Price Parity Clauses for Hotel Room Booking: Empirical Evidence from Regulatory Change*

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Abstract

This paper examines the impact of most favored nation (MFN) clauses on retail prices, taking advantage of two natural experiments that changed vertical contracting between hotels and major digital platforms. First, a broad E.U. intervention narrowed the breadth of "price parity clause" obligations between hotels and major Online Travel Agencies (OTAs). Second, France and Germany went further and eliminated all price-parity agreements for top OTAs. Using transaction data from different hotel chains, we find direct sales by hotels to customers became relatively cheaper than OTA sales for mid-level and luxury hotels. Comparisons with hotel pricing outside the E.U. confirm the relative reduction in prices for mid-level and luxury hotels, while finding an opposite pattern for budget hotels. Overall, regulating MFNs resulted in significantly cheaper direct channel sales in two out of three hotel segments. Primary effects come from the narrow price-parity intervention and not from complete elimination of MFNs.

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Key words: Price Parity Clause (PPC), Most favored nation (MFN), Most favored customer (MFC), Hotel Industry, Impact Evaluation, Online Travel Agency (OTA), Digital platforms.

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1. Introduction

Online Travel Agencies (OTAs) have gained considerable importance as a distribution channel for independent hotels and hotel chains around the world. OTAs provide many benefits to consumers in facilitating a wide search and comparison of hotels.[1] In principle, this can translate into fiercer competition across hotels. Additionally, OTAs may help independent and new hotels to enter the market or to operate on a larger scale, which may also be beneficial for consumers. On the other hand, OTAs' commissions are expensive for hotels since they account for 10%-20% of a night's room rate.[2] Thus, a higher fraction of sales flowing through this distribution channel may end up increasing hotels' operating costs and finally prices faced by travelers.

There is an open question about the OTA impact on prices. OTAs can add value to consumers by lowering search costs. But the cost raising effect of commissions charged by the OTA, combined with a contractual inability for direct hotel sales to reflect lower costs, could raise consumer prices. In this paper, we examine the impact of OTA contractual form on prices. To do this, we use two natural experiments that features a regulatory change in contracting forms in selected jurisdictions.

The regulatory change arose due to potential economic and legal concerns over OTA market power and the most-favored nation (MFN) clauses. Prior to the regulatory intervention, OTAs and hotels instituted "wide" MFN clauses that ensured hotels and other OTAs could not set rates for hotel rooms that were below those of an OTA. In the hotel industry, these are called Price Parity Clauses (PPCs). The regulatory concern focused especially on wide PPCs that would apply to all of a hotel's transactions. The wide-PPC that became the industry standard reportedly required hotels to offer the same or a better room price on a given OTA than the prices offered on competing sales channels, including other OTAs and the hotels' own direct online channels. In 2015, competition authorities from France, Italy and Sweden adopted parallel decisions accepting identical commitments from their market-leading OTA, Booking.com. The latter committed itself to switch from wide-PPCs to narrow-PPCs in its contracts with hotels located in the E.U. countries. In practice, this switch translates into the possibility for hotels to offer lower prices on alternative OTAs and on their own direct channels, provided that these latter discounts are part of a loyalty program (and

thus not directly advertised to the general public). The second largest OTA in the market, i.e., Expedia, also committed itself to switch to narrow-PPCs in the E.U. during the year 2015.

Wide-PPCs can reduce free-riding behavior from other distribution channels and, in this way, would promote OTAs' investments and would avoid direct price charges to final users. (See Ezrachi, 2016, Wang and Wright, 2020.) Absent the PPC clauses, a hotel could have an incentive to advertise its rooms on a given OTA, and then offer lower prices for the same products on its own website, thereby avoiding the payment of commission fees.

However, potentially undesired anticompetitive effects could emerge from the establishment of such clauses. One theory is based on the impossibility for hotels to respond to an increase in commission fees of a given OTA, by setting higher retail prices in this OTA in comparison to other channels. This restriction for hotels to divert sales to cheaper channels may create the incentives for competing OTAs to simultaneously increase commission fees in equilibrium, resulting in higher distribution costs for hotels and in higher retail prices for travelers. In this vein, Boik and Corts (2016) develop a theoretical model in which platform most-favored-nation (PMFN) clauses may indeed result in both higher commission fees charged by intermediary platforms and in higher retail prices.[3,4] In another approach, Edelman and Wright (2015) examine a platform model with differentiated buyers and suggest that price coherence arising from MFNs could lead select buyers to over-consume the intermediary services (e.g., OTA services) when, considering all the costs, they would not be best off from not doing so and would otherwise be consumers of disintermediated (direct hotel) services. In short, retail prices may be inflated because intermediaries who deliver a value to some buyers can raise demand for overall intermediary services by preventing other buyers (who would have otherwise bought directly) from paying lower amounts for disintermediated purchases. The excessive adoption of intermediary services can result not only in higher average prices but also over-investment by intermediaries and reduced consumer surplus.

MFNs may be linked to other mechanisms for inducing price uniformity. While in principle price uniformity is not necessarily harmful, Akman and Sokol (2017) argue that online MFNs can resemble online resale price maintenance (RPM). Fletcher and Hviid (2017) explain the manner in which some aspects of MFNs may bear substantial similarity to the worst horizontal element of RPM, and could yield, as Ezrachi (2015) notes, price uniformity

effects. As a potential benefit of price uniformity, Moorthy and Winter (2006) suggest that price matching guarantees can signal to uninformed consumers that a firm has low prices.

The European Commission (EC) also suggested concerns could arise regarding the presence of narrow-PPCs.[5] The hypothesis is that this type of clause is related to the existence of reduced incentives for hotels to offer differentiated prices on different OTAs. Specifically, under a narrow-PPC regime, retail prices posted on the direct channel cannot be lower than retail prices posted on the most-expensive OTA.[6] Therefore, offering low retail prices on a low-cost OTA (in order to divert sales to cheaper channels) would necessarily cannibalize the sales of the hotel direct channel. For this reason, hotels' incentives to price differentiate across OTAs would be reduced.[7]

Some theoretical research points out ambiguities in the implications of MFNs for consumers. Wang and Wright (2020) suggest that prevention of showrooming effects is an important element of MFN clauses among platforms that lower search costs. They suggest that, while wide price-parity clauses are unfavorable to consumers, narrow MFNs, which apply the MFN in some circumstances but not others (e.g., to direct public internet advertising of prices but not to discounts that are available through other ways), have ambiguous effects and could improve consumer surplus.[8] The ambiguity may be particularly important in comparison to eliminating PPCs. Johansen and Vergé (2017) suggest that even wide PPCs can have ambiguous effects to the extent that sellers' participation constraints prevent a guaranteed high commission.

In light of the theoretical arguments for and against PPCs, including for potentially ambiguous effects, empirical evidence on real hotel bookings is of value. Taking advantage of the regulatory natural experiment of the switch from wide-PPC to narrow-PPC, we empirically assess its impact on online booking prices in the E.U. using data from multiple hotel chains. On the one hand, the lower incentives to price differentiate across channels potentially induced by narrow-PPCs should be particularly stronger for hotel chains because the direct channel represents a relevant substitute for OTAs (and thus the potential cannibalization of own sales should be a real concern).[9] On the other hand, hotel chains are also more likely to hold a loyalty program, which could allow them to undercut prices posted on OTAs. In this latter scenario, the theory of harm associated to narrow-PPCs should not necessarily hold. The purpose of this paper is to measure the outcome of this tradeoff.

