

Much ado about nothing? Online platform price parity clauses and the EU Booking.com case *

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September 17, 2018

Abstract

Price parity clauses are a modern-day antitrust challenge posed by online platforms. Their adoption may indeed soften competition across platforms, thereby increasing commission rates for client sellers and final prices for consumers. *Booking.com*, together with other online travel agencies, has been at the center of various EU antitrust investigations during recent years for the use of these clauses. In this paper, we concentrate on the most relevant decisions taken in the EU and provide an evaluation of how the removal of price parity clauses has impacted hotel prices on *Booking.com*. In particular, we collect posted prices on this platform for three countries (France, Italy, and Spain) that have been differently affected by these decisions. The resulting dataset allows us to perform a difference-in-differences analysis, by exploiting the variation of room prices across countries and along the booking period, before and after the main events. Our analysis suggests that these investigations and subsequent interventions did not significantly reduce prices paid by consumers on *Booking.com*, at least in the short run. This may be partly explained by the sluggishness of hotels in adjusting their prices, a finding that this paper also highlights.

JEL: D40, K21, L11, L42, L81.

*We are grateful to Martyn Andrews, Annette Broocks, Joan Calzada, Vincenzo Denicolò, Renato Gomes, Vicente Lagos, Ulrich Laitenberger, Ambre Nicolle, Luigi Pascali, Andrew Rhodes, John Rust, Marc Rysman, Fiona Scott-Morton, Yevgeniya Shevtsova, Tommaso Valletti, Antonio Vázquez, Thibaud Vergé, Mazhar Waseem, Julian Wright, Lorenzo Zirulia and seminar participants at the 10th Digital Economics Conference (ParisTech), 11th Digital Economics Conference (Toulouse School of Economics), XXXIII Jornadas de Economía Industrial (Barcelona), Competition and Market Authority, EARIE 2018 (Athens), IIOC 2018 (Indianapolis), IMAEF 2018 (Corfu), MaCCI 2018 (ZEW, Mannheim), National University of Singapore, Ofcom, University of Bologna, University of Loughborough, University of Manchester, and University of Salento for helpful comments and discussion. We also thank Lucy Scioscia for editorial assistance. We gratefully acknowledge financial support from the NET Institute (www.NETinst.org). The usual disclaimer applies.

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1 Introduction

Online platforms provide useful services to customers, but can also exploit their dominant position to impose unfair conditions to their client sellers. Particular attention has been recently devoted to controversial practices that are generally referred to as most favored nations (MFN) provisions. These are contractual terms used by online platforms to prevent client sellers from offering their products or services at different prices on alternative sales channels. They are widespread in industries such as entertainment, insurance, energy supply, digital goods, and payments systems.

One particular type of vertical MFN restraint has been widely adopted by leading online travel agencies (OTAs) such as *Booking.com* and Expedia: price parity clauses (PPCs). These are usually divided into two types. A "wide" PPC requires that the price charged by hotels on OTAs cannot be reduced when selling via alternative channels, including direct selling. A "narrow" PPC is less rigid, as it allows hotels to charge a lower price when selling through rival OTAs; in any case, hotels cannot charge a lower price when selling directly. Both types of clauses have raised serious antitrust concerns, as in most countries the OTA sector is highly concentrated. The adoption of these price restrictions may indeed reduce competition between OTAs, thereby increasing the commission rate paid by client hotels, which could in turn raise final prices for end consumers.

The aim of our analysis is to evaluate whether the partial or full removal of PPCs may contribute to leveling off the playing field between OTAs and hotels, thereby driving down final prices. In order to do so, we consider what recently happened in the EU, where several national competition authorities (NCAs) took action against these clauses. Italy, France, and Sweden were at the forefront of those who led the initial inquiries. The result was the commitment by *Booking.com* to switch from wide to narrow PPCs across the whole EU starting from July 1st, 2015. Other national jurisdictions went even further and abolished all PPCs outright: France was the first to do so in August 2015, followed by Austria in November 2016, Italy in August 2017 and Belgium in July 2018. In Germany, the Bundeskartellamt (the German competition authority) prohibited in 2013 all PPCs

used by Hotel Reservation System (HRS), a major German OTA; a similar decision was reached against *Booking.com* in December 2015.

PPCs have received increasing attention in other parts of the world, although not much has been done in terms of setting regulations.¹ As a matter of fact, there is not even an international consensus on the need to intervene. In the US, a recent complaint against OTAs was dismissed without even addressing the question of whether or not PPCs harm competition.² Prominent academics and experts in the field are, however, taking a firm stand. Baker and Scott Morton (2018), for example, recently reiterated that prices are bound to increase due to platform MFNs and stressed that antitrust enforcement against PPCs should also be a priority in the US.³ Jean Tirole, in a recent interview, criticized these clauses, through which “you have become a “unique” customer, and so the platform can set large fees to the merchant to get access to you”.⁴

In this paper, we focus on the short-run effect of antitrust interventions against PPCs in the EU. We consider hotels listed on *Booking.com*, the most prominent OTA, controlling almost 60 percent of the EU market in 2016.⁵ We collected data on prices listed on *Booking.com* in the period 2015-17 for tourism regions in the Mediterranean that belong to France, Italy, and Spain. The resulting dataset is highly detailed as it comprises room prices for several stay dates, posted by hotels on *Booking.com* before and after the most relevant EU antitrust decisions, whose short-term impact is then gauged in our econometric analysis.

We first study the legislative interventions banning every type of price restriction in

¹Notable exceptions are Australia, Brazil and New Zealand, where *Booking.com* and Expedia have, in agreement with regulators, adopted narrow PPCs. In Turkey, *Booking.com* was temporarily blocked in 2017 by the court in a dispute with local travel agents. In Switzerland, a parliamentary motion was passed in September 2017 to ban PPCs, and the government has two years to implement the proposal. PPCs have also been recently investigated in Japan and Singapore.

²Online Travel Co. Hotel Booking Antitrust Litig., 997 F. Supp. 2d 526 (N.D. Tex. 2014).

³In the US, particular attention has been given to the market for credit card services, where platforms set fees both to merchants and end users. In this context, there is a wide debate on the use of no surcharge rules, a form of vertical MFN which prohibits merchants from charging higher prices to consumers who pay by card instead of other means (see, e.g., Carlton and Winter, 2017; Schwartz and Vincent, 2006, 2017).

⁴Econ Focus, Fourth Quarter 2017, available at: https://www.richmondfed.org/publications/research/econ_focus/2017/q4/interview.

⁵Source: HOTREC 2015-16 Annual Report, available at: <https://www.hotrec.eu/category/publications/annual-reports/>.

France (August 2015) and Italy (August 2017). Then, we consider both the announcement of *Booking.com*'s commitment to switch from wide to narrow PPCs (April 2015), and its subsequent enforcement (July 2015). For the banning of PPCs, and for the initial commitment of *Booking.com*, we adopt a difference-in-differences (D-in-D) methodology, as we can clearly identify a "treated" category (either French or Italian hotels). For both treated and non-treated hotels and holding the stay date fixed, we track room prices throughout the booking period that includes the policy change. For the removal of wide PPCs in July 2015, a comparison group is not available given that all countries are subject to the same shock. In this case, we simply study the dynamics of prices posted on *Booking.com* before and after the event took place.

The results of the D-in-D analysis suggest that the full removal of PPCs in France in 2015 had a negligible effect on prices on *Booking.com*. The price drops were of very small magnitude, ranging from 0.4 to 1 percent, and not statistically significant. Similar conclusions arise when considering the case of Italy, which abolished PPCs in August 2017. The results for both countries are also confirmed by a synthetic control analysis. The other two major events that we investigate are related to the change in the PPC regime. We find that both the announcement to switch from wide to narrow PPCs in April 2015 and its enforcement in July 2015 had a minimal and insignificant impact on prices.

To sum up, our findings indicate that the main antitrust events of 2015 and 2017 did not have a significant short-run impact on prices posted on *Booking.com*. This does not necessarily imply that the antitrust effort carried out in the EU against PPCs was in vain. In fact, we cannot exclude the possibility of price reductions in the medium-long run and/or in the direct sales channels, both of which we do not observe. However, our analysis sets off a red flag as it shows that the desired price reduction on *Booking.com* did not occur, at least in the short run. This may be partly explained by the sluggishness of hotels in adjusting their prices, a finding that our analysis also highlights. Other factors may have played a role, such as the strategic response of leading OTAs to the antitrust actions. The elimination of PPCs may then represent only one aspect of the very complex challenge of regulating online platforms such as OTAs.

The growing attention to the economic effects of PPCs and their removal following antitrust intervention has attracted a large body of theoretical research (see Section 3). At the empirical level, the European Competition Network (2017) report provided a preliminary evaluation of the removal of wide PPCs in the EU. The analysis was based upon a survey filled out by 16,000 hotels in ten member countries complemented by hotel room price data obtained from major metasearch websites and from leading OTAs such as *Booking.com*, Expedia and HRS.⁶ The results were not conclusive and called for further inquiry but pointed to: (i) minor changes in the commission fees, (ii) limited awareness of hoteliers of the policy change and (iii) scarce propensity to price differentiate between sale channels.

Recent empirical research has tried to overcome the dearth of data in order to shed more light on this complex issue. Hunold et al. (2018) use metasearch data of more than 30,000 hotels in different countries collected from Kayak during the period January 2016 to January 2017. Their study focused on hotels in Germany, a country that prohibited *Booking.com* from using all types of PPCs in December 2015. They found the elimination of PPCs incentivized hotels to expand room availability on OTAs and increased the number of sales channels. Moreover, they also showed that hotels charged the lowest price on the direct channel more often in Germany than in countries that did not abolish such clauses. Ennis et al. (2018) consider a dataset of proprietary hotel-level data for 2014 and 2016, for different hotels both in the EU and around the world. Their evidence suggests that the switch from wide to narrow PPCs brought about a price decrease on direct channels with respect to OTAs in the EU, especially for more expensive hotels.

