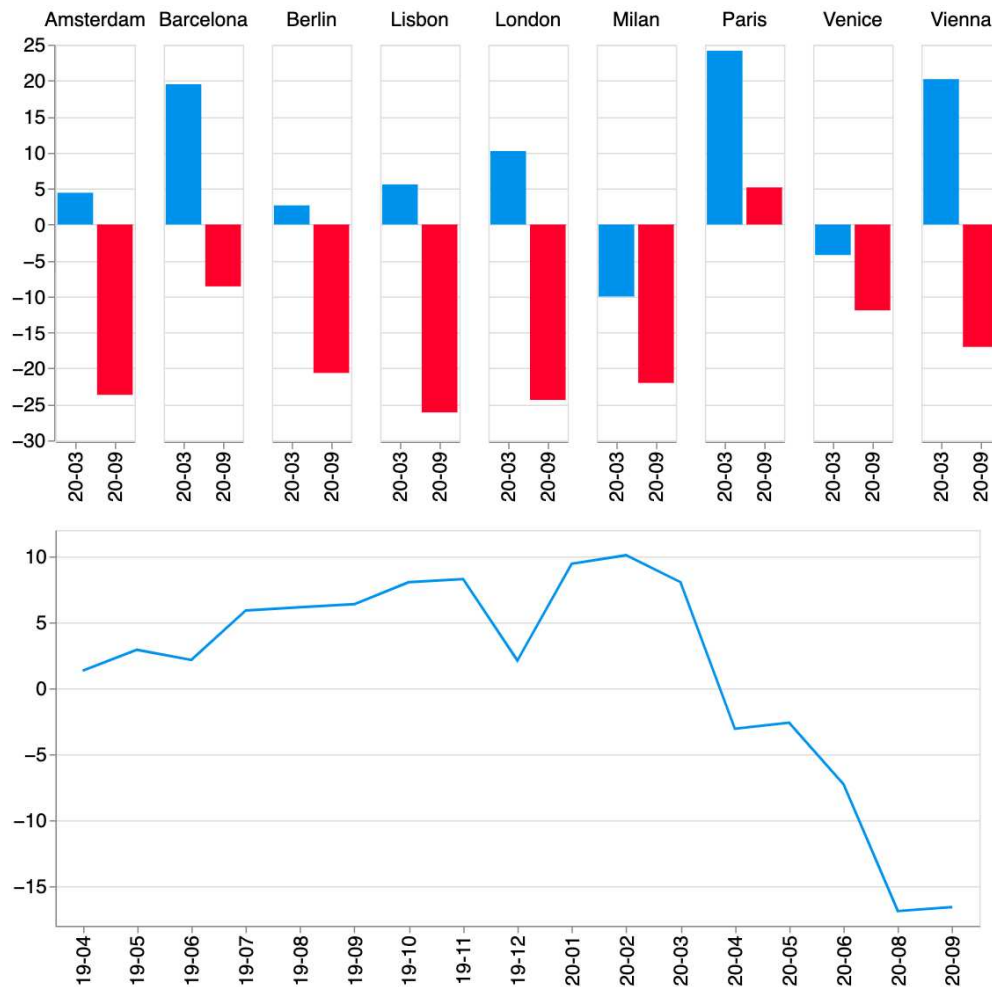
320 Airbnb was on a dynamic growth path with a rising number of active  
 321 listings prior the pandemic (Figure 7). Even in March 2020, on average 8%  
 322 more active offers were available in the analysed cities, although the decline  
 323 of offers already began in Milan and Venice. However, data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