Using proprietary hotel-level data from different hotel chains that operate in European countries and also from hotels operating in a number of countries around the world, we carry out reduced form regression analysis to test whether price differentiation across channels increased after the regulation change. This analysis represents an empirical test of the theory of harm associated to narrow-PPCs. Specifically, we compare average booking sales prices by these chains on two large OTAs of the market and on their own online direct channels, using data from the year before the regulatory change in 2015 and from the year after. We include a comparison of pricing patterns before and after the regulatory change between the E.U hotels and a control group of hotels from non-E.U. countries. In other words, before-after and difference-in-differences analyses are performed using data from multiple hotel chains. The idea is to test whether the switch to narrow-PPCs has had an impact on the price differential between OTAs and the direct channel.

Results from the before-after analysis suggest that, following the switch to narrow-PPC in the EU, average retail prices offered on the direct channel are more likely to be cheaper than average prices posted on OTAs for mid-level and luxury hotels. This result is robust to the comparison with retail prices posted in hotels located outside the E.U. (i.e., from a difference-in-differences analysis), but only for mid-level and luxury hotels. Opposite results are found for budget hotels in both before-after and difference-in-differences specifications, suggesting that different economic forces or factors may be at play in the budget hotel segment than in higher level segments.

Further exploration is made for the France and Germany, where MFN clauses (including narrow-PPCs) between OTAs and hotels have been totally or partially banned. Both for the before-after and the difference-in-differences, the probability of the direct channel being cheaper has increased, mainly for mid-level hotels in Germany with coefficients of a similar or even larger magnitude compared to other E.U. countries. However, for other types of hotels located in France and Germany, coefficients are either non-significant or lower in magnitude compared to other E.U. countries. These results can be interpreted in two different ways. First, they may cast doubt on the effectiveness of the "stronger" policy intervention, as, for some combinations of hotel type and country, no significant effect is observed in these countries compared to the average effect on non-E.U. countries. Second, the direct channel could have become relatively cheaper than OTAs in both E.U. and non-E.U. countries. For instance, retail

reservation prices paid by E.U. citizens for hotel rooms located outside the E.U. may have also been influenced by the policy change even though the legal constraints did not extend outside the E.U.

This paper adds substantially to existing work on PPC clauses. Hunold *et al*. (2018) use data on posted prices for hotel rooms on OTAs (for instance, Booking.com and Expedia) and hotels' direct channels, during the period January-2016 to January-2017. The data was collected from the metasearch website Kayak.com. Taking advantage of the fact that Booking.com was prohibited to use narrow PPCs in Germany since February 2016, they compare changes in some relevant outcomes in this country with respect to changes in other European countries. Results suggest that the abolition of the narrow-PPC increased the use of both Booking.com and the direct channel by hotels. With respect to pricing, in line with our results, they find that hotel chains establish their direct channels more often as a cheaper channel relative to major OTAs and as the cheapest online channel available.[10]

Mantovani, Piga and Reggiani (2021) analyze retail prices listed on Booking.com during the period 2014-2016 in three touristic regions of France, Italy, and Spain. Their results suggest that prices decreased in 2015 and bounced back in 2016. In addition, they show that the 2014-2015 price reduction was sharper in France and Italy and that the posterior 2015-2016 price increase was less intense in these countries compared to Spain. The authors suggest that these asymmetric changes across countries may be related to different intensities of antitrust enforcement, with France and Italy being more active than Spain in this regard. Finally, the paper suggests that the posterior 2016 price increase may be explained by demand shocks and/or technology improvements implemented by Booking.com (e.g., a better revenue management system).

The European Commission (2017) and nine Member State competition authorities collected room price data posted on major metasearch websites and on the largest OTAs of the market. The main specification applied is a difference-in-differences approach using pricing data provided by metasearch websites and using hotels located in Canada as control group. Price differentiation is defined as a binary variable that takes the value of one when the price posted on one OTA differs by at least five percent from prices posted on other OTAs. The results of this analysis suggest a significant increase in price differentiation across OTAs because of the switch from wide to narrow-PPCs and as a result of the additional prohibitions

set by France and Germany. This dataset is limited, however, as it did not consist of actual transaction data and could not include non-observed direct prices. European Commission (2017) found that 40% of hotels report undercutting OTAs with price and room availability, which tends to suggest that hotels have often acted to take advantage of the narrow PPCs.[11]

The main distinguishing feature of our study in comparison with previous empirical literature is that we rely on actual transaction prices, not posted prices. This means that the transactions reported for OTAs are based on real sales, not the universe of available prices that is found from surveys of prices available on the internet. Moreover, the data used includes sales for loyalty program customers whose offered and paid prices are unobservable from general web search. Our dataset covers pre- and post-PPC removal periods (i.e., years 2014 and 2016 with all months represented proportionally to stays). Another specific feature of our dataset is that it includes countries located both in and out of the E.U., thus providing a substantial improvement in the empirical analysis of the existing theories of price setting in the pricing parity, or MFN, literature with a transaction-based control set of observations not subject to PPC regulation. More generally, this paper contributes to evaluating theories for hotel chain response to regulation and contributes to the literature on MFN and price parity clauses.

The addition of transaction based empirical work to the broader MFN literature is fruitful. As one example, similar questions to those for hotels and OTAs arise with credit card companies that have sometimes used restrictions on what merchants can differentially charge customers based on the payment mechanism used.

The paper is organized as follows. Section 2 briefly describes the evolution of PPC regulations in Europe. Section 3 presents the data and some basic summary statistics. Section 4 displays the results of an econometric assessment of the impact of the wide-PPC removal on booking prices. Finally, Section 5 summarizes our main conclusions.

2. Price parity clauses in the E.U.

In April 2015, in response to several antitrust concerns, competition authorities from France, Italy and Sweden adopted parallel decisions accepting identical commitments from a market-leading OTA, Booking.com.[12] These commitments include:[13]

i. Booking.com cannot prevent hotels from offering better or equal room prices via competing OTAs (but not via the direct channel);

ii. Booking.com cannot prevent hotels from offering discounted room prices provided that these are not marketed or made available to the general public online. In other words, discounted prices can be offered online to members of a hotel's loyalty program and/or via offline channels.

These commitments were, in practice, extended by Booking.com and Expedia across the E.U. Hence, these countries moved from a scenario with "wide-PPCs" to one with "narrow-PPCs." As mentioned before, a wide-PPC requires hotels to offer a given OTA the most favored prices in comparison to any other distribution channel, while a narrow-PPC allows a hotel to offer better prices through competing OTAs and through its own direct channel, provided that these latter discounts are part of a loyalty program.

According to these competition authorities, the adoption of narrow PPCs should generate a reduction in Booking.com commission rates and/or in an improvement of its quality of service, which will ultimately lead to lower room prices and/or better services for final consumers. Moreover, the commitments should also make it easier for new OTAs to enter the market or to expand their operations.

Some countries have not even accepted narrow-PPCs. For instance, in July 2015 the French parliament passed a law that prohibits PPCs for all hotels in France.[14] Similarly, in December 2015, the German competition authority prohibited the narrow PPC clauses of Booking.com.[15] During the second half of 2016 the Austrian government also banned PPCs in contracts between hotels and OTAs (to apply in January 2017) and Italy followed suit in mid-2017.[16] Table 1 summarizes National Competition Authority (NCA) decisions regarding PPCs in Europe.