Our paper both differs and complements the empirical analysis carried out in the aforementioned studies. We focus exclusively on prices that appear on *Booking.com*. However, our data are extremely detailed, thus allowing for a precise matching of hotel rooms by type, characteristics, and quality. Importantly, we are also able to track prices throughout an extensive booking period. This enables us to evaluate the price dynamics immediately

⁶The European Commission worked together with the Belgian, Czech, French, German, Hungarian, Irish, Italian, Dutch, Swedish and UK NCAs.

before and after *all* the most important EU antitrust decisions involving *Booking.com* in the countries that we consider. Notwithstanding the different samples and approach, our results are coherent with the findings of all the previous studies. On the one hand, like the European Competition Network (2017) report, we do not find significant price changes, at least on *Booking.com*; on the other hand, our conclusions cannot rule out increased price differences between sales channels, as in Hunold et al. (2018) and Ennis et al. (2018).

We also contribute to recent empirical evidence on the impact of regulation on platform pricing. Chen and Liu (2011) investigate the effects of a Most-Favored Customer (MFC) clauses on price competition among major electronics retail platforms.⁷ Unlike other markets,⁸ prices diminished after adopting these clauses. Ater and Rigbi (2018) evaluate the impact of a price transparency regulation imposed on Israeli supermarkets. Using a D-in-D approach, they document a price drop resulting from this mandatory online disclosure. De los Santos and Wildenbeest (2017) also employ a D-in-D approach to empirically investigate how different supplier-platform vertical relationships may affect retail prices. They exploit the US antitrust intervention in the e-book sector, that shifted back the pricing power from the e-book publishers to the distributing platforms. They show that this decision led to sharp price decreases.

Finally, our work is related to the recent literature on dynamic pricing in the hotel and airline sectors. Although we do not aim to disentangle the motives for price fluctuations (*e.g.*, opportunity costs of the perishable capacity as in Talluri and Van Ryzin, 2006; capacity pricing, as in Alderighi et al., 2015; strategic motives, as in Möller and Watanabe, 2010), our approach enables us to control for the price changes that may occur throughout the booking period of a hotel room.

The rest of the paper is structured as follows. Section 2 illustrates the main events in the recent antitrust cases involving *Booking.com*. Section 3 reviews the theoretical literature to highlight the conceptual underpinnings of our empirical analysis. Section 4 presents

⁷These clauses guarantee refunds to consumers in case future discounts by the same retailer become available on the product they purchased.

⁸Scott Morton (1997) and Crocker and Lyon (1994) focused respectively on pharmaceutical drugs and natural gas, markets in which prices increased over time after an MFC rule was added.

the data. Section 5 explains our empirical strategy. Section 6 provides the results. Section 7 proposes a synthetic control analysis of the price impact of abolishing PPCs in France and Italy. Section 8 concludes by discussing the results and their policy implications.

2 The Booking.com EU antitrust case

In the period 2014-17, several important antitrust events occurred in the EU with regard to the use of PPCs in the OTA sector. Table 1 briefly summarizes the main inquiries, events and decisions, with a particular focus on the *Booking.com* case.

[Insert Table 1 about here]

Following the complaints filed by rival OTAs and trade groups representing hotel owners, NCAs throughout Europe opened inquiries on *Booking.com* and other dominant OTAs. The first cases occurred in the UK and Germany. In the former country, the UK Office of Fair Trading (now the Competition and Market Authority) investigated *Booking.com*, Expedia, and IHG (Intercontinental Hotels Group) on the related issue of preferential agreements. In the latter, the Bundeskartellamt prohibited HRS (Hotel Reservation Service) from using PPCs and, in December 2015, it reached a similar decision against *Booking.com*.

In relation to our analysis, in April 2015, the French, Italian and Swedish NCAs, after investigating *Booking.com*, accepted its commitment to switch from wide to narrow PPCs. The commitment came into effect across all EU countries on July 1st, 2015.⁹ We will specifically focus on this event in Section 6.2. Moreover, in July 2015, the French Parliament passed the Macron Law (Law on Economic Growth and Activity no. 2015-990), according to which all PPCs were banned. The provision was promulgated on August 6th, 2015. As it represents an interesting element of difference among the studied countries, it will be discussed in Section 6.1. Similar laws were enacted in Austria in November 2016

⁹Other countries participating at some stage to the EU investigation were Belgium, the Czech Republic, Germany, Hungary, Ireland, the Netherlands, and the UK.

and in Italy in August 2017: this latter episode (Italy's Competition Law no. 124/2017) will be analyzed in Section 6.1.

To sum up, the three countries in our study differed in their commitment against PPCs. France and Italy not only actively inquired on the case, but also directly intervened to outlaw all PPCs. Spain, on the contrary, adopted a 'wait-and-see' approach and, to date, narrow PPCs can still be adopted by OTAs.

3 Theoretical predictions

In the traditional wholesale setting, a vast theoretical literature emphasized the role of MFN agreements as a commitment device not to price discriminate between retailers (see, e.g., Schnitzer, 1994, Besanko and Lyon, 1993, Cooper and Fries, 1991). A recent stream of the MFN literature has shifted the attention to *platform PPCs*, where the contractual relationship usually follows the "agency model": sellers decide the final price on the platform, which charges a commission rate per transaction. This body of work provides the theoretical underpinnings of our analysis.

Boik and Corts (2016) set up a model in which a unique supplier reaches consumers through two platforms. The demand is elastic and both the fees and prices are linear in quantities. The results indicate that PPCs lead to higher commission fees which contribute to increase final prices. Moreover, PPCs can also distort the entry choices of new platforms, particularly if they are less efficient than the incumbent ones. Johnson (2017) compares the wholesale and the agency models in a framework with multiple revenue-sharing suppliers and platforms, and inelastic demand. He also studies the effects of platform MFN clauses, obtaining results in line with Boik and Corts (2016): PPCs soften competition between retailers. Both papers, however, do not explicitly model a direct sales channel for suppliers. Johansen and Vergé (2017) consider two platforms, several suppliers and consumers with elastic demand. A key element of their analysis is the interplay between suppliers' substitutability and their possibility to also sell directly, which imposes a limit to the fees platforms can charge. It follows that higher fees do not always result from the

imposition of PPCs which, as a consequence, do not necessarily raise final prices.

Edelman and Wright (2015) examine consumers' decision to either purchase directly or through platforms. This depends on the balance between the heterogeneous costs of joining a platform (e.g., filling out forms) and the ancillary benefits of buying through it. Platforms are allowed to invest in such benefits. PPCs harm consumers by diverting them from direct channels, thereby increasing the final prices and leading to excessive investment in these benefits. Wang and Wright (2017) propose a model related to Edelman and Wright (2015) in which platforms provide both search and intermediation services. Consumers positively value these services, but can decide to free-ride if direct purchasing is allowed, a phenomenon called "showrooming". In this context, wide PPCs prevent showrooming but hamper competition among platforms. On the contrary, narrow PPCs may preserve competition, while at the same time avoiding free-riding on the platforms' search services.¹⁰

A common trait of this theoretical literature is that prices are expected to decrease, both in direct channels and on the platforms, following the removal of PPCs.¹¹ The elimination of these restrictive contractual agreements should in fact enhance competition between sales channels, leading to lower commission fees passed through to prices. This is a medium-long run effect, as it implies an adjustment of the platforms' fees. However, as we previously pointed out, the only available evidence on OTAs fees, provided by the European Competition Network (2017) monitoring report, suggests that the EU policy interventions had a minor impact on the fees charged by *Booking.com* and other OTAs to client hotels.¹²

In this perspective, the literature could provide useful guidance on the expected price impact of the main episodes that we study. In particular, using the search platforms model adopted by Wang and Wright (2017), we focus on the optimal prices as a function of the

¹⁰Wals and Schinkel (2018) build upon Wang and Wright (2017)'s model to show that, under narrow PPCs, the adoption of a best price guarantee by a platform can achieve the same effect of wide PPCs.

¹¹A notable exception, as discussed above, is provided in the analysis by Johansen and Vergé (2017) when competitive pressure on the supplier side is relatively high.

¹²Based on this report, 90% of hotels that responded to the electronic survey stated there had been no change in the basic commission rate charged to them by OTAs in the period from July 2015 to June 2016.

fees. The expressions are as follows:

$$p_s^i = f_s^i + \mu(x_i), \quad (1)$$

$$p_s^d = \mu(x_d), \quad (2)$$

in which s are the suppliers/hotels, i are the platforms/OTAs, d is the direct channel, f_s^i are the agency fees and $\mu(x_j)$ is a measure of the markup as a function of the reservation value of the indifferent consumers on each channel $j = i, d$.

In a wide PPC regime, as it was the case in the EU before July 1st, 2015, the previous expressions (1)-(2) imply that the price of a hotel room on all sales channels is $\max\{p_s^i, p_s^d\}$. Given that *Booking.com* is the leading OTA in the EU, it is likely that its fees and mark-ups are among the highest. Hence, *Booking.com* may represent the benchmark in setting the unique equilibrium price.

Then, if only one of the OTAs relaxes its contractual terms and switches to narrow PPCs, the equilibrium prices on the platform should not be affected. Indeed, if commission fees do not change, *Booking.com* may keep acting as the reference for establishing the direct price. As a result, no price change is expected following *Booking.com's* commitment becoming binding after July 1st, 2015

Finally, in August 2015 and in August 2017, respectively, France and Italy abolished by law all types of PPCs. Following these events, hotels are supposedly free to price differentiate across sales channels. On the platforms, prices should be set according to (1). However, if commission fees f_s^i do not decline, *Booking.com's* prices may remain unchanged. To sum up, no significant price changes on *Booking.com* are predicted in these countries, at least in the short run.

4 Data collection

The empirical analysis is based on data retrieved from *Booking.com* before and after the main antitrust events of 2015 and 2017. The analysis focuses on four tourism regions in the Mediterranean: Sardinia and Sicily (Italy), Balearic Islands (Spain) and Corsica (France). The four regions are geographically close and have fairly similar characteristics, representing comparable alternatives for potential visitors. In fact, they attract almost the same type of tourist not only for the beauty of their beaches, but also for their ancient culture, art, architecture, and for their cuisine, which is rooted in the traditional and distinct flavours and foods of the Mediterranean.¹³ Of particular interest for our analysis, these regions belong to three countries that have been affected by the European inquiries on *Booking.com* and its successive developments, albeit to different degrees. Indeed, Italy and France were directly involved in the initial investigations and further removed all types of PPCs, whereas Spain never played an active role and narrow PPCs can still be lawfully enforced.