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



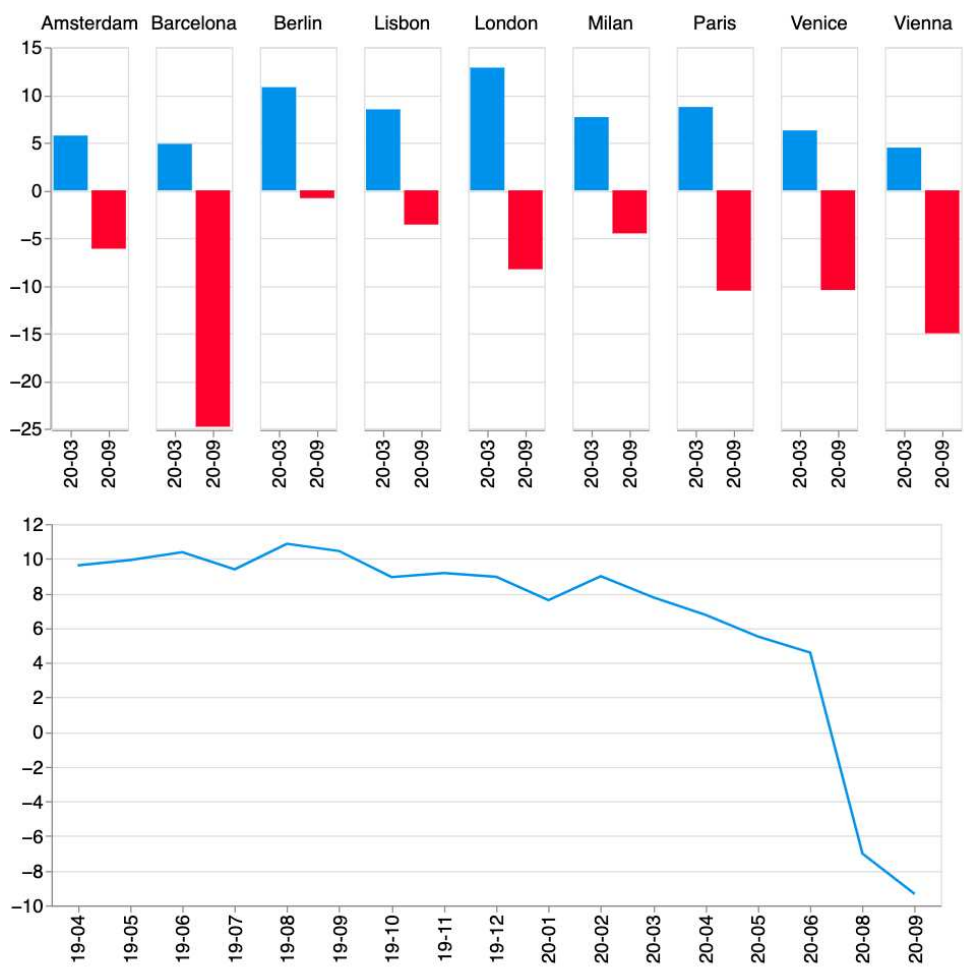
Source: Own elaboration based on data from STR LLC

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



Source: Own elaboration based on data from Inside Airbnb

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



Source: Own elaboration based on data from Inside Airbnb

329 In the absence of information on the actual bookings, the number of  
330 reviews are used as a proxy to analyse changes in demand. Figure B.13  
331 in the Appendix present the average number of new reviews across time.  
332 Prior to the pandemic, active listings received 1.4-2.3 reviews per month. In  
333 March, this value dropped to 1.17, while by May there were virtually no new  
334 reviews. The second half of summer marked a temporary rise in travelling,  
335 as the numbers of new reviews rose again, although to a level around 50%  
336 lower than in 2019 (1.14 in September 2020 vs 2.07 in September 2019).

337 Unlike hotels, Airbnb hosts did not decrease prices immediately: the rates  
338 for accommodation had been above the 2019 levels until the summer. By  
339 September, however, prices had dropped on average by around 9%. Similarly  
340 to hotels, prices decreased the most in Barcelona (more than 25%). On the  
341 other hand, prices remained at the 2019 level in Berlin.

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

#### 346 *4.3. Airbnb prices: regression analysis*

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

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

355 The city dummies reveal significant price differences between the various  
356 cities (Table B.7). Relative to Paris, most cities are significantly cheaper  
357 (Berlin is the cheapest, with on average 33% lower prices), only Amsterdam  
358 is even more expensive (by 58%).