In contrast to the E.U., very few countries on other continents have implemented narrow PPC requirements. During the period of 2013 to 2017, countries outside the E.U. did not implement restrictions on OTA pricing practices, apart from Australia's move from wide PPCs to narrow PPCs in September 2016, in a settlement between major OTAs and the Australian competition authority.

Table 1 – Summary of NCA and legal decisions concerning PPCs (2013-2017)

Country	Date	Decision	Observations
UK	August 2013	Issued draft commitments for online hotel booking	Closed 2015
Germany	December-2013	Prohibition of PPCs used by HRS (major OTA in Germany)	Decision appealed and confirmed by Dusseldorf court in 2015
France, Italy, Sweden	April-2015	Commitments by Booking.com to switch from wide-PPCs to narrow-PPCs	Booking.com and Expedia commit to narrow PPCs in all E.U. countries starting in July-2015 and in August-2015, respectively.
France	August-2015	*Loi Macron* voids all OTAs' PPCs	
Germany	December-2015	Prohibition of all PPCs by Booking.com	Prohibition overturned by Higher Dusseldorf Court on 4 June 2019, moving to narrow PPCs
Austria	January 2017	All PPCs are rendered null	
Italy	August 2017	Rate parity clauses are banned	

Source: Report on the Monitoring Exercise Carried Out in the Online Hotel Booking Sector by E.U. Competition Authorities in 2016; Article 1 (166) of Annual Competition Law of Italy; Amendment to Austrian Federal Act Against Unfair Competition, 30 Nov 2016; for the UK, see Haynes (2015).

3. Data

Our dataset contains proprietary hotel-level data for every Tuesday of years 2014 (pre-wide-PPC removal) and 2016 (post-wide-PPC removal), for different hotel chains that operate across a large number of countries in the E.U. and the rest of the world. We classified hotels in three different groups, namely (i) budget hotels, (ii) mid-level hotels, and (iii) luxury hotels. In all, we have information on hotels located in and out of the E.U., accounting for approximately 1.6 million bookings per year.[17,18]

Every observation in the sample contains information of the number of room-nights sold and revenues (net of loyalty discounts) for bookings made through two different channels:

the hotels' own websites and a group of major OTAs. All hotels in our sample have a direct channel. For instance, for the case of the E.U., these three channels account for almost 90 per cent of the rooms booked online during the period covered for the sample. Table 2 exhibits basic summary statistics of booking prices of hotels located in the E.U. for the three different types of hotel (i.e., budget, mid-level and luxury) with prices normalized by the average price of the rooms sold in 2014 by hotel type. The table shows that a substantial number of actual hotel bookings are represented in the data, and that bookings increased substantially between 2014 and 2016, suggesting that macroeconomics conditions should have a role in the empirical analysis. Mean prices for mid-level and luxury hotels exhibiting average nominal price changes of 1% or more between 2014 and 2016, while budget hotels exhibited almost no nominal price change, suggesting that price conditions and demand conditions between the three types of hotels varied over the period.[19]

Table 2 – Summary statistics on hotel booking prices

Hotel Type	Var.	Booking Year	
		2014	2016
Budget	Bookings	904,046	1,087,017
	Mean	1.0000	1.0009
	Std. Dev.	0.3808	0.3977
	Min.	0.0000	0.0000
	Max.	4.8997	5.1351
Mid-level	Bookings	419,454	555,098
	Mean	1.0000	1.0183
	Std. Dev.	0.3886	0.3778
	Min.	0.0000	0.0000
	Max.	6.9746	5.4637
Luxury	Bookings	109,842	130,730
	Mean	1.0000	1.0780
	Std. Dev.	0.4970	0.4646
	Min.	0.0000	0.0000
	Max.	15.6365	5.1451

Notes: For each hotel type, all prices have been normalized by the average retail price of 2014. In addition, all prices are net of loyalty discounts given to customers.

Within each year, there is an upward trend of prices. A before-after estimation is not able to definitively distinguish the long-term trend effect from the regulatory change, due to having only data from the 12 months of 2014 and 2016. We do find that a 12-month upward trend would exist in all years as an artefact of the seasonal variation within hotel occupancy

which typically involves low occupancy during the winter and high occupancy (and higher prices) during the summer and fall.[20] We address below these effects with occupancy and macroeconomic performance figures. Further confirmation that long-term trends do not explain any findings of changed price patterns will be provided by a differences-in-differences approach, which via the international comparison, controls for any unobserved industry trends during the year of regulatory change.

4. Empirical analysis

The adoption of OTAs' commitments in the E.U. represents an exogenous variation of the contractual relationships between these platforms and hotels. This new regulation provides a structural change similar to a natural experiment that allows us to measure the impact of the switch from wide to narrow PPCs (or removal of PPCs in the cases of France and Germany) on different outcomes of interest. The empirical objective is to compare the evolution of booking prices, before and after the adoption of the commitments by major OTAs, and across countries impacted and not impacted by the change in policy (as displayed in Table 1). Thus, a reduced form before-after analysis and a difference-in-differences approach are implemented to test the impact of this new policy on booking prices.

4.1 Conjectures: Pricing across channels

MFN agreements may be seen as contracts that are designed to affect pricing across channels. In this instance, the PPCs between a given OTA and a hotel are designed to ensure that retail prices for the same product are not lower when shown to consumers on different channels from that OTA. OTAs argue that such agreements help to limit free riding by hotels that might otherwise attract customers from the broad selection displayed via the online booking site by offering lower prices for direct purchases. Yet PPCs have also been argued to serve as a mechanism that raises prices to consumers, notably because a PPC locks in the OTA commission to the direct sales cost structure.

On the one hand, hotels may wish to set *lower* prices than the OTA due to their lower cost structure for direct provision. Chen and Wright (2017) suggest that when commissions are determined by the intermediaries, i.e., OTAs, the one-sided binding constraint – which

only prevents pricing below that of the given OTA – suggests that direct sellers have an incentive to set lower prices for their direct sales. Similarly, Fletcher and Hviid (2015) argue that PPCs one-sidedness may be supporting the price-raising coordination outcomes of RPM. One might have the default expectation, then, that reducing the strength of a PPC would lead to lower prices. [21]

On the other hand, hotels may wish to set *higher* prices on their direct channel if the direct channel customers have more inelastic demands than the customers coming from OTAs. Charging higher prices than OTAs rests within the contractual ability of hoteliers even with the original wide PPC contract, as this only guarantees equal or lower prices than other channels to the specific OTA holding the contract, not equal pricing across all channels.

The E.U. countries adopted two approaches to addressing the perceived competitive problems of wide PPCs. The majority approach moved to allowing only narrow PPCs in 2015, preventing direct sales over the internet at lower retail prices than the OTAs. The second approach, adopted by France (via 2015 legislation) and Germany (via a Bundeskartellamt decision in 2015) went further, and forbade PPCs altogether, thus allowing hotel direct channels to set publicly observable lower prices than OTAs. Using these two regulatory natural experiments, we test three conjectures.

Conjecture 1. *A regulatory requirement to move from a wide-PPC to a narrow- or no-PPC is expected to be followed by a reduction in prices for the direct channel compared to the intermediary channel.*

If correct, this suggests that moving from a wide MFN to a partial MFN or absence of MFN for hotel sales increases the frequency of lower consumer prices over the direct channel, a hypothesis that was raised by the European Commission (2017) study of online hotel booking.