The data were retrieved using a "web crawler", designed to automatically connect to *Booking.com*. The crawler launched online queries to book accommodation in all the lodging establishments available in the regions studied. It then saved information about the posted prices together with the characteristics of the rooms available at each establishment. The crawler also retrieved data on the characteristics of the lodging establishments (e.g., type of establishment, number of rooms, star rating, users reviews, etc.) listed on *Booking.com* during the period of the study. For the purpose of our analysis, we focus only on establishments listed as hotels.¹⁴

The crawler operated on a daily basis, retrieving information on room prices for the following stay dates: from March 17th to September 30th 2015 for the events that took

¹³The Mediterranean diet is part of the "Intangible heritage" protected by UNESCO.

¹⁴There are several reasons for this choice. Data on apartments, villas and other lodging establishments tend to be more "noisy". Indeed, many of these establishments are small family-run businesses or private properties rented for the summer period. Their listing and pricing strategies are likely to be affected by a high number of factors (e.g., recurring consumers visiting every year in the same period), the contractual clauses imposed by *Booking.com* being only one of them. Finally and most importantly, in contrast to small apart-hotels and B&Bs, hotels are more likely to have a direct sales channel.

place that year, and the entire month of September 2017 for Italy’s Competition Law. For each stay date, the crawler issued queries starting 70 days before up to the day before the stay. Up until the last two weeks before the stay date, the frequency of the queries was every five to ten days. It then intensified to track more closely the room pricing as the stay date approached. Thus, the room prices refer to a specific product identified by the combination of hotel, room type and date of stay; prices are tracked during the booking period, so that we can observe whether the pricing of a product changes after a policy measure becomes active.

Our sample features a total of 3326 establishments registered on *Booking.com* as hotels: 425 in France, 1892 in Italy and 1009 in Spain. Table 2 presents the characteristics of these hotels. The average hotel in our sample has about 53 rooms, it registered on *Booking.com* in June 2011, and has a user rating of 8.07 on the platform, obtained through about 200 reviews. The average star rating is 3.28 and about 13% of the hotels are affiliated to a chain.

[Insert Table 2 about here]

Table 3 presents an overview of the hotel prices in 2015. The focus is on the evolution of the mean price of a double room, the most common room typology in our sample, for stay dates from March to October and for sub-periods of two months. The table shows that seasonal variability, which is expected on seaside tourism destinations, is well captured in our dataset. In particular, the peak prices are registered in July-August in all countries.

[Insert Table 3 about here]

5 Empirical strategy and dynamic hotel pricing

We aim to evaluate whether the most relevant antitrust events related to PPCs had an effect on hotel prices posted on *Booking.com*. The events we focus on are:

- (i) National legislative interventions banning *all* types of PPCs:
 - a. The Macron Law, which came into force in France on August 6th, 2015;

- b. Italy's Competition Law, which came into force on August 29th, 2017;
- (ii) *Booking.com's* removal of Wide PPCs:
- a. *Booking.com's* commitment to the French, Italian and Swedish CAs to remove wide PPCs, announced on April 21st, 2015;
 - b. *Booking.com's* commitment to remove wide PPCs came into force in all EU countries on July 1st, 2015.

For the national legislative interventions, (i), and for the announcement of *Booking.com's* commitment, (ii).a, there is a clear group of treated hotels. We adopt therefore a D-in-D methodology. For episode (ii).b, as the removal of wide PPCs was extended to all EU countries, a comparison group is not available as all hotels in our sample are treated. Hence, we simply study the dynamics of prices posted before and after the event took place.

More precisely, in our data, a panel identifier defines a unique product which is the combination of three pieces of information: room r , date of stay t , and hotel i of country j . The temporal dimension of the panel is denoted by the number of days d ahead of stay. For example, the posted prices of a double room with no breakfast and free cancellation for the 10th of September 2015 at the Hotel Costa Azul in Palma de Mallorca (Spain) are tracked between 70 days and the last day before the stay, *i.e.*, the 9th of September 2015, a period long enough to include observations before and after the Macron law implementation.

Given this panel structure, we focus on rooms for stay dates after each of the main events (i) and (ii) and exploit the variation of room prices along the booking period, before and after the recalled events. In particular, for events (i) and (ii).a, we adopt the following model:

$$\ln p_{sd} \times 100 = \alpha_s + \beta_1 TC + \beta_2 PostTR + \beta_3 TC PostTR + \sum_{j=1}^2 \eta_j d C_j + u_{sd} \quad (3)$$

where s identifies a unique product (room/stay date/hotel) and d the number of days ahead of stay. The dependent variable is the natural logarithm of the price of product s , d

days ahead of stay.¹⁵ The variable TC is a dummy that takes value 1 if the room is in the treated country (e.g., France in episode (i).a, Italy in (i).b, Italy and France in (ii).a); $PostTR$ denotes a dummy variable that switches on for room prices posted after the treatment (e.g., observations collected after the 6th of August 2015 in episode (i).a). In order to allow for possible different trends through the booking period, equation (3) also includes a booking time trend for panels in each country C_j (the treated country, France or Italy, defines the reference category). Finally, α_s is a product level fixed effect. The parameter of interest is β_3 , which captures the difference-in-differences effect of the treatment (e.g., for the Macron Law in (i).a, the difference between the average price change before and after the treatment in the treated group (hotel rooms in France) and the control group (hotel rooms in Italy and Spain)).

For event (ii).b, e.g., the July commitment of *Booking.com*, we use a similar specification:

$$\ln p_{sd} \times 100 = \alpha_s + \beta PostTR + \sum_{j=1}^2 \gamma_j C_j PostTR + \sum_{j=1}^2 \eta_j d C_j + u_{sd} \quad (4)$$

but all countries are treated, hence γ_j capture the before and after event price changes by country (France is the reference category).

Several issues may affect the validity of our empirical strategy. First of all, the samples used to study each event may suffer from *attrition* as some room typologies may occasionally drop out of the sample during the booking period. For example, hotels may have successfully sold these rooms well in advance of the date of stay. To detect potential problems with systematic attrition, we distinguish between "good" and "bad" panels: good panels have observations both before and after the antitrust event, whereas bad panels only include observations before the event. We use regression to check that the characteristics of good and bad panels are similar. This exercise is presented in Appendix A and it suggests that attrition does not reduce the scope of our analysis.

Second, countries may differ in many dimensions, potentially affecting the dynamics of hotel prices throughout the booking period. For example, demand conditions may

¹⁵For an easier interpretation of the results, the natural logarithm of the price is multiplied by 100.

change before or after the studied events, depending on the country that we consider. In order to deal with this issue, we employ fixed-effects panel methods and country-level trends, as explained when introducing (3). We also focus on a relatively narrow window of dates of stay to minimize the risk of heterogeneous changes in conditions between countries. Furthermore, in an effort to keep a relatively balanced panel, we focus on three observations before and three observations after the event, when available: the first, the last and the median observation of each panel. As a result of this strategy, for example, more than 50% of the observations employed to study (i).a, *i.e.*, the promulgation of the Macron Law, fall within a window of fifteen days before and after this event, and more than 90% within a window of thirty five days. Additional information on distribution of the width of the windows can be found in Appendix B.

Third, and related to the influence of demand conditions, hotel pricing is characterized by a *high volatility* in the last days of the booking period. Last minute discounts or sudden price spikes are common in this industry, and this may confound the possible effect of the policy change. For this reason, in our benchmark regressions we exclude observations related to the last 9 days before the stay. In our analysis, however, we also report the regressions based upon the full samples in order to assess the impact of price volatility towards the end of the booking period.

Last but not least, many hotels *never change prices* throughout the booking period: once the price of a room is set and posted on the platform, even if this occurs well ahead of the date of stay, it is nonetheless never amended. This holds independently of the demand conditions, the remaining room capacity or any other shock that may affect the establishment. Actually, we observed that several hotels never changed the price of a room on *Booking.com* during the whole tourism season. This is a relevant finding which may appear surprising; however, the scarce propensity of hotels to engage in dynamic pricing is well established in the hospitality literature (see, *e.g.*, Abrate and Viglia, 2016 and Melis and Piga, 2017). To illustrate this point, Table 4 identifies the *dynamic hotels* in our sample. A hotel is defined dynamic if the price of a specific room changes at least once by more than 3 euros over two consecutive observations in the booking period.

The share of dynamic hotels is usually lowest when considering small establishments and in Italy. We further note that those hotels who adjust their prices at least once, do not always do so for every room. In any case, price changes happen quite rarely, as illustrated in Appendix C.

[Insert Table 4 about here]

The overall picture suggests that the hotels in our sample are rather sluggish in changing their prices throughout the booking period. It is therefore unlikely that these hotels reacted to policy changes. For this reason, we also include in our analysis a specification based on a reduced sample that only selects the "dynamic" panels, *i.e.*, rooms whose price changed at least once. The aim of this exercise is to test whether this more dynamic sample reacted differently to antitrust interventions.

6 The price impact of the main antitrust events

6.1 Eliminating all PPCs by law

We present the main findings of our investigation on the short-term effects of eliminating *all* types of PPCs on hotel prices listed on *Booking.com*. Table 5 displays the results of estimating equation (3) for events (i).a, the promulgation of the Macron Law in France on August 6th, 2015 (Columns 1 to 3), and (i).b, the promulgation of Italy's Competition Law on August 29th, 2017 (Columns 4 to 6). The estimates focus on dates of stay between August 22nd and September 30th, 2015, and between September 13th and September 30th, 2017, respectively.

[Insert Table 5 about here]

The benchmark specification, in column (1), is based on a sample including all the panels but omitting observations in the last nine days of the booking period. As discussed in Section 5, this should limit the possible confounding effects of price volatility implied

by last minute discounts or price spikes. We refer to this specification as No LMD (Last Minute Dynamics) in the table.

The results of the estimation show that prices slightly decreased for hotels in the full sample (*i.e.*, the coefficient of PostTR, with a value of -0.758%) following the Macron Law. The D-in-D coefficient of interest (PostTR France) indicates that hotel prices in France decreased more than in the control group, but only by about 0.4%, and in a not statistically significant way. In addition, the coefficients for the number of days before the stay (Days) and its interactions with the country dummies highlight the importance of allowing for country-specific trends within the booking period. Whereas hotel prices were rather stable in France, they tended to increase as the date of stay approached, both in Italy and Spain (negative and significant coefficients for Days Italy and Days Spain).

The specifications in column (2) of Table 5 is based on a sample that also includes LMD observations. Column (3) focuses instead on a sample based exclusively on "dynamic panels" (*i.e.*, rooms whose price changed at least once in the booking period, as defined in Section 5). These specifications are indicated, respectively, as Plus LMD and Dynamic Panels.