359 While these results provide new insights for the hedonic price literature,  
360 the most important aspect of this exercise is to identify the effect of the pan-  
361 demic on the prices. First, the year dummies support our previous findings  
362 on the upward trend prior the crisis: prices on average had been lower by  
363 2.6% in 2019 and 5% in 2018 relative to 2020. Second, the dummy variables  
364 for the specific months reveal which months had been more expensive relative

365 to December (October, November and June). Most importantly, *covid* is sig-  
366 nificant and shows that prices had been lower by 4.4% during the pandemic.  
367 Therefore, controlling for the listing attributes and specific time of the year,  
368 hosts on average decreased prices by such amount.

369 However, this result may underestimate the decrease of price in case of  
370 listings that were actually booked during the pandemic. The analysed sample  
371 includes listings that were available but remained unadjusted on the platform.  
372 In order to account for this heterogeneity, we include *rev\_covid* for listings  
373 that received new reviews during the pandemic, and an interaction with *covid*  
374 as well. Therefore, we can evaluate to what extent the price was adjusted  
375 for listings that were booked following the introduction of restrictions. The  
376 coefficient *rev\_covid* is significant and positive: on average, these offers were  
377 5.9% more expensive than the remaining sample. The coefficients for *covid*  
378 and its interaction with *rev\_covid* show an interesting scenario: while prices  
379 decreased in the entire sample by 2.4 %, in case of the reviewed listings  
380 this decrease of price was greater - 7%. This suggests that hosts serving  
381 guests had to decrease prices by a greater extent than the overall population  
382 of offers. However, this discount is still significantly lower than the levels  
383 observed for the traditional hotel industry.

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

Table 4: Results of the random effects panel data regression

	<i>Dependent variable:</i>	
	log_price	
	(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 <sup>2</sup>	0.537	0.538
Adjusted R <sup>2</sup>	0.537	0.538
F Statistic	4,174,265.000***	4,207,295.000***

*Note:* \*p<0.1; \*\*p<0.05; \*\*\*p<0.01



388 4.4. Changing characteristics of Airbnb listings during COVID-19

389 Unlike hotels, Airbnb hosts can pivot from short-term accommodation  
390 provision during low demand periods. The previous results showed that a  
391 significant share of Airbnb hosts stopped accepting new bookings during the  
392 pandemic. This supports that an increasing number of listings returned to  
393 the long-term rental market.

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

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

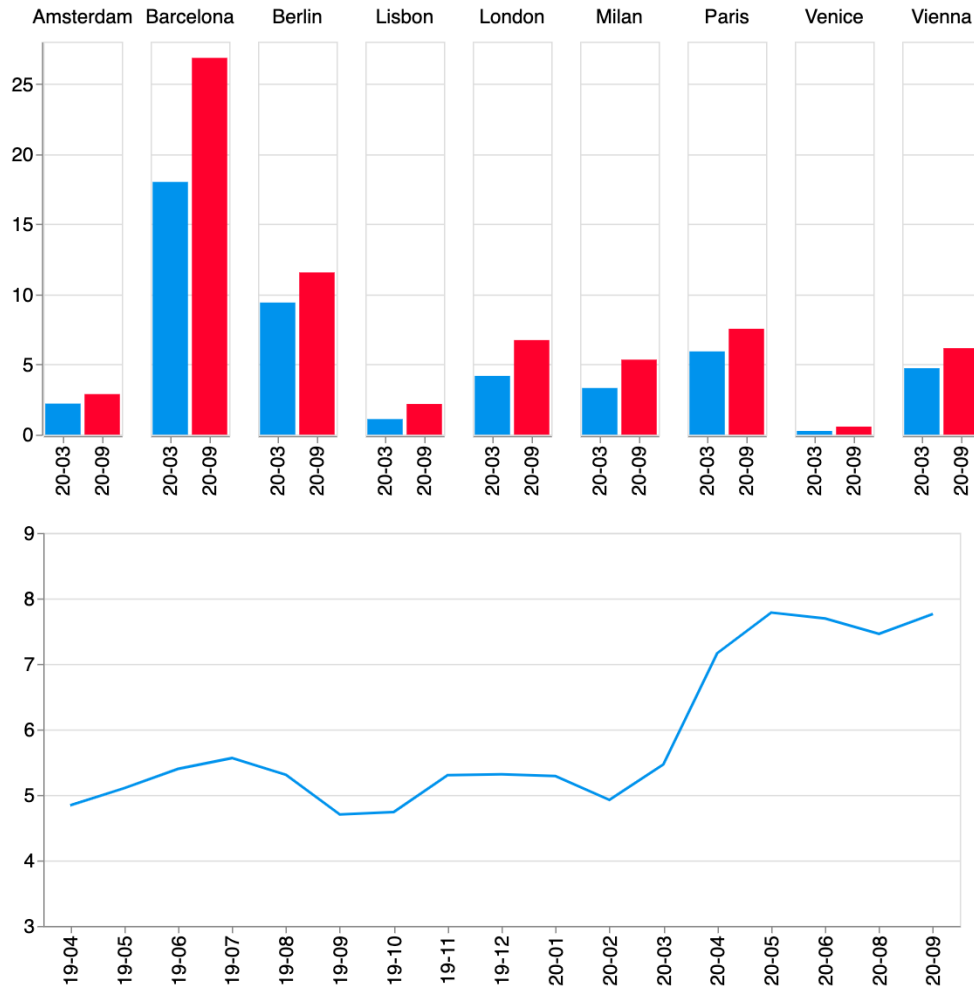
402 Therefore, we should see an increase in the share of Airbnb listings offered  
403 for longer time periods. The data supports that such process was taking  
404 place: before the pandemic, the average share of active offers with minimum  
405 14 night stays had been between 5-6%, and has increased to 7% by April and  
406 around 8% by May. The share of such offers remained at a similar level during  
407 the summer months. Between March and September, the share of such offers  
408 has risen in all of the analysed cities, the most in Barcelona (Figure 9).