Conjecture 2. *The full elimination of PPC is frequently associated with a larger price reduction effect than the partial elimination of PPC.*

This is equivalent to hypothesizing that a full elimination of MFNs is more effective than a partial elimination in lowering consumer prices for hotel sales, or more precisely, increasing the frequency with which direct sales are cheaper than OTA sales.

For both Conjecture 1 and 2, it is worth noting that hotels and OTAs might respond to a change in PPC contracts differently depending on the supply and demand conditions of different types of hotels.

Conjecture 3. *The magnitude of change from partial or full elimination of PPCs should be lower for budget hotels than mid- and luxury hotels.*

This conjecture is based on the following considerations. If consumers booking budget hotels are more price sensitive, a small reduction in prices would be enough to divert consumers from OTAs to the direct channel. Thus, one should expect a lower magnitude in budget hotels compared to other types of hotels. In addition, if consumers booking budget hotels are more price sensitive, and if OTAs can more feasibly retaliate against hotels setting lower prices (e.g., by punishing their rankings), hotels would be less willing to make these discounts in the first place.

4.2 Methodology

To evaluate these conjectures, we focus on a dependent variable that measures the frequency with which prices from the direct channel are cheaper than the OTAs. Since we are looking at alterations in the likelihood of the direct channel being cheaper than the intermediary, we estimate changes in this likelihood after the regulatory change. A positive difference means that the direct channel is more frequently cheaper after the regulatory change; a negative difference means the direct channel is less frequently cheaper after that change.[22] A positive difference would be predicted under Conjecture 1. Under Conjecture 2, the frequency with which direct prices are cheaper than indirect ones would be higher under a regulatory change that eliminates PPCs completely compared to one that partially eliminates the PPCs (the narrow PPC). Under Conjecture 3, lower frequency differences would be predicted for budget hotels than other types of hotels.

The general structure of the analysis is to undertake a before-after comparison between countries, which permits an initial examination of the quantitative effects within the E.U.. We then estimate the main analysis using a difference-in-differences approach, which includes a control group of non-E.U. countries that did not have the regulatory change. In both models, to better identify impacts of regulatory change, trend effects are included in the estimation, to ensure that the effects from regulatory change are not inadvertently conflated with trends that could have given a result of positive change (if trends are positive) even absent the regulatory change. Trends are included both by time and by type of hotel. The years of focus are 2014 and 2016, with the regulatory change having occurred in 2015. As discussed below, the difference-in-differences analysis is further supported by testing for common trends according to a procedure like the one proposed by Ashenfelter, Hosken and Weinberg (2013) and presented in Section OA3 in Online Appendix.

4.2.1 Before-after specification

For the before-after specification, we estimate the following reduced-form model:

$$DC^{\delta}_{i,h,c,t} = \alpha_0 + \left(\alpha_{bu} D_{bu} + \alpha_{ml} D_{ml} + \alpha_{lu} D_{lu}\right) PPC_t + \alpha_1 LS_{it} + \alpha_2 NR_{it} + \alpha_3 EAI_{c,t} + \sum_{Y=2014,2016} \left(\alpha_{bu,Y} + \alpha_{ml,Y} D_{ml} + \alpha_{lu,Y} D_{lu}\right) T_t + \alpha_{5i} FE_i + \varepsilon_{it} \quad (1)$$

where index i refers to a hotel, h refers to the type of this hotel, i.e., $h \in \{bu, ml, lu\}$ where bu stands for budget hotel, ml for mid-level and lu for luxury, c refers to the country, t defines the period and where:

- $DC^{\delta}_{i,h,c,t} = 1$ if $\bar{P}_{DC,i,h,c,t} \leq \bar{P}_{OTA,i,h,c,t} + \delta$;
- $\text{PPC}_t = 1$ if $t = 2016$, and $\text{PPC}_t = 0$ if $t = 2014$
- $D_h = 1$ when $i \in h, h \in \{bu, ml, lu\}$;
- $T_t = \tau$ $\tau \in \{1, 2, ..., 12\}$ if $t \equiv M$ $M \in \{\text{January, February, ..., December}\}$ assuming that January is associated with 1, February with 2, and so on until December = 12;
- LS stands for the average length of stay, NR for number of rooms booked, and EAI for economic activity index;
- FE refers to individual and monthly fixed effects.

The variable $DC^{\delta}_{i,h,c,t}$ is binary and takes the value of one if $\bar{P}_{DC,i,h,c,t}$, the average retail price of the direct channel for hotel *i* at date *t* is cheaper than $\bar{P}_{OTA,i,h,c,t}$, the average retail price posted on OTAs, by more than δ.[23] The idea is to capture whether the probability of the direct channel being cheaper than OTAs on a given date has increased after the switch to narrow-PPCs. The variable PPC_t is a binary variable that takes the value of one if the booking date belongs to year 2016, the period after the switch to narrow-PPCs or no PPC. The main parameters of interest are α_{bu}, α_{ml}, and α_{lu} which show the estimated effect of the narrow-PPC change on budget hotels, mid-level hotels and luxury hotels, respectively. If these parameter estimates are positive, that means the direct channel has become more frequently cheaper than the OTA channel.[24]

Additionally, for each hotel, observable hotel characteristics are included for the average length of stay *LS* and for the number of rooms booked *NR* for the three different channels (i.e., the two OTAs and the direct channel) of the reservations booked on a given date *t*. A broad economic activity index, *EAI*, by country is added to cover country-specific economic changes over the course of the year.[25] Trend variables are included by year and by hotel type. We use a fixed effects panel estimation.

To distinguish between effects of the full elimination of PPCs and the partial elimination of most European countries, we estimate the before-after Equation (1) with European data, with the two countries that fully eliminated PPCs in 2015 (France and Germany) receiving separate coefficients from the other E.U. countries. This permits testing Conjecture 1 and Conjecture 2.

Equation (1) is then transformed as follows:

$$\begin{aligned} DC^{\delta}_{i,h,c,t} = \alpha_0 &+ \left(\alpha_{bu,\overline{eu}} D_{bu} + \alpha_{ml,\overline{eu}} D_{ml} + \alpha_{lu,\overline{eu}} D_{lu}\right) PPC_t * EU_i \\ &+ \left(\alpha_{bu,fr} D_{bu} + \alpha_{ml,fr} D_{ml} + \alpha_{lu,fr} D_{lu}\right) PPC_t * FR_i \\ &+ \left(\alpha_{bu,de} D_{bu} + \alpha_{ml,de} D_{ml} + \alpha_{lu,de} D_{lu}\right) PPC_t * DE_i \\ &+ \alpha_1 LS_{it} + \alpha_2 NR_{it} + \alpha_3 EAI_{c,t} + \sum_{Y=2014,2016} \left(\alpha_{bu,Y} + \alpha_{ml,Y} D_{ml} + \alpha_{lu,Y} D_{lu}\right) T_t + \alpha_{5i} FE_i + \varepsilon_{it} \end{aligned} \quad (2)$$

where $EU_i = 1$ if hotel *i* is located in a European countries different from France and Germany. The dependent variable in Equation (2) is the same as in Equation (1). The main parameters of interest in Equation (2) are $\alpha_{bu,fr}$, $\alpha_{ml,fr}$, and $\alpha_{lu,fr}$ for French budget, mid-level and luxury

hotels, respectively, $\alpha_{bu,de}$, $\alpha_{ml,de}$, and $\alpha_{lu,de}$ for Germany and $\alpha_{bu,\overline{eu}}$, $\alpha_{ml,\overline{eu}}$, and $\alpha_{lu,\overline{eu}}$ for the rest of the E.U. which show the estimated effect of the PPC elimination (France and Germany) or narrowing (rest of E.U.) on budget hotels, mid-level hotels and luxury hotels, respectively.[26]