The results of both columns (2) and (3) are in line with the benchmark of column (1). Column (2) shows that hotel prices on *Booking.com* diminished in all countries, and more so in France after the Macron Law. However, the D-in-D effect in France is again not statistically significant. We also note that the magnitude of the coefficients (PostTR and PostTR France) are even smaller than in the benchmark, indicating that price spikes tend to prevail in all countries in the last days of the booking period and, particularly, after the law came into force. Column (3) reveals that, when focusing only on the sub-sample of dynamic panels, the prices of all hotels significantly fell by about 1% and by an additional 1% in France. In magnitude, these effects are larger than in the benchmark, yet the D-in-D coefficient is again not statistically significant.

Overall, these results indicate that, at least for dates of stay between August 22nd and September 30th, 2015, the Macron Law did not significantly affect prices charged on *Booking.com* by French hotels. We can summarize this discussion in:

Finding 1. *The banning of all PPCs in France on August 6th, 2015 did not bring about significant short term price changes on Booking.com.*

We now turn to Italy's Competition Law. The benchmark specification in column (4) indicates that prices on *Booking.com* increased in all countries in our sample. The increase was of about 0.9% for hotels in the control group. Contrary to expectations, prices increased in Italy by a further 1%. Both the coefficient for Italy and that for the control group are, however, not statistically significant. Moreover, in each country the time trends are not statistically significant, as indicated by the coefficients for the number of days before the stay (Days) and its interactions with the country dummies. Overall, this suggests that prices were rather steady before and after the legislative intervention in Italy, for dates of stay between September 13th and September 30th, 2017.

The specification in column (5) of Table 5 reintroduces in the sample the observations from the last 9 days of the booking period. Column (6), instead, reports the results of the estimation focusing exclusively on the dynamic panels.

The results in columns (5) and (6) confirm the unresponsiveness of prices highlighted in benchmark column (4). There are, however, some noticeable differences. In column (5), for instance, whereas the prices of the control group still increase, the sign of the D-in-D effect (PostTR Italy) goes in the opposite direction (-2.4%). Nonetheless, the latter effect is not statistically significant and may be driven by last minute discounts. In column (6) the results are fully in line with the benchmark, the only difference being represented by the magnitude of the coefficients of interest, which are slightly larger for both the control group (+1.4%) and the treated group (+1.6%). Also in this case, both coefficients are not statistically significant. We can then state the following:

Finding 2. *The banning of all PPCs in Italy on August 29th, 2017 did not bring about significant short term price changes on Booking.com.*

The evidence provided on the legislative interventions of both France and Italy is fairly consistent and robust. At least in the short run, our results clearly indicate that prices on *Booking.com* were not significantly affected by the complete removal of PPCs. These

findings are further illustrated by Figures 1 and 2. These figures report the full distribution of the price differentials before and after the two events that we analyzed, by date of stay. For clarity of presentation, we limit our attention to 3 and 4 star hotels, as these categories are the most represented in our sample. In each figure, the left panel refers to the treated group and the right panel to the control group. Both for the Macron Law (Figure 1) and for Italy's Competition Law (Figure 2), we observe that, although there is a wide span of price differentials (positive and negative), the median of both groups is actually zero.

[Insert Figure 1 about here]

[Insert Figure 2 about here]

Finally, as chains are likely to have a higher bargaining power over OTAs than independent hotels, one may wonder whether they responded faster to the policy changes. In Table 6, we show how the D-in-D coefficients vary depending on chain affiliation. For the French case, following the Macron Law, the price of both chain and independent hotels decreased, with the former experiencing a larger price drop than the latter. However, the difference is rather small in absolute value and not statistically significant. Regarding Italy's Competition Law, chain hotels experienced a price reduction, whereas the opposite occurred for independent hotels. Both effects are, however, not statistically significant. To sum up, the analysis largely confirms the results of Table 5 for both events.

[Insert Table 6 about here]

6.2 Antitrust dealings with Booking.com

We now analyze the short-term price effects of *Booking.com's* commitment to switch from wide to narrow PPCs. Table 7 presents the estimation of equation (3) for event (ii).a, *i.e.*, the announcement of the commitment in front of the French, Italian (and Swedish) NCAs of April 21st, 2015 (Columns 1 to 3), together with the estimation of equation (4) for event (ii).b, *i.e.*, the enforcement of the commitment across all EU countries on July 1st, 2015

(Columns 4 to 6). The estimates are based on dates of stay between May 6th and June 30th, 2015, and between July 16th and August 31st, 2015, respectively.

[Insert Table 7 about here]

As in Section 6.1, the benchmark specification in column (1) includes all the panels, minus the observations in the last nine days of the booking period. The results of the estimation indicate that, following the April announcement, prices slightly increased for the control group (+0.5%). Such an increment is, however, not statistically significant. The D-in-D coefficient (PostTR Treated) shows that hotel prices in the treated countries, France and Italy, were subject to a further negligible increase, which is again not significant. The country coefficients for the number of days before the stay (Days) are also very small in magnitude and not significant, completing a picture that reveals very sluggish pricing in the window of dates around the announcement.

The specifications in columns (2) and (3) provide further evidence confirming these findings. As usual, column (2) includes the observations from the the last nine days of the booking period. The results are not very different compared to the benchmark. The moderate price increase in the control group (+0.7%) is now significant, but only at the 5% level; the D-in-D coefficient of interest is negative (-0.4%), indicating a very modest price reduction for hotels in France and Italy, but still not significant. The results of this specification, as in previous events, may reflect the volatility of the last days of the booking period. Column (3) focuses on dynamic panels and the results display a similar pattern. Prices in this sub-sample increased slightly more in the control group (+0.8%) while they decreased by a negligible amount (-0.07%) for treated hotels; both coefficients are, again, not significantly different from zero.

It follows that also the evidence that comes from analyzing this event points to a substantial lack of immediate response by hotels, at least for dates of stay between May 6th and June 30th, 2015. We can state the following:

Finding 3. *Booking.com's commitment to switch from wide to narrow PPCs on April 21st, 2015 did not bring about significant short term variations on the prices hotel charged on Booking.com.*

The result is perhaps not surprising, given that we focused on the simple announcement of a set of commitments that were going to take place in July of the same year, initially confined to Italy, France, and Sweden. However, on June 25th, 2015, the commitment of *Booking.com* to eliminate wide PPCs was extended to all EU member states, starting from July 1st, 2015. It follows that the three countries that we consider were all affected by the event, although one may expect that hotels in Spain were less prepared to adjust prices on *Booking.com*, especially during peak season.

The final exercise that we carry out is therefore a careful investigation of the effect on hotel prices of the enforcement of the commitment on July 1st, 2015. Column (4) presents the results of estimating equation (4) in the benchmark specification, *i.e.*, on a sample with all panels but excluding the last 9 days of the booking period. The modest rise in hotel prices in France (+0.4%) is not statistically significant, as it can be seen from the coefficient and standard error of PostTR. The price dynamics after the event for the other countries are measured by taking French hotels as a benchmark. As Spanish hotels decreased their prices compared to the benchmark (-0.5%), the overall net effect on prices in Spain is about -0.1%. However, the coefficient of PostTR Spain is again not significant, indicating no difference in the price change of Spanish and French hotels. Compared to France, instead, the price decrease of Italian hotels is significant at the 5% level. The PostTR Italy coefficient is approximately -0.7%, implying an overall net price decrease in Italy of about 0.3%, a very small magnitude after all. The country time trends are all significant: within the booking period, prices in France tended to decrease as the date of stay approaches, whereas the opposite pattern is registered for Italy and Spain. These effects are visualized in Figure 3, which further highlights that they are not only rather small in magnitude but also not statistically different from zero.

[Insert Figure 3 about here]

The specifications in columns (5) and (6) corroborate the findings of the benchmark in (4). Column (5) reintroduces in the sample the observations related to the last 9 days of the booking period. The increased price volatility renders the coefficients of all the

variables statistically significant. In particular, the new estimates suggest that French hotels increased their prices after July 1st by almost 1%. Italian and Spanish hotels had a significantly different price dynamics, although the implied price changes (obtained as the sum of the coefficient of PostTR and of the coefficients of PostTR Italy and PostTR Spain, respectively) are very small in magnitude: -0.27% in Italy and -0.19% in Spain. Column (6) considers only the "dynamic panels", and its results indicate price reductions in all countries: -0.3% in France, a further -0.45% in Italy leading to an overall -0.75%, and an increase of 0.18% in Spain, implying a decrease of 0.13%.

As a consequence, we confirm that the pricing behaviour of hotels on *Booking.com* did not significantly change when the commitment of *Booking.com* became effective, at least for dates of stay between July 16th and August 31st, 2015. We can then summarize our results in:

Finding 4. *The prices that hotels charged on Booking.com did not significantly change in all the countries of our study around the switch from wide to narrow PPCs on July 1st, 2015.*

All in all, we can conclude that price variations, if any, were very small, both following the announcement of *Booking.com*'s commitment and immediately after the commitment came into force. These findings are consistent with those provided in Section 6.1, with reference to the ban of all PPCs. The overall picture that emerges from our analysis reveals therefore that the policy interventions against PPCs, introduced at different levels in the EU, did not lead to significant short-run effects on the pricing decisions of hotels on *Booking.com*.

7 Synthetic control analysis

A potential concern is the quality of the control groups employed in our previous analysis. In particular, when studying the price impact of banning all types of PPCs in Subsection 6.1, we used hotels in non-treated countries as a control for their counterparts in the treated country. We focus on these events and perform a synthetic control group analysis

to address this issue (Abadie and Gardeazabal, 2003, Abadie et al., 2010).¹⁶ Specifically, this method relies on a weighted average of control firms (synthetic control) that is as similar as possible to the treated hotels regarding the pre-treatment prices on *Booking.com*. The benefit of building this synthetic control group is that the characteristics of the treated hotels before the regulatory change can be better approximated by a combination of untreated lodging establishments rather than by an unweighted group of hotels. This methodology has been recently applied in the context of platforms also by Calzada and Gil (2017) and De los Santos and Wildenbeest (2017).