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

416 Third, the number of listings mentioning *covid* or *quarantine* is identified  
417 with the same methodology. Figure 11 reveals that a growing number of  
418 listings included the term "covid", although their average share did not ex-  
419 ceed 2%. Finally, the number of listings that included the term "quarantine"  
420 remained insignificant during the pandemic (Table B.14 in the Appendix).

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

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



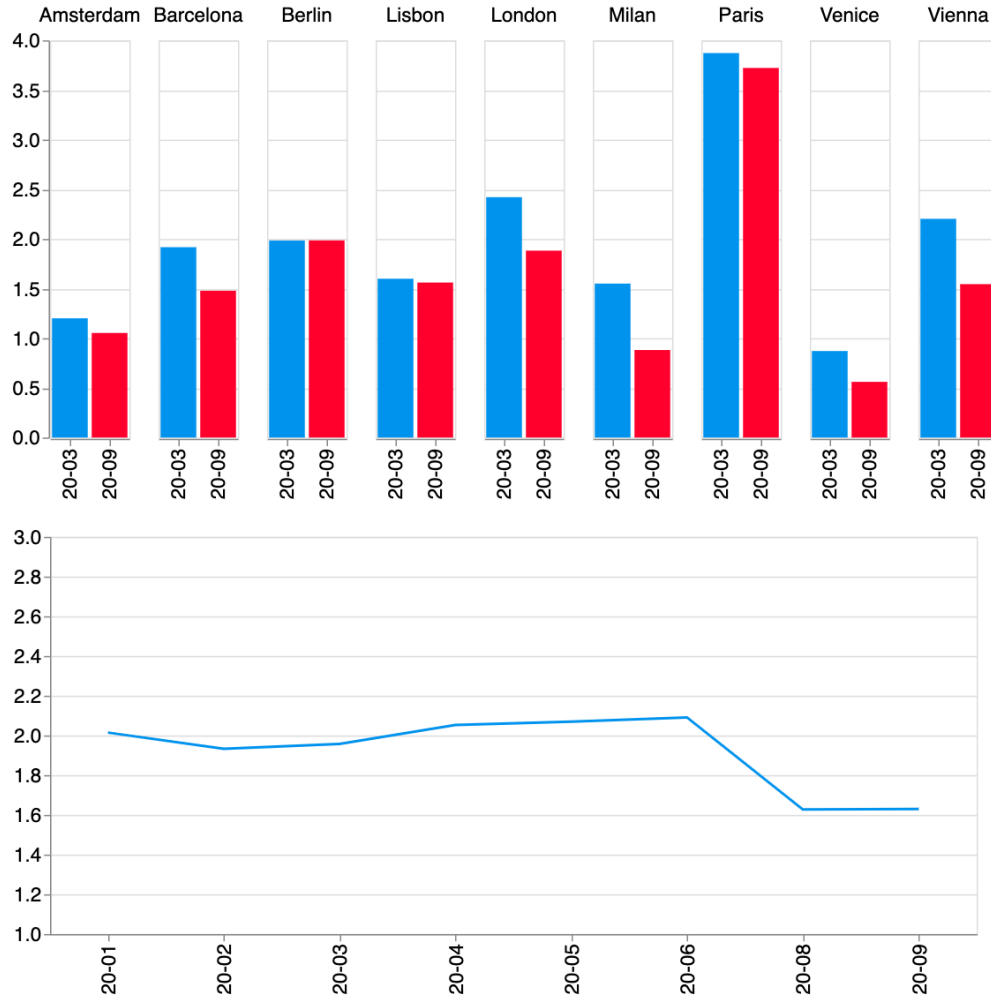
Source: Own elaboration based on data from Inside Airbnb