4.2.2 Difference-in-differences for E.U. and non-E.U.

To examine whether these results are robust to the comparison with the evolution of retail prices of hotels located outside the EU, we estimate a difference-in-differences model that takes advantage of hotel chain data from the control group of countries that did not experience a regulatory change in PCC conditions over this time period. The model takes the form of Equation (3):

$$\begin{aligned} DC_{i,h,c,t}^{\delta} = {} & \alpha_0 + \left(\alpha_{bu,eu} D_{bu} + \alpha_{ml,eu} D_{ml} + \alpha_{lu,eu} D_{lu}\right) PPC_t * EU_i \\ & + \alpha_1 LS_{it} + \alpha_2 NR_{it} + \alpha_3 EAI_{c,t} + \sum_{Y=2014,2016} \left(\alpha_{bu,Y} + \alpha_{ml,Y} D_{ml} + \alpha_{lu,Y} D_{lu}\right) T_t + \alpha_{5i} FE_i + \varepsilon_{it} \end{aligned} \tag{3}$$

where $EU_i = 1$ if hotel *i* is located in a European country.

The coefficients $\alpha_{bu,eu}$, $\alpha_{ml,eu}$, and $\alpha_{lu,eu}$ estimate an average impact of the regulatory changes on PPCs on the likelihood of prices being lower via the direct channel compared to the OTA channel for budget, mid-level and luxury hotels respectively.

We also estimate the difference-in-differences Equation (3) by dividing out the E.U. observations between those in the two countries that eliminated all PPCs in 2015 (France and Germany) and the rest of the EU, as follows:

$$\begin{aligned} DC_{i,h,c,t}^{\delta} = {} & \alpha_0 + \left(\alpha_{bu,eu} D_{bu} + \alpha_{ml,eu} D_{ml} + \alpha_{lu,eu} D_{lu}\right) PPC_t * EU_i \\ & + \left(\alpha_{bu,fr} D_{bu} + \alpha_{ml,fr} D_{ml} + \alpha_{lu,fr} D_{lu}\right) PPC_t * FR_i \\ & + \left(\alpha_{bu,de} D_{bu} + \alpha_{ml,de} D_{ml} + \alpha_{lu,de} D_{lu}\right) PPC_t * DE_i \\ & + \alpha_1 LS_{it} + \alpha_2 NR_{it} + \alpha_3 EAI_{c,t} + \sum_{Y=2014,2016} \left(\alpha_{bu,Y} + \alpha_{ml,Y} D_{ml} + \alpha_{lu,Y} D_{lu}\right) T_t + \alpha_{5i} FE_i + \varepsilon_{it} \end{aligned} \tag{4}$$

The dependent variable in Equation (4) is the same as in Equation (3). The parameters of interest are $\alpha_{bu,fr}$, $\alpha_{ml,fr}$, and $\alpha_{lu,fr}$ for French budget, mid-level and luxury hotels, respectively, $\alpha_{bu,de}$, $\alpha_{ml,de}$, and $\alpha_{lu,de}$ for Germany and $\alpha_{bu,eu}$, $\alpha_{ml,eu}$, and $\alpha_{lu,eu}$ for the rest of the E.U. (noted

EU), which show the estimated effect of the PPC elimination (France and Germany) or narrowing (rest of E.U.) on budget hotels, mid-level hotels and luxury hotels, respectively. They provide a difference-in-differences estimator of the impact of the switch to narrower-PPCs on the probability of the direct channel being cheaper than OTAs in the E.U.

The difference between the coefficients for France and Germany, on the one hand, and those of the rest of Europe, on the other, provide a test of Conjecture 2, about whether complete elimination of PPC has a larger impact on the likelihood of direct channel being cheaper than the narrow-PPC rule. For example, testing for whether α_{1GEbu}-α_{1EUbu} = 0 allows us to examine whether the full elimination of PPCs has a different impact for budget hotels in Germany compared to a narrow PPC.

4.3 Results

The results from the before-after estimations are presented below followed by results from the difference-in-differences estimation. A combined assessment of results follows the two types of results with a discussion of each conjecture.

4.3.1 Before-after estimates

Results of the before-after estimations from Equation (1) are displayed in Table 3, considering values for δ of 2.5% (Column 1), 5% (Column 2) and 10% (Column 3).[27, 28, 29, 30] As seen in the table, there is a significant increase in the probability of the direct channel being on average cheaper than OTAs post-switch to narrow-PPC, for mid-level and luxury hotels, for all the values of δ and for all hotel types. Interestingly, the opposite result is found for budget hotels, with the frequency of their direct prices being cheaper than OTAs being lower than for OTAs after the switch to narrow PPCs. In the line of Conjecture 3 above, we hypothesize that economic factors governing client demand at budget hotels may be different from that at other hotels. For example, the absolute economic benefit of search may be lower for budget hotels. Alternately, benefits may be included as part of the base package in budget hotels that are not included over the OTA channel. Loyalty programs may have different impacts in this segment from others. The magnitude of the coefficients is larger for the most expensive hotel types (i.e., mid-level and luxury).

Table 3 – Before-after analysis on E.U. countries

Estimations	Probability of the direct channel being on average cheaper than OTAs $DC^{\delta}_{i,h,c,t}$					
	(1) $\delta = 2.5\%$	(2) $\delta = 5\%$	(3) $\delta = 10\%$	(4) $\delta = 2.5\%$	(5) $\delta = 5\%$	(6) $\delta = 10\%$
Variables						
Narrow PPC × Budget hotels	-0.0873***	-0.0879***	-0.0752***	-	-	-
	(0.0114)	*(0.0112)*	*(0.00979)*			
Narrow PPC × Mid-level hotels	0.0805***	0.0727***	0.0540***	-	-	-
	(0.0152)	*(0.0152)*	*(0.0135)*			
Narrow PPC × Luxury hotels	0.0988**	0.0888**	0.0791**	-	-	-
	(0.0414)	*(0.0409)*	*(0.0356)*			
No PPC × France × Budget hotels	-	-	-	-0.0783***	-0.0797***	-0.0724***
				(0.0120)	*(0.0119)*	*(0.0110)*
No PPC × France × Mid-level hotels	-	-	-	0.0121	0.00605	-0.00537
				(0.0146)	*(0.0145)*	*(0.0137)*
No PPC × France × Luxury hotels	-	-	-	0.0304	0.0260	0.0449
				(0.0377)	*(0.0389)*	*(0.0397)*
No PPC × Germany × Budget hotels	-	-	-	-0.0827***	-0.0887***	-0.0777***
				(0.0196)	*(0.0187)*	*(0.0144)*
No PPC × Germany × Mid-level hotels	-	-	-	0.173***	0.160***	0.142***
				(0.0185)	*(0.0179)*	*(0.0158)*
No PPC × Germany × Luxury hotels	-	-	-	0.0762	0.0702	0.0293
				(0.0650)	*(0.0623)*	*(0.0308)*
Narrow PPC × Other EU × Budget hotels	-	-	-	-0.110***	-0.105***	-0.0785***
				(0.0174)	*(0.0168)*	*(0.0139)*
Narrow PPC × Other EU × Mid-level hotels	-	-	-	0.142***	0.136***	0.0988***
				(0.0239)	*(0.0242)*	*(0.0204)*
Narrow PPC × Other EU × Luxury hotels	-	-	-	0.166***	0.150***	0.126***
				(0.0558)	*(0.0557)*	*(0.0422)*
Length of stay	-0.0139***	-0.00290	0.00751**	-0.0134***	-0.00236	0.00803**
	(0.00362)	*(0.00375)*	*(0.00375)*	*(0.00360)*	*(0.00372)*	*(0.00374)*
Total number of rooms booked	-0.00168	-0.00404***	-0.00739***	-0.00196	-0.00433***	-0.00772***
	(0.00157)	*(0.00150)*	*(0.00133)*	*(0.00154)*	*(0.00145)*	*(0.00130)*
Economic activity index	-0.000151	0.000280	0.000565***	-0.000229	0.000194	0.000478**
	(0.000237)	*(0.000224)*	*(0.000204)*	*(0.000229)*	*(0.000216)*	*(0.000201)*
Constant	0.486***	0.369***	0.216***	0.493***	0.377***	0.225***
	(0.0267)	*(0.0249)*	*(0.0225)*	*(0.0259)*	*(0.0240)*	*(0.0218)*
F-statistic	33.57	30.45	25.56	32.23	26.79	26.84
P-value	0.00	0.00	0.00	0.00	0.00	0.00
Individual FE	YES					
Trend	YES					
Number of observations	96335					