In order to implement this analysis, we collapse our specific search observations data (room-date of stay-days ahead of stay level) into group-week for the Macron Law and into group-date for Italy's Competition Law. In the former case, given the relatively long period of data coverage, grouping observations by week allows for a clear data visualization. In the latter case, this is not necessary, given that daily data are sufficiently scattered. We define our groups by country (France, Italy or Spain) and hotel star rating (one to five stars). This categorization enables us to create a synthetic control group for the average treated hotel and ten potential controls. The program creates optimal weights using the logarithm of *Booking.com*'s prices for the pre-treatment period and a number of other co-variates (*e.g.*, the days ahead of stay, the chain affiliation dummy, the hotels' capacity, the users' rating and the number of reviewers on the platform, the hotels' experience using *Booking.com* and the town level availability of hotels).

Figures 4 and 5 show the logarithm of prices on *Booking.com* for the treated units and their synthetic counterparts before and after the Macron Law and Italy's Competition Law, respectively. The figures are based on a sample that excludes observations in the last nine days of the booking period, therefore corresponding to the No LMD benchmark in Table 5, columns (1) and (4). In Appendix D we also present the synthetic control analysis for the sample including the last nine days and that focusing on dynamic panels only, as in columns (2)-(3) and (5)-(6) of Table 5, respectively.

¹⁶We limit our attention to the national legislative interventions because event (ii).a is an announcement rather than a regulatory change, while event (ii).b does not allow for a treated-control group design.

[Insert Figure 4 about here]

[Insert Figure 5 about here]

The figures show that, prior to the legislative interventions, the synthetic control closely tracks the average treated hotels, the only exception being represented by the very initial days for the Italian case. Notice, however, that the discrepancy between the treated and the control units occurs for a limited number of days and its magnitude is at most 1.5%. After the events, the average treated hotels keep following the respective synthetic control units, slightly diverging in the last periods covered by our samples. The price of the treated unit slightly decreases in France, whereas it increases in Italy. Overall, these price patterns are in line with the estimates of the D-in-D effects in columns (1) and (4) of Table 5, respectively.

8 Discussion and conclusions

Online platforms profoundly revolutionized the business model of firms belonging to different sectors. Amid their impressive growth, these platforms have been raising a number of new antitrust challenges and the use of MFN clauses is currently one of the most debated. This paper focused on PPCs imposed by OTAs to client hotels and presented one of the first empirical assessments of the short-run effects of the (both partial and full) removal of these restrictive contractual provisions. Our illustration was based on data from *Booking.com*, the most popular OTA in the EU. The analysis covered all the main antitrust events that involved *Booking.com* between 2015 and 2017 in the countries of our sample: France, Italy and Spain.

The D-in-D analysis showed that the complete removal of *all types of PPCs* did not lead to significant short-run price reductions on *Booking.com* in France, following the promulgation of the Macron Law. The price reductions, if any, were of very small magnitude, ranging from 0.4% to 1%. Similar results arose when considering the short-run effects of Italy's Competition Law. In this case, prices on *Booking.com* did not even appear to diminish;

any effect was, once again, not statistically significant. The results were also confirmed by a synthetic control analysis, for both the Macron Law and Italy's Competition Law. The other two events that we considered, related to the *switch from a wide to a narrow PPC regime*, also reveal very small price variations, mostly not statistically significant.

Our findings do not necessarily imply that the policy interventions in the EU were ineffective. Indeed, we focused on a narrow window of dates in the vicinity of the major policy events. Hence, we were able to capture only localized and short-run price variations. This does not exclude the potential presence of price effects in the medium-long run. In a companion paper (Mantovani et al., 2017), we used a related dataset to investigate the dynamics of hotel prices listed on *Booking.com* in the 2014-16 period. Our methodology consisted of matching rooms with identical or very similar characteristics and then comparing prices at one year distance. The evidence showed an overall price decrease between 2014 and 2015, followed by a price surge between 2015 and 2016. We rationalized these results by taking into account the interplay between different yet related facts that characterized the 2014-16 period, including demand changes and *Booking.com's* innovative strategies, that may have countered the removal of wide and narrow PPCs. The presence of these concurrent factors, however, did not allow the identification of the potential effect of the EU antitrust interventions.

Moreover, our dataset only covered prices posted on *Booking.com*. Hence, we cannot exclude that possible price reductions occurred on other OTAs, for example Expedia, and/or on hotels' direct sales channels. The complementary results obtained by Hunold et al. (2018) and Ennis et al. (2018) seem to point in this direction, especially for the direct channels. Interestingly, a recent paper by Cazaubiel et al. (2018) uses a unique dataset from two major hotel chains in Scandinavia in order to estimate the degree of substitution between *Booking.com* and Expedia, and hotels' own websites. They consider a boycott against Expedia headed by hotels between 2012 and 2014. Their research is still in progress, but preliminary evidence shows that, during the boycott, most consumers remained loyal to Expedia. They also find that hotels' own websites are poor substitutes for OTAs, which seems to confirm that price reductions on direct channels are compatible with a certain

degree of price stickiness on OTAs.

Last but not least, as in most of the literature, we did not observe the commission rates charged by *Booking.com* to client hotels. However, our conclusions are not only consistent with the existing available evidence but they can also be interpreted on the basis of the intuition provided by the theoretical literature. On the one hand, the findings provided by the European Competition Network (2017) documented not only minor changes in the commission fees charged by OTAs following the removal of PPCs, but also a more general stasis in the pricing behavior of hotels. On the other hand, theoretical models suggest that price reductions should be driven by decreases in commissions rates. Yet, precisely because such rates did not significantly decline, prices remained relatively stable, as suggested by the theoretical predictions in Section 3.

Notwithstanding these caveats, the analysis in the paper and the results provided can be especially relevant to policy makers, in a global landscape characterized by heterogeneity. The evidence, in fact, is based on a uniquely detailed database on hotel prices on *Booking.com* in three EU countries which were differently affected by recent antitrust interventions against PPCs. The EU's action constituted an unprecedented attempt to regulate OTAs. In the rest of the world, with exceptions such as Australia, New Zealand and Switzerland, NCAs have only recently looked into this issue. Moreover, similar forms of platform MFN provisions in industries as diverse as publishing and insurance are receiving increasing attention. Hence, the EU experience may be extremely helpful not only to other countries but also to other sectors, in which similar clauses are adopted.

The most important lessons that come from our study are as follows. First, if price variations in response to policy changes are to be expected, they may not take place in the short run. Eventual price reductions, if any, are more likely to occur in the medium-long run and especially on small OTAs and/or on the hotels' direct sale channels, rather than on a dominant platform such as *Booking.com*. Second, our results seem to confirm the scarce propensity of hoteliers to engage in dynamic pricing. The reasons for this are manifold and cannot be only related to the stringent contractual relations imposed by OTAs. However, this essentially means that hoteliers are not particularly keen on price differentiating

across sales channels, thereby stifling one of the main pro-competitive mechanisms of removing PPCs. This suggests that the intrinsic characteristics of an industry must be carefully taken into account by regulators. Third, our work, combined with the evidence in the European Competition Network (2017) report, suggests that the policy intervention should be complemented by an effective information campaign in order to induce a more immediate price response by hoteliers. The lack of awareness of the contractual changes may have crucially reduced any potential short-run impact on prices.

Finally, leading OTAs such as *Booking.com* responded to the elimination of PPCs by introducing new forms of contractual relationships with client hotels. Between 2015 and 2016, *Booking.com* also undertook significant structural changes that improved the quality of its services. Case in point, precisely on April 2015, *Booking.com* launched the *BookingSuite* system, which helps independent and boutique hotels to build innovative and user-friendly websites. Hence, *Booking.com* may have reinforced its control over client hotels, thereby affecting their pricing decisions. This may have contributed to keep prices relatively stable, together with opening new questions in terms of price transparency. In this context, a careful assessment of the medium-long run effect of antitrust intervention on OTAs is particularly challenging and it will require further investigation.

A Attrition: comparing "good" and "bad" panels

In this appendix, we focus on the issue of the possible attrition bias of rooms dropping out during the booking period. These may systematically differ from those that are left in the sample before and after the events studied. We use the following specification to compare "good panels", used in our sample, with "bad panels", those rooms whose price could be retrieved only before the event under consideration:

$$\ln p_{sd} = \alpha_s + \sum_{j=1}^2 \omega_{1j} d C_j + \sum_{j=1}^2 \omega_{2j} d C_j BadPanel + u_{sd}, \quad (5)$$

where *BadPanel* is a dummy that takes value 1 if a panel contains only observations before the date of the event. The parameters of interest are ω_{2j} , which capture the difference in the slopes of the prices between good and bad panels in each country.

The results are reported in Table 8 for the national legislative interventions. In both the Macron Law and Italy's Competition Law, the slopes of the bad panels are not significantly different from the good ones for all the countries in our sample. Table 9 reports instead the results related the switch from wide to narrow PPCs. For the April's commitment, we once again confirm that bad panels conform to good panels. Only with regard to July's removal of wide PPCs, we detect some potential attrition. In particular, the price of bad panels in France grows significantly faster than those of good panels, whereas the opposite occurs in Italy. As our analysis of event (ii).b is not based on a D-in-D design, the latter findings on bad panels do not impinge on the overall robustness of our general findings.

[Insert Table 8 about here]

[Insert Table 9 about here]

B Distribution of the dates before and after the events

In this appendix we report precise information about the width of the windows of dates before and after the four events analyzed in the paper. Table 10 shows the percentiles of

the distribution. More precisely, negative (positive) numbers indicate the distance between the percentile and the last (first) observation retrieved prior to (after) the event. For all events, the table confirms that the vast majority of observations lies within a relatively narrow time span.

[Insert Table 10 about here]

C Dynamic pricing: panel level evidence

Table 11 provides evidence on dynamic pricing at room (panel) level. For each event, we report the percentage of dynamic panels by nation. One can notice that between 50 % and 70 % of the rooms have changed price at least once during the booking period. No price variation is, instead, detected in the remaining rooms.

[Insert Table 11 about here]

D Synthetic control analysis: other specifications

In this appendix we present the graphical visualization of the synthetic control analysis carried out in Section (7) for the samples including the last nine days (Plus LMD) and those considering dynamic panels only (Dynamic Panels). Figures 6 and 7 confirm that, before the studied events, the synthetic control tracks the average treated hotels. The Plus LMD panels show that the common path of the two units persists also after the events. Turning to Dynamic Panels, we notice instead a downward divergence of the prices of the treated hotels a few weeks after the Macron Law. The magnitude of the difference ranges between 1 and 2%, in line with the D-in-D effects in column (3) of Table 5. In the case of Italy, the two units follow a similar trajectory also after the event, with the treated unit mostly lying below the synthetic one.