## 425 5. Conclusions

### 426 5.1. Key insights

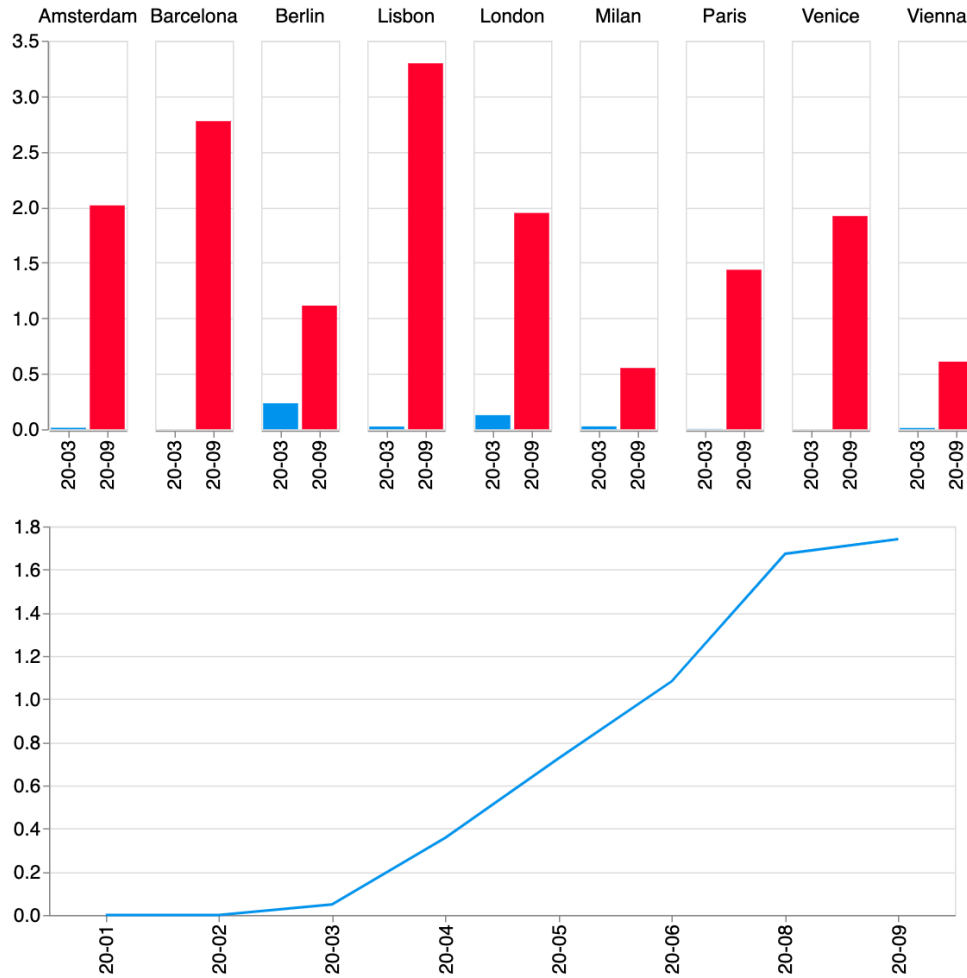
427 The empirical analysis revealed the dramatic impact of the pandemic on  
 428 both the traditional hotel industry and Airbnb in 9 major European cities.