Notes: Robust standard errors in italic in parenthesis (clustered at the city level). Three (two-, one-)-starred coefficients are significant at a p-value lower than 0.01 (0.05, 0.1, respectively). The estimation of Equation (1) and (2) only considers hotels for which there is at least one online booking during both years 2014 and 2016.

One way to verify whether the increase in the probability of the direct channel being cheaper than OTAs is explained by the switch to narrow PPC (in E.U. countries), or by the ban of all kinds of PPCs (mainly in France and Germany), is to test whether there is a differentiated impact in France and Germany compared to the rest of E.U. countries. Columns (4)-(6) of Table 3 present the results from estimating Equation (2). These columns split the coefficient of interest into three different dummy variables according to whether hotel i is in France, Germany or another E.U. country.

We find a differentiated effect for France and Germany. Indeed, all the before-after coefficients for mid-level and luxury hotels are not significantly different from zero in the case of France, while in the case of Germany only the coefficients associated with mid-level hotels remain positive and significant. In addition, all the before-after coefficients for the rest of EU countries remain on average positive and significant for mid-level and luxury hotels, which suggests that the effect in the probability of the direct channel being cheaper than OTAs in these types of hotels is explained by the switch to narrow PPC and not necessarily from the ban of all kinds of PPC. Finally, for budget hotels all the coefficients are negative and significant for France, Germany, and the rest of the E.U. countries.

4.3.2 Difference-in-differences estimates

Results of the difference-in-differences estimation from Equation (3) are displayed in Table 4, considering values for δ of 2.5% (Column 1), 5% (Column2) and 10% (Column 3).[31, 32, 33, 34, 35] Results reported in Table 4 suggest that the probability of the direct channel being cheaper than OTAs increased significantly in the E.U. compared to hotels located in other continents for mid-level and luxury hotels. For budget hotels, the probability of the direct channel being cheaper is lower after the narrow PPC was implemented as in the before-after estimation. This feature of budget hotels is perhaps not surprising, due to the lower margins of budget hotels and likely lower room for pricing differences across all channels. This supports Conjecture 3 above.

Columns (1)-(3) of Table 4 are based on Equation (3) and do not distinguish the French/German case from the rest of Europe. Columns (4)-(6) of Table 4 present the results from estimating Equation (4) when separating the French and German data from the rest of Europe. Columns (4)-(6) therefore presents the difference-in-differences results when splitting

the coefficient of interest -i.e., the difference-in-differences coefficient in columns (1)-(3)- into three different dummy variables according to whether hotel i is located in France, Germany or another E.U. country. Results show that, for the case of France, the coefficients are positive and significant for luxury hotels only, while for the case of Germany, the coefficients are positive and significant for mid-level hotels for all values of δ and for luxury hotels for $\delta = 2.5\%$ only. For the rest of E.U. countries all the coefficients for mid-level and luxury hotels are on average positive and significant. In terms of magnitudes, only for the case of mid-level hotels in Germany we observe a stronger effect compared to other E.U. countries. Finally, for budget hotels all coefficients are negative and significant for France, Germany, and the rest of E.U. countries.

4.3.3 Assessment

The results from Table 3 and 4, covering both before-after and difference-in-differences estimates, are useful for evaluating the conjectures. Conjecture 1, on the effect of regulatory change away from the wide-PPC contracts to either narrow-PPC contracts or complete elimination of PPCs, is supported for mid-level and luxury hotels in Table 3 and 4 where the likelihood of receiving lower prices over the direct channel has increased after the narrow PPC introduction by between 8% and 21% for E.U. hotels. The conjecture is not supported for budget hotels with declines of between 3% and 11% for E.U. hotels.

Conjecture 2, that a full elimination of PPCs has a stronger effect than a narrow PPC, is not supported across all hotel types. It is supported for German mid-level hotels, where the effect is stronger than the E.U. average effect. Conjecture 2 is also supported for budget hotels, in which both France and Germany have significantly lower (in absolute value) effects than other E.U. countries, by 2 to 3%. This is confirmed by a one-tailed t-test on the differences in coefficients (from Table 5) for France and Germany respectively.[36] The relative "positive" relationship from the French and German cases in budget hotels counteracts, to some extent, the generally negative relationship for budget hotels after the regulatory change but does not eliminate the negative impact. This difference between budget and other hotel segments suggests a differential impact across segments, given that the full elimination of PPCs has a less negative impact on budget hotels than the narrow PPC. Curiously, Conjecture 2 is

supported for the budget segment which is exactly the segment in which Conjecture 1 is rejected.