[Insert Figure 6 about here]

[Insert Figure 7 about here]

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Tables

Table 1: Inquiries and decisions on PPCs in the EU, 2014-17

May 2014	Italian Competition Authority (ICA) investigates <i>Booking.com</i> .
Sep 2014	UK Competition and Market Authority (CMA) investigates <i>Booking.com</i> .
Nov 2014	French Competition Authority (FCA) investigates <i>Booking.com</i> .
Dec 2014	European Commission launches market tests on OTAs.
Apr 2015	Parallel decisions by the FCA, SCA and ICA: <i>Booking.com</i> commits to eliminate wide PPCs.
Jul 2015	<i>Booking.com</i> 's commitment comes into effect in the EU.
Aug 2015	Macron Law promulgated in France: all PPCs prohibited.
Sep 2015	CMA closes investigation on <i>Booking.com</i> .
Oct 2015	Italian Parliament proposes a law to eliminate all PPCs.
Dec 2015	German Competition Authority prohibits <i>Booking.com</i> from applying PPCs.
Nov 2016	Austrian Parliament approves a law eliminating all PPCs.
Aug 2017	Italian Parliament approves Competition Law 124/2017: all PPCs prohibited
Nov 2017	Belgian Government proposes to outlaw all PPCs.

Table 2: Hotel characteristics, full sample

	Obs	Mean	Std Dev	Min	Max
Users' rating	2752	8.07	0.78	4.7	9.9
Number of reviewers	3171	199.54	254.08	5	3692
Stars	2221	3.28	0.87	1	5
Number of rooms	3326	52.68	83.65	1	1024
On Booking.com since	3326	12/06/11	971.80	28/08/01	16/10/15
Chain affiliation	3326	13.05	33.69	0	1

Table 3: Mean price in Euros of a double room on *Booking.com* in 2015

	Mar-Apr	May-Jun	Jul-Aug	Sep-Oct
France	88	118	151	111
Obs	36,408	131,645	115,116	97,362
Italy	84	98	130	98
Obs	158,245	536,764	460,634	367,407
Spain	110	123	171	128
Obs	71,791	316,228	262,111	234,221

Table 4: Dynamic hotels: share of hotels that change prices at least once

	Hotel size		
	Small (< 25)	Medium (25 – 99)	Large (> 99)
France	221	145	12
% dynamic	86.67	92.95	85.71
Italy	918	402	102
% dynamic	70.83	86.45	77.86
Spain	294	256	355
% dynamic	88.29	90.78	90.10

Table 5: Eliminating PPCs in France and Italy

	(i.a) Macron Law			(i.b) Italy's Competition Law			
	(1)	(2)	(3)	(4)	(5)	(6)	
Variables	D-in-D No LMD	D-in-D Plus LMD	D-in-D Dynamic Panels	Variables	D-in-D No LMD	D-in-D Plus LMD	D-in-D Dynamic Panels
PostTR	-0.758*** (0.183)	-0.398** (0.195)	-1.039*** (0.361)	PostTR	0.936 (1.624)	5.036*** (1.904)	1.421 (2.572)
PostTR France	-0.399 (0.334)	-0.288 (0.349)	-1.096 (0.691)	PostTR Italy	1.105 (2.101)	-2.410 (2.457)	1.603 (3.367)
Days	0.0186* (0.010)	0.046*** (0.012)	0.037* (0.020)	Days	-0.020 (0.012)	-0.014 (0.016)	-0.036* (0.020)
Days Italy	-0.054*** (0.013)	-0.075*** (0.015)	-0.096*** (0.025)	Days France	0.033 (0.022)	0.070*** (0.026)	0.057 (0.037)
Days Spain	-0.077*** (0.014)	-0.079*** (0.017)	-0.129*** (0.026)	Days Spain	-0.003 (0.021)	0.035 (0.026)	0.002 (0.033)
Constant	462.548*** (0.277)	461.542*** (0.303)	475.465*** (0.490)	Constant	500.650*** (1.150)	498.026*** (1.383)	506.571*** (1.861)
Observations	203,354	228,857	106,789	Observations	227,490	264,988	144,543
R-squared	0.005	0.003	0.008	R-squared	0.035	0.027	0.055
Number of panels	49,763	49,764	25,998	Number of panels	48,800	48,812	31,482

Dependent variable: Logarithm of room price \times 100

France is the treated country in (i.a); Italy is the treated country in (i.b)

Robust standard errors in parentheses

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

Table 6: Eliminating PPCs in France and Italy and chain hotels

Variables	(1)	(2)
	(i).a	(i).b
	No LMD	No LMD
PostTR France No Chain	-0.184 (0.352)	
PostTR France Chain	-0.528 (1.728)	
PostTR Italy No Chain		1.789 (2.088)
PostTR Italy Chain		-2.951 (3.563)
Constant	462.5*** (0.277)	501.2*** (1.242)
Room FE	Yes	Yes
Time trends	Yes	Yes
Observations	203,354	227,490
R-squared	0.006	0.036
Number of panels	49,763	48,800

Dependent variable: Logarithm of room price \times 100

Only D-in-D coefficients reported

France is the treated country in (i).a; Italy is the treated country in (i).b

Robust standard errors in parentheses

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

Table 7: *Booking.com's* removal of Wide PPCs

(ii).a April Commitment				(ii).b Wide Parity Removal			
	(1)	(2)	(3)		(4)	(5)	(6)
	D-in-D	D-in-D	D-in-D		Countries	Countries	Countries
Variables	No LMD	Plus LMD	Dynamic Panels	Variables	No LMD	Plus LMD	Dynamic Panels
PostTR	0.498 (0.311)	0.716** (0.354)	0.832 (0.755)	PostTR	0.420 (0.275)	0.981*** (0.290)	-0.312 (0.475)
PostTR Treated	0.009 (0.345)	-0.381 (0.414)	-0.070 (0.865)	PostTR Italy	-0.726** (0.320)	-1.255*** (0.348)	-0.466 (0.549)
				PostTR Spain	-0.524 (0.364)	-1.174*** (0.387)	0.184 (0.625)
Days	0.009 (0.011)	0.014 (0.011)	0.022 (0.029)	Days	0.052*** (0.015)	0.087*** (0.015)	0.072*** (0.026)
Days Italy	-0.002 (0.014)	-0.017 (0.014)	-0.008 (0.035)	Days Italy	-0.069*** (0.017)	-0.103*** (0.018)	-0.114*** (0.029)
Days Spain	-0.032* (0.019)	-0.018 (0.019)	-0.061 (0.040)	Days Spain	-0.101*** (0.019)	-0.140*** (0.019)	-0.142*** (0.032)
Constant	440.815*** (0.320)	440.461*** (0.369)	457.181*** (0.711)	Constant	477.558*** (0.275)	477.045*** (0.291)	490.040*** (0.491)
Observations	143,410	163,344	57,179	Observations	259,885	287,313	118,128
R-squared	0.003	0.001	0.004	R-squared	0.004	0.005	0.006
Number of panels	38,537	38,538	15,274	Number of panels	59,214	59,223	33,393

Dependent variable: Logarithm of room price \times 100

France and Italy are the treated group in (ii).a

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 8: "Good" vs "bad" panels: Macron Law and Italy's Competition Law

(i).a Macron Law		(i).b Italy's Competition Law	
Variable	(1)		(2)
Days France	0.550** (0.236)	Days Italy	0.393* (0.201)
Days France BadPanel	-0.549 (0.345)	Days Italy BadPanel	0.107 (0.266)
Days Italy	0.444 (0.326)	Days France	-0.690** (0.331)
Days Italy BadPanel	0.198 0.437	Days France BadPanel	0.507 (0.408)
Days Spain	0.964*** (0.328)	Days Spain	0.259 (0.363)
Days Spain BadPanel	0.331 (0.448)	Days Spain BadPanel	-0.207 (0.357)
Constant	462.893*** (0.062)	Constant	499.848*** (0.090)
Observations	116,868	Observations	201,142
R-squared	0.008	R-squared	0.006
Number of panels	58,474	Number of panels	100,571

Dependent variable: Logarithm of room price \times 100

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

Table 9: "Good" vs "bad" panels: April Commitment and Wide PPCs Removal

(ii).a April Commitment		(ii).b Wide Parity Removal	
Variable	(1)	Variable	(2)
Days France	-0.199 (0.203)	Days France	0.028 (0.320)
Days France BadPanel	0.157 (0.235)	Days France BadPanel	1.134*** (0.439)
Days Italy	-0.112 (0.291)	Days Italy	0.679* (0.372)
Days Italy BadPanel	0.022 (0.334)	Days Italy BadPanel	-1.145** (0.530)
Days Spain	1.238*** (0.381)	Days Spain	0.600 (0.409)
Days Spain BadPanel	-0.480 (0.405)	Days Spain BadPanel	-0.617 (0.510)
Constant	441.400*** (0.040)	Constant	475.959*** (0.063)
Observations	166,604	Observations	128,310
R-squared	0.004	R-squared	0.004
Number of panelid	83,310	Number of panelid	64,164

Dependent variable: Logarithm of room price \times 100
 Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 10: Distribution of the dates of search by event

Percentile	Macron	Italy	April	July
5 %	-39	-33	-31	-37
10 %	-32	-28	-25	-31
25 %	-21	-22	-13	-20
50 %	-7	-9	0	-3
75 %	8	8	16	9
90 %	26	13	26	19
95 %	30	17	34	28

Table 11: Dynamic panels

	Macron	Italy	April	July
France				
% dynamic panels	49.54	47.42	33.57	55.12
Number of panels	6,724	3,494	6,891	7,757
Italy				
% dynamic panels	50.88	62.94	37.62	55.93
Number of panels	27,444	23,347	18,382	33,195
Spain				
% dynamic panels	55.81	69.07	49.81	57.86
Number of panels	15,595	22,077	13,264	18,262