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



Source: Own elaboration based on data from Inside Airbnb

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



Source: Own elaboration based on data from Inside Airbnb

429 Between March and May 2020 there was virtually no demand for accommod-  
430 ation, while the summer peak period also brought only minor improvement.

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

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

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

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

464 The results support the necessity of financial help for the traditional hos-  
465 pitality sector in order to preserve workplaces. The data suggests that hotels  
466 across all segments adopted strong measures to stay in business, significantly

467 decreasing profit margins. In the case of Airbnb hosts, such public support  
468 is not justified, as they can earn income based on their property without  
469 tourists as well.

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

## 476 *5.2. Limitations and further research*

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

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

487 The analysis also provides insights on novel research gaps. As an ex-  
488 ample, the results showed significant differences between the analysed cities  
489 in key metrics, such as changes in hotel supply. Future research could ex-  
490 plore these divergent measures and evaluate which cities managed the crisis  
491 more effectively. Moreover, next efforts could analyse the different strategies  
492 of hotels in greater detail and analyse the main drivers of hotel performance  
493 during the pandemic.

494 The analysis highlights new research areas for Airbnb as well. An in-  
495 teresting research topic is the identification of hosts that were successful in  
496 managing the pandemic and the exploration of their strategies. Additionally,  
497 new research could evaluate the overall changes in the characteristics of the  
498 Airbnb market and examine the differences between listings that remained  
499 on the market and the ones that were withdrawn.

500 **Appendix A. Dataset and Methods**

Table A.5: Date of scraping in September 2020 and missing data

City	Date of Scraping in September 2020 and 2019 <sup>9</sup>	Missing month
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 A.6: Terms searched in name / description by language

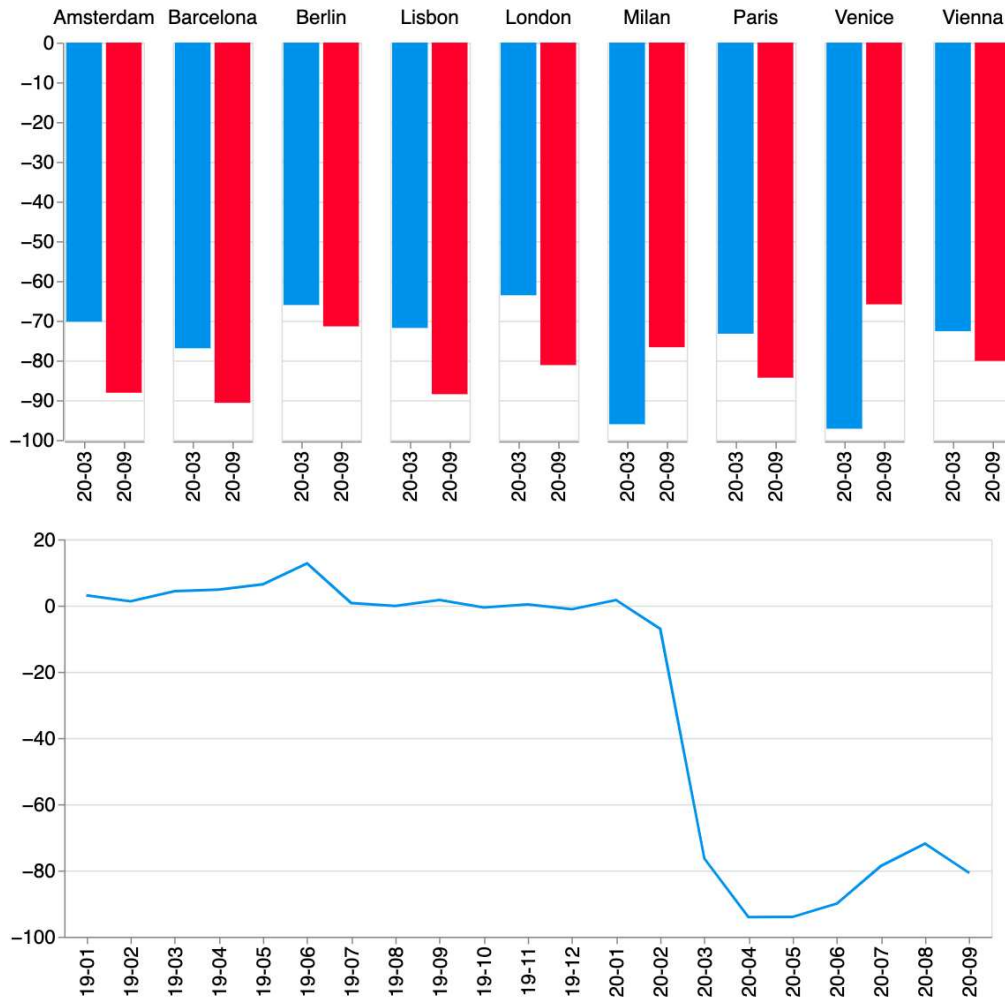
English	Office	Quarantine
Dutch	bureau	quarantaine
French	bureau	quarantaine
German	büro	quarantäne
Italian	ufficio	quarantena
Portuguese	escritório	quarentena
Spanish	oficina	cuarentena
Swedish	kontor	karantän