Table 4 – Difference-in-differences analysis on E.U. versus other continents

	Probability of the direct channel being on average cheaper than OTAs $DC^{\delta}_{i,h,c,t}$					
Estimations	(1) $\delta = 2.5\%$	(2) $\delta = 5\%$	(3) $\delta = 10\%$	(4) $\delta = 2.5\%$	(5) $\delta = 5\%$	(6) $\delta = 10\%$
Variables						
Narrow PPC × EU x Budget hotels	-0.0423**	-0.0433***	-0.0330***	-	-	-
	(0.0165)	*(0.0147)*	*(0.0116)*			
Narrow PPC × EU x Mid-level hotels	0.0886***	0.0839***	0.0669***	-	-	-
	(0.0193)	*(0.0171)*	*(0.0158)*			
Narrow PPC × EU x Luxury hotels	0.140***	0.122***	0.0935***	-	-	-
	(0.0365)	*(0.0357)*	*(0.0283)*			
No PPC × France × Budget hotels	-	-	-	-0.0326*	-0.0345**	-0.0296**
				(0.0171)	*(0.0154)*	*(0.0125)*
No PPC × France × Mid-level hotels	-	-	-	0.0208	0.0178	0.00818
				(0.0184)	*(0.0164)*	*(0.016)*
No PPC × France × Luxury hotels	-	-	-	0.0721**	0.0590*	0.0600**
				(0.0340)	*(0.0324)*	*(0.0289)*
No PPC × Germany × Budget hotels	-	-	-	-0.0376	-0.0441**	-0.0357**
				(0.0233)	*(0.0212)*	*(0.0162)*
No PPC × Germany × Mid-level hotels	-	-	-	0.181***	0.171***	0.155***
				(0.0216)	*(0.0195)*	*(0.0174)*
No PPC × Germany × Luxury hotels	-	-	-	0.116*	0.101	0.0414
				(0.0625)	*(0.0614)*	*(0.0293)*
Narrow PPC × Other EU × Budget hotels	-	-	-	-0.0659***	-0.0615***	-0.0377**
				(0.0205)	*(0.0188)*	*(0.0153)*
Narrow PPC × Other EU × Mid-level hotels	-	-	-	0.149***	0.146***	0.111***
				(0.0268)	*(0.0257)*	*(0.0224)*
Narrow PPC × Other EU × Luxury hotels	-	-	-	0.206***	0.181***	0.139***
				(0.0506)	*(0.0503)*	*(0.0400)*
Length of stay	-0.0133***	-0.00603**	0.00295	-0.0129***	-0.00569*	0.00328
	(0.00293)	*(0.00299)*	*(0.00280)*	*(0.00292)*	*(0.00298)*	*(0.00279)*
Total number of rooms-booked	-0.000142	-0.000302**	-0.000565***	-0.000159	-0.000321***	-0.000586***
	(0.000121)	*(0.000118)*	*(0.000100)*	*(0.000119)*	*(0.000115)*	*(0.0000983)*
Economic activity index	0.000388	0.000682**	0.000931***	0.000272	0.000554*	0.000802***
	(0.000318)	*(0.000292)*	*(0.000268)*	*(0.000315)*	*(0.000288)*	*(0.000263)*
Constant	0.454***	0.358***	0.206***	0.466***	0.371***	0.219***
	(0.0352)	*(0.0327)*	*(0.0301)*	*(0.0346)*	*(0.0319)*	*(0.0292)*
F-statistic	19.52	20.64	17.37	20.19	20.58	19.51
P-value	0.00	0.00	0.00	0.00	0.00	0.00
Individual and Month FE	YES					
Trend	YES					
Number of observations	118 200					

Notes: Robust standard errors in italic in parenthesis (clustered at the city level). Three (two-, one-)-stars indicates a p-value lower than 0.01 (0.05, 0.1, respectively). The estimation of Equations (3) and (4) only considers hotels for which there is at least one online booking during both years 2014 and 2016.

Conjecture 3, suggesting that magnitudes will be lower for budget hotels, is supported by Tables 3 and 4. After the introduction of partial or full elimination of PPCs, the likelihood of prices in budget hotels being lower on direct platforms than on OTAs falls relative to mid- and luxury hotels.

5. Conclusion

This paper assesses the impact of the wide-PPC removal on online booking prices that resulted from the commitments adopted by the two largest OTAs of the market in Europe and legislation in France, all occurring during the year 2015. Results from both a set of before-after specifications and a set of differences-in-differences specifications suggest that following the wide-PPC removal in the EU, the probability of the direct channel being on average cheaper than OTAs has significantly increased at least for the groups of mid-level and luxury hotels. In contrast, the probability has decreased for budget hotels. Thus, these results shed light on the potentially effects of PPCs on online booking prices. In particular, the evidence presented in this paper suggests that the presence of wide-PPCs between OTAs and hotel direct channels could result in a softening of price-competition among these channels, though perhaps not for all hotel segments.

In the two countries where MFN clauses between OTAs and hotels have been totally banned, the difference-in-differences estimator shows significant effects mainly for mid-level hotels in Germany; these effects are of a similar or even larger magnitude compared to other E.U. countries. In addition, for other types of hotels located in France and Germany, the estimated effects are either non-significant or lower in magnitude compared to other E.U. countries. Nonetheless, these two countries experienced a significantly smaller budget hotels effect, relatively to other E.U. countries, suggesting that the full elimination of PPCs may have had more effects in the budget segment than other segments. These latter results can be interpreted in two different ways. First, they may cast doubt on the general effectiveness of the strongest policy intervention. However, it must be noticed that the results for France could have been disrupted by the impact of the unmeasurable effects of terrorist attacks in Paris in 2015, even though these were mostly outside the dates reviewed. For Germany, Booking.com and HRS were stopped by Bundeskartellamt and court decisions in 2015 from engaging in PPCs with hotels, and Expedia limited itself to narrow PPCs EU-wide. Second, they could

arise if the direct channel becomes relatively cheaper than OTAs in both E.U. and non-E.U. countries because of the regulatory intervention. Indeed, this could be the case if, for example, retail reservation prices paid by EC citizens for hotel rooms located outside the E.U. may be also influenced by the policy change in Europe.

Our results are relevant not only for the specific questions related to impacts of hotel and OTA PPC clauses, but also provide empirical evidence on the nature of MFN impacts. While we do not suggest the results are necessarily directly applicable to other industries, the results may provide information on default expectations when key industry characteristics are similar.

Future work could usefully develop a structural model of supply and demand for different channels and hotel types to understand the ways that MFN clauses affect buyer and seller reactions, particularly for different hotel segments. Such an extension could explore how substitution patterns affect outcomes and examine whether platform market power exists in the hotel sector.

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Footnotes

[1] OTAs play an important role in online reputation of hotels through their reviews and ratings, which in turn receive management attention and hotel response. (See Proserpio and Zerbas, 2017.)

[2] See Morgan Stanley analysis in "Pillow Fight: Hotels vs. Online Travel Agencies", June 23th 2016. Article retrieved on August 7th 2017 from the following link accessed on February 8th 2022: https://www.morganstanley.com/ideas/hotels-vs-online-travel-agencies.

[3] In a different theoretical model, Johnson (2017) also finds that, under an agency model between sellers and intermediaries (i.e., sellers determine retail prices and pay a per-transaction commission fee to intermediaries), PMFNs raise commission fees and retail prices.

[4] A second theory of harm is linked to the fact that wide-PPCs have the potential to act as entry barriers. Indeed, under a PPC regime, it is more difficult for a new OTA to enter or expand its market share via the offer of lower commission rates in exchange for hotels offering lower retail prices for their rooms. In line with this intuition, Boik and Corts (2016) show that, under certain conditions, PPCs can indeed act as entry deterrents.

[5] See Paragraph 3 of the report on the monitoring exercise of the online booking sector carried out by the EC, available at the following link accessed on February 15th 2022:

http://ec.europa.eu/competition/ecn/hotel_monitoring_report_en.pdf. The German competition authority decision for Booking.com specifically sought to ban all forms of PPC, while the French competition authority decision permitted narrow PPCs, followed by a French legislative change that forbade them.

[6] This reasoning holds under the assumption that narrow-PPCs clauses are widely adopted by OTAs, or at least by the major OTAs in the market.

[7] Note that Gomes and Mantovani (2020) study the effect of capping commissions as an alternative to easing or lifting price parity rules.

[8] Wals and Schinkel (2018) have pointed out one respect in which the ambiguity disappears, namely when narrow PPCs are combined with best price guarantees.

[9] Thanks to a referee suggestion, it is worth noting that chains may have been able to negotiate individual contracts with OTAs, and these have not been observed. Possible subjects of negotiation could include elimination of the price parity clauses.