Figures

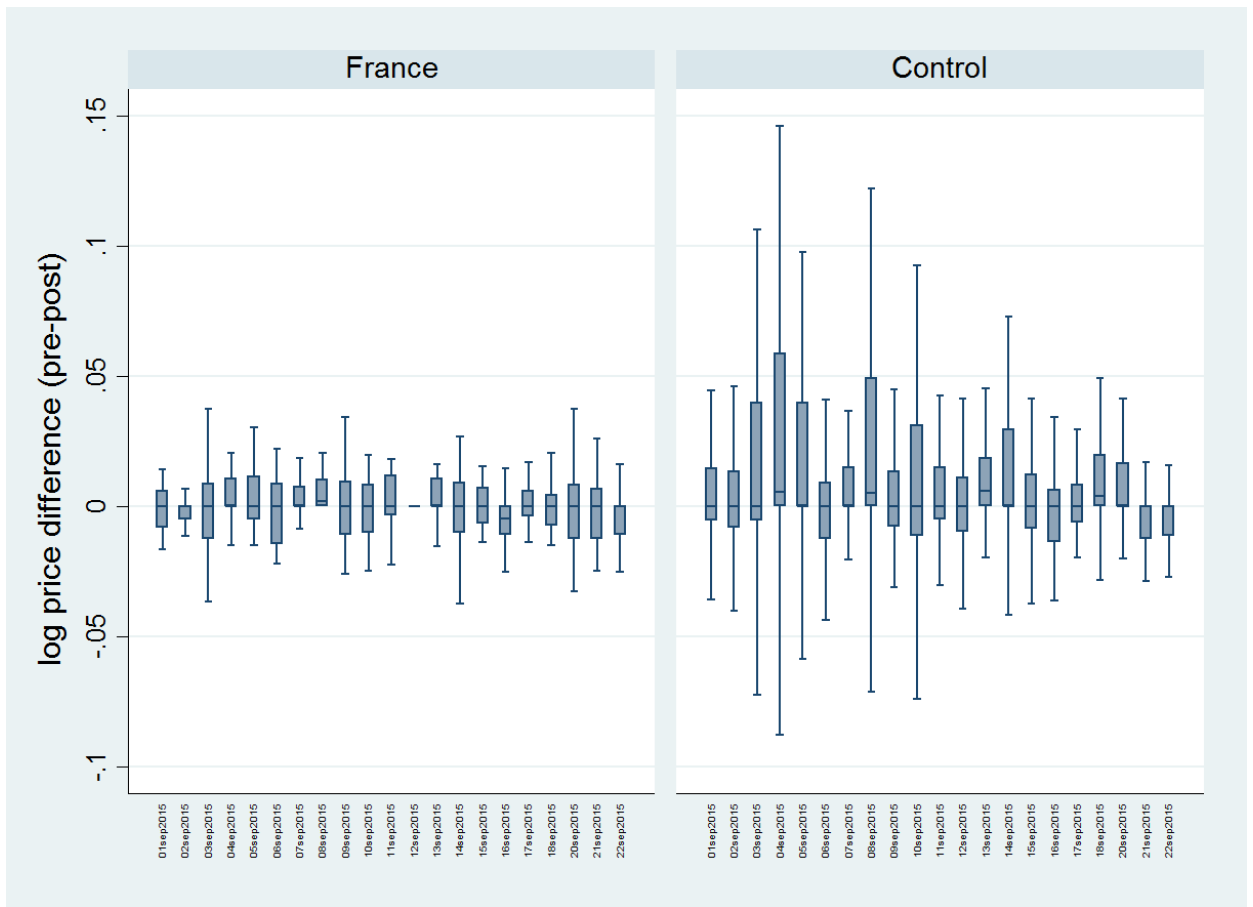


Figure 1: Distribution of price changes pre and post the Macron Law: 3 and 4 star hotels

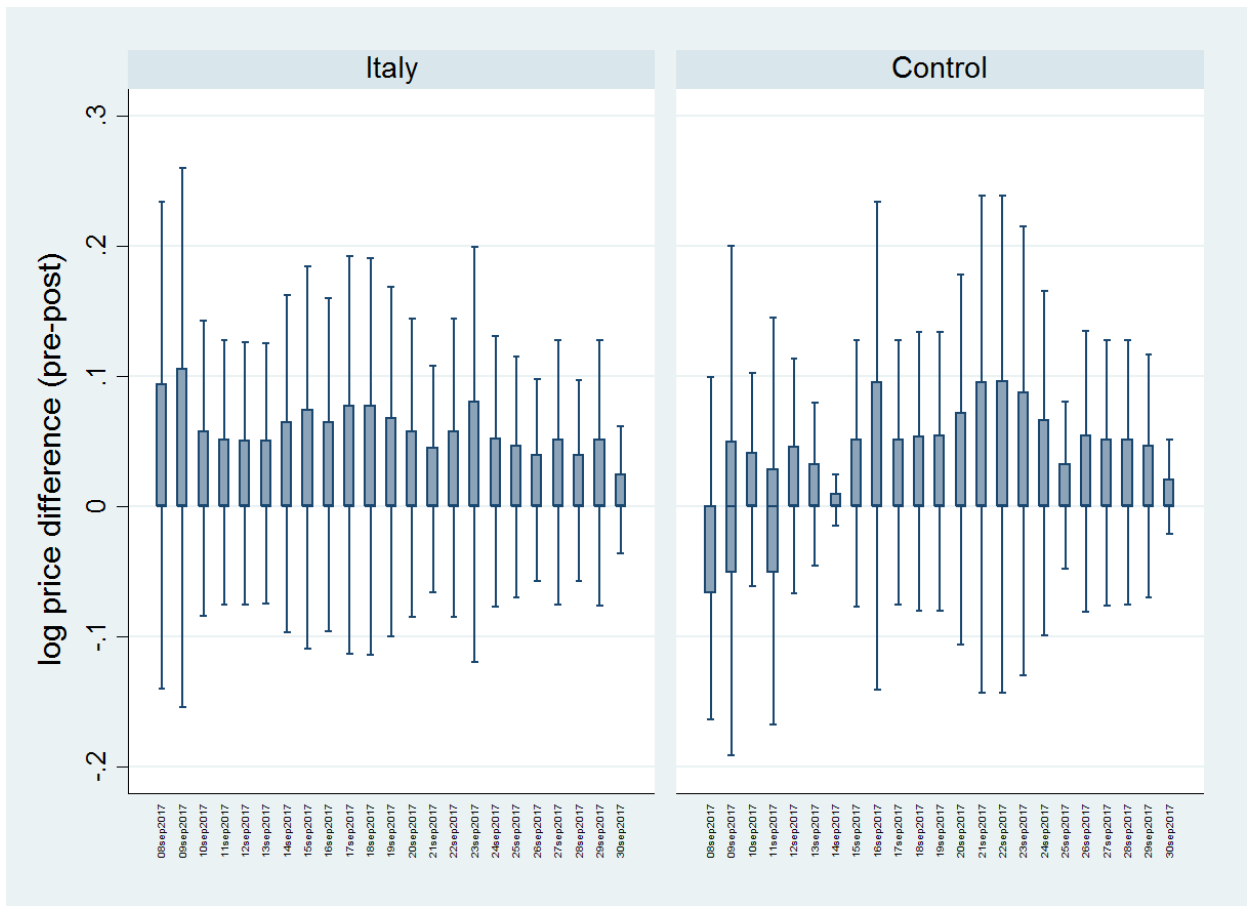


Figure 2: Distribution of price changes pre and post Italy's Competition Law: 3 and 4 star hotels

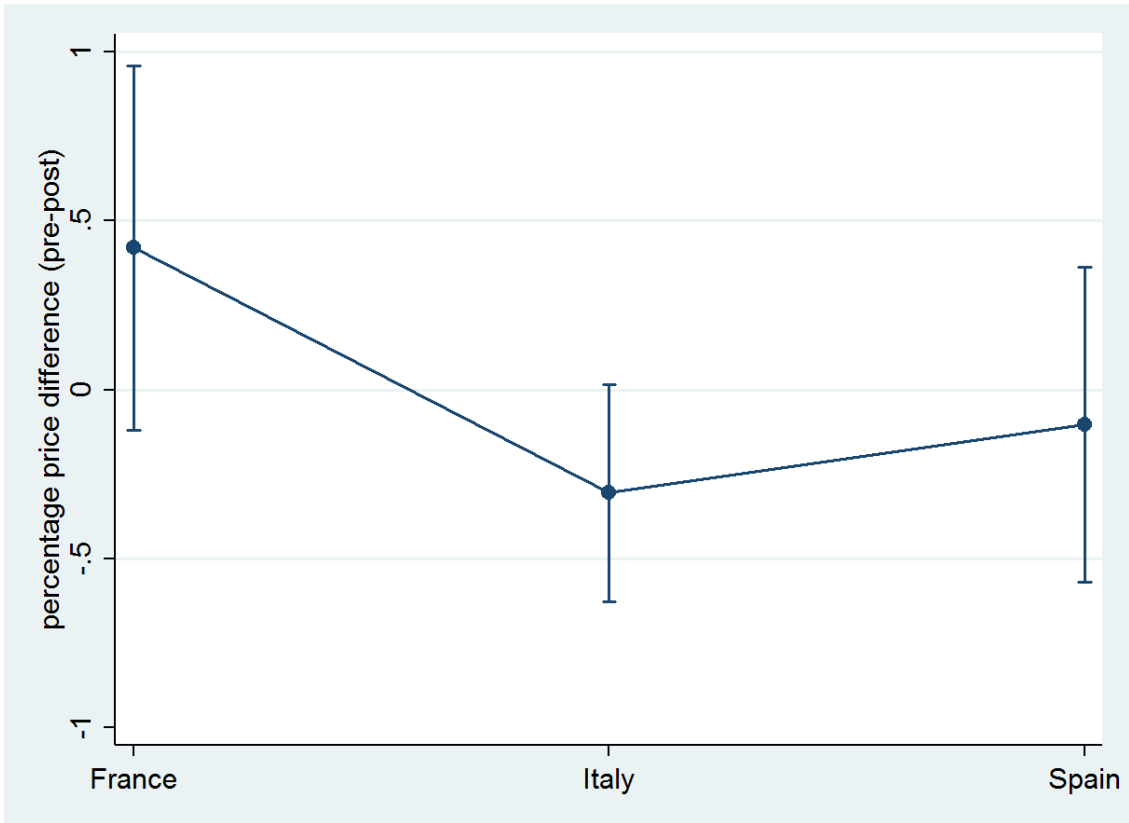


Figure 3: Hotel price changes pre and post *Booking.com*'s July commitment in the EU