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<sup>9</sup>date with the highest number of scraped listings

501 **Appendix B. Results**

Figure B.12: Hotel RevPar: Percentage change from same month previous year (below: average across cities)



Source: Own elaboration based on data from STR LLC

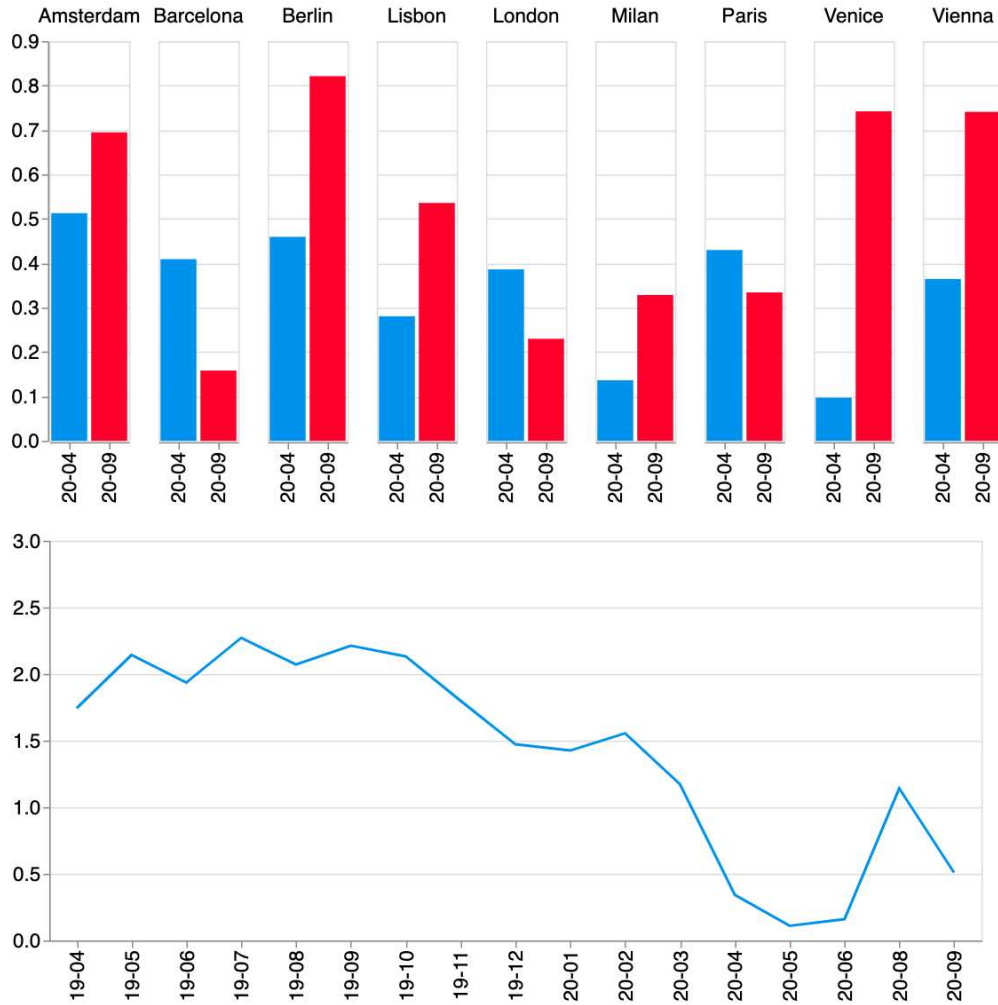


Table B.7: Results of the random effects panel data regression: city and month dummies

	<i>Dependent variable:</i>	
	log_price	