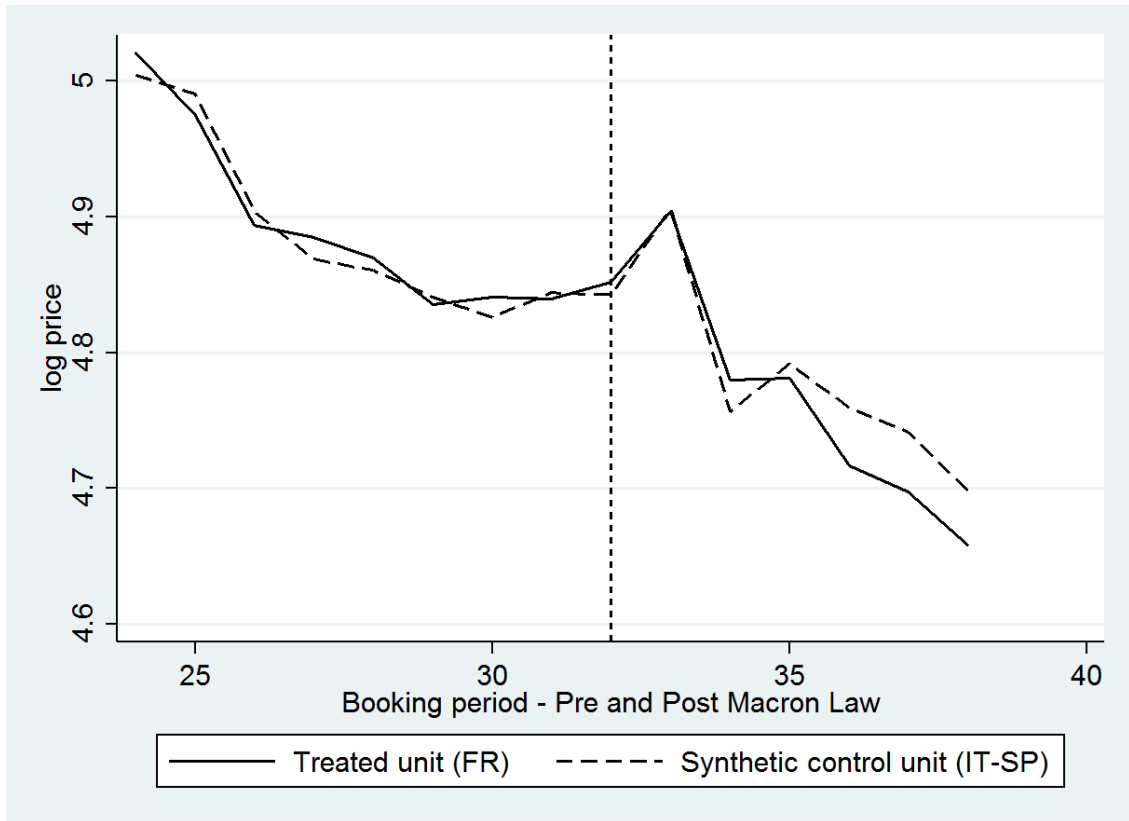


Figure 4: Synthetic controls and hotel prices pre and post the Macron Law: weekly data, excluding the last nine days of the booking period.

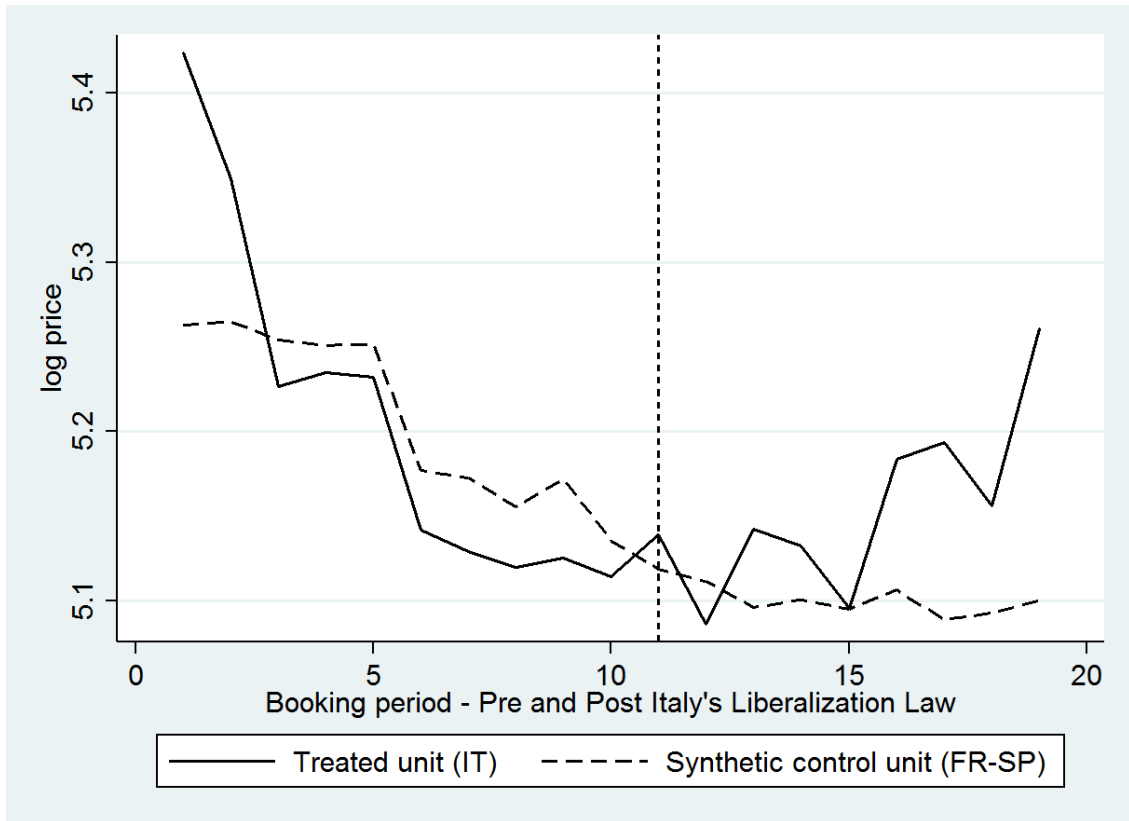


Figure 5: Synthetic controls and hotel prices pre and post Italy's Competition Law: daily data, excluding the last nine days of the booking period.

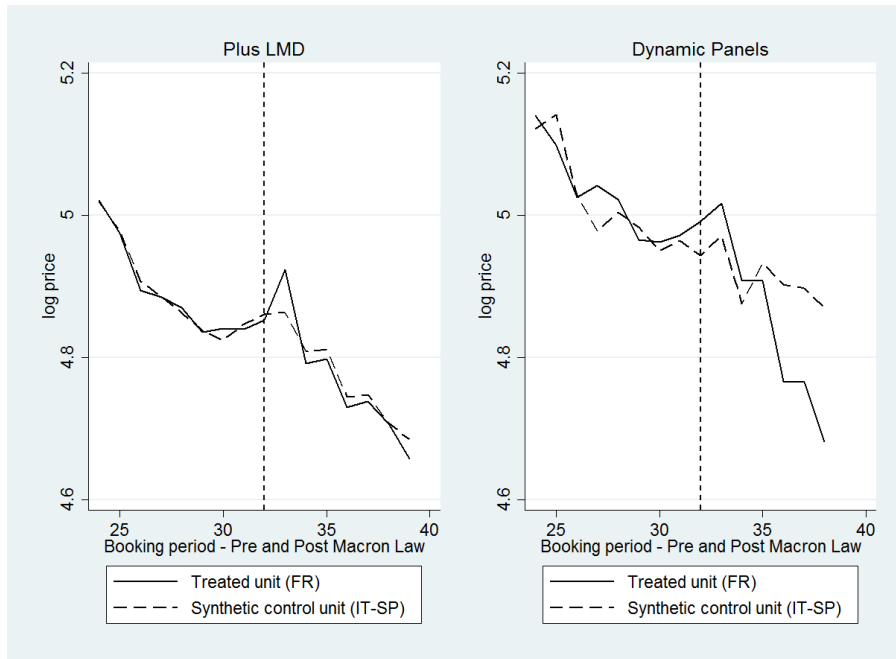


Figure 6: Synthetic controls and hotel prices pre and post the Macron Law: weekly data.

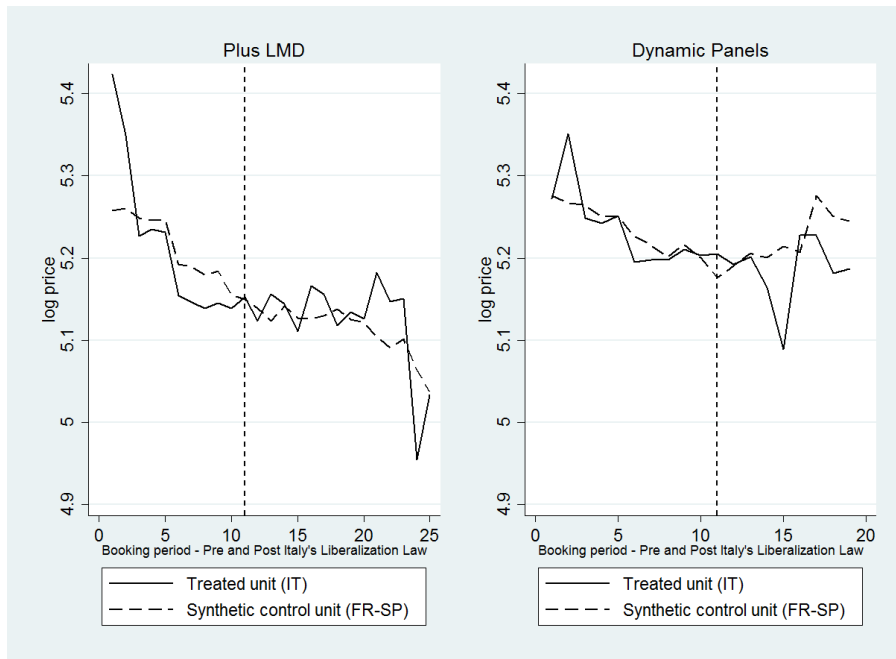


Figure 7: Synthetic controls and hotel prices pre and post Italy's Competition Law: daily data.