	(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)

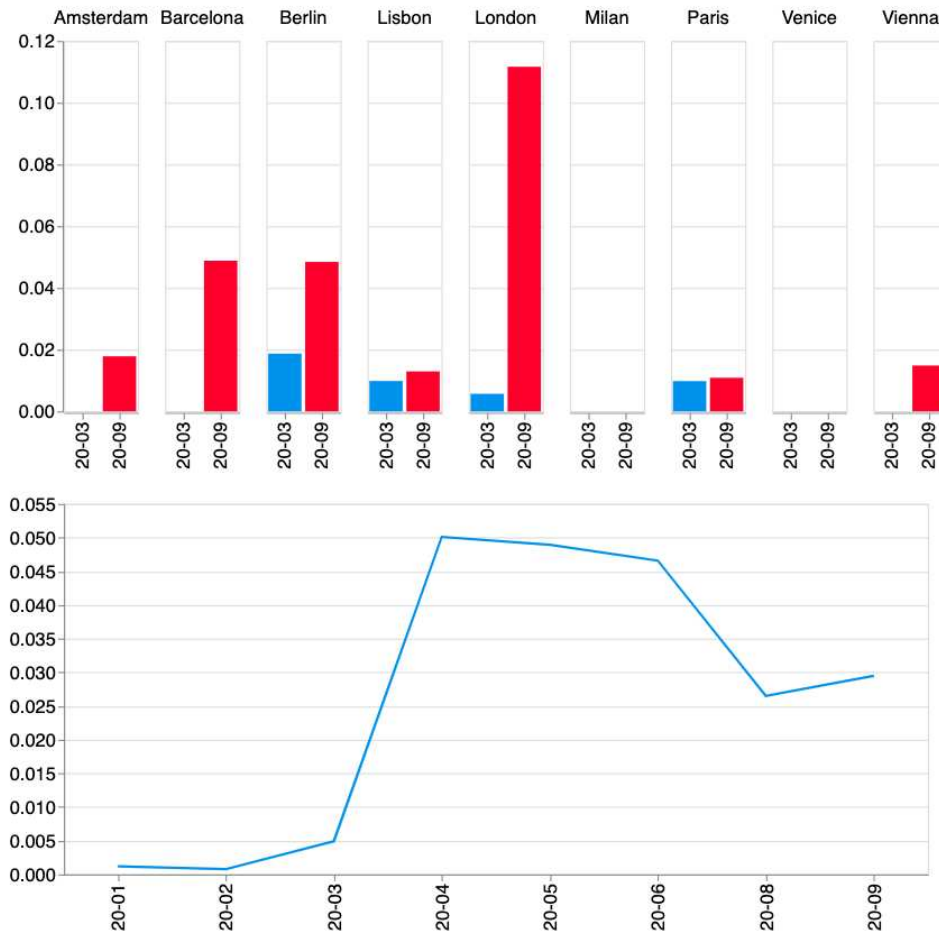
*Note:* \*p<0.1; \*\*p<0.05; \*\*\*p<0.01

Figure B.13: Average number of new Airbnb reviews (below: average across cities)



Source: Own elaboration based on data from Inside Airbnb

Figure B.14: Share of Airbnb listings that include the word quarantine in the name or description



Source: Own elaboration based on data from Inside Airbnb

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