[10] In a recent paper, Cure *et al.* (2021) provide evidence that the vertical integration between OTAs and meta-search platforms (MSPs) could play an important role on hotel prices by affecting the positioning of hotels in the search results.

[11] In 2016 a group of ten E.U. competition authorities carried out a coordinated monitoring exercise of the online hotel booking sector (European Commission, 2017). The purpose of this exercise was to measure the effects of the recent changes in PPCs contracts introduced by the major OTAs in the market. According to survey responses from September 2016, the main changes observed by respondents as a result to the switch to narrow-PPCs were (i) 21% - 31% of hotels said that they have differentiated across OTAs in terms of prices and room availability, respectively, (ii) 40% of hotels said that they have undercut prices posted on OTAs (via lower prices posted on their direct channels), (iii) 30% of hotels said that at least on certain periods they have chosen to make rooms available exclusively on their own direct channels and not on OTAs, (iv) approximately 50% of the hotels said that sales through their loyalty programs have increased, and (v) 90% of hotels said that there were no changes in terms of OTAs' commission fees.

[12] For more details, see the following press release: https://webgate.ec.europa.eu/multisite/ecn-brief/en/content/french-italian-and-swedish-competition-authorities-accept-commitments-offered-bookingcom#_ftn

[13] The commitments were proposed by Booking.com on December 2014, and they had to be mandatorily executed no later than July-2015. See the summary of the decision by the French Competition Authority, accessed on February 15th 2022 at: https://www.autoritedelaconcurrence.fr/en/communiques-de-presse/21-april-2015-online-hotel-booking-sector

[14] See the French law "Loi no 2015-990 du 6 août 2015 pour la croissance, l'activité et l'égalité des chances, Article 133. "

[15] See Hunold *et al*. (2018) for an evaluation of the effects of the ban of Booking.com's PPCs in this case.

[16] For more details, see amendment to the Federal Act against Unfair Competition (Bundesgesetz, mit dem das Bundesgesetz gegen den unlauteren Wettbewerb 1984 - UWG und das Preisauszeichnungsgesetz geändert werden BGBl. I Nr. 99/2016 of 30 November 2016 and Article 1 (166) of Annual Competition Law of Italy, 2017.

[17] We do not consider chain-country combinations for which there is only information of only one year (either only 2014 or only 2016). Thus, under this criterion we dropped 0.26% of observations from sample of hotels in Europe. Similarly, we dropped 0.5% of observations from the sample of hotels located outside Europe. Since the construction of the dependent variable needs a comparison between the average prices posted on both the direct channel and OTAs, the sample does not consider hotel-day combinations for which there are either no bookings via the direct channel or no bookings via OTAs (on that specific day). For this reason, around 10% and 17% of the observations from the sample are considered as missing values in the before-after and difference-in-differences` regressions, respectively.

[18] Hotels located in 13 different countries account for almost 80% of the observations in the sample of hotels located outside Europe.

[19] Nominal values are used in the analysis that follows because for each hotel we are interested on the price difference between direct channel and OTAs, and not on the level of prices.

[20] The authors verified this seasonal pattern across countries using monthly hotel occupancy data from the World Bank.

[21] The presence of multiple channels (including the direct channel) may play an important role in disciplining the strategy of major OTAs and in mitigating any potential form of market power exploitation at the retail level. In addition, the fact that consumers are sensitive to price differences between channels may suggest that any restriction on the ability of hotels to offer differentiated prices across online distribution channels can result in

negative consequences for travellers' welfare. Further research to understand the demand and supply effects behind the change of pricing would be valuable to the extent that adequate data are available.

[22] For this shorthand description of regulatory change, we are referring to changes instituted by government authorities, whether sector regulators, competition authorities or legislatures. This approach to regulatory change therefore includes competition authority decisions and settlements between competition authority agreements and companies within the broad category of regulatory change. The authors recognise that many competition authorities are not engaged in sector regulation nor providing constant oversight of companies and, in this sense, are not regulators.

[23] A similar econometric approach is adopted by the report on the monitoring exercise of the online booking sector carried out by the EC, available at the following link: http://ec.europa.eu/competition/ecn/hotel_monitoring_report_en.pdf

[24] Note that there is no specific effect of the dummy variable *PPC* in Equation (1) because it is collinear with the trend.

[25] The series is IMF Economic Activity, Industrial Production Index.

[26] As for Equation (1) we omit the specific effect of PPC. Since we add fixed effects, we did not introduce specific effects for France, Germany and other countries to avoid collinearity.

[27] For the case of mid-level and luxury hotels, results presented in Table 3 are robust to the removal of trends. However, for the case of budget hotels because of the removal of trends from the regressions, the PPC's coefficient becomes positive and significant for $\delta = 2.5\%$ and not significant for the other cases. See Columns 1 to 3 in Table AO1.1 in Section OA1 of the Online Appendix. This confirms that the determination of prices for budget hotels differs from that of the two other types of hotels.

[28] Results displayed in Table 3 are also robust to the removal of the economic activity variable. See Columns 4 to 6 in Table AO1.1 in Section OA1 of the Online Appendix. Note that, in the before-after specifications estimated in this section, the removal of the economic index variable does not result in a change in the number of observations.

[29] For the case of budget and mid-level hotels, results presented in Table 3 are robust to the inclusion of country-specific trends; however, magnitudes of the coefficients are lower in absolute value. For the case of luxury hotels, the inclusion of country-specific trends results in that only the coefficient for $\delta = 2.5\%$ remains positive (with a lower magnitude) and significant. See Table AO1.2 in Section OA1 of the Online Appendix.

[30] U.K. is excluded from the countries involved in the estimations because its competition authority implemented a narrow PPC requirement prior to 2014.

[31] Common trend tests are performed, following Ashenfelter *et al.*, (2013). No difference in pre-trends is found to differentiate the treatment and control groups. This validates the use of the difference-in-differences method. See Section OA3 of the Online Appendix.

[32] Australian data is excluded from the countries involved in the difference-in-differences estimation due to its competition authority having implemented a narrow PPC requirement in the course of 2016.

[33] Results presented in Table 4 are robust to the removal of trends; however, magnitudes are slightly lower. See Columns 1 to 3 in Table AO2.1 in Section OA2 of the Online Appendix.

[34] Results displayed in Table 4 are also robust to the removal of the economic activity variable. See Columns 4 to 6 in Table A.3. Note that the removal of this latter variable allows for a 9.9% increase in the number of observations, as this economic activity index is not available for all the countries in the control group (i.e., countries outside of the E.U.).

[35] For the case of budget and mid-level hotels, results presented in Table 4 are robust to the inclusion of country-specific trends; however, the magnitudes of coefficients are lower in absolute value. For the case of luxury hotels, the inclusion of country-specific trends results in that only the coefficient for $\delta = 2.5\%$ remains positive (with a lower magnitude) and significant. See Table AO2.2 in Section OA2 of the Online Appendix.

[36] A one-tailed test is appropriate if the expectation is that a full elimination of PPC would have a stronger effect on direct channel pricing than a partial elimination. In columns (4)-(6) of Table 3, with $\delta = 2.5\%$, for the difference between coefficients for France budget and the rest of E.U., the t-value is equal to 2.15, which means the null hypothesis is not rejected at the 5% level. For the difference between coefficients between German budget and the rest of E.U., the t-value is equal to 1.50, which means the null hypothesis is not rejected at the 10% level. For columns (4)-(6) of Table 4, with $\delta = 2.5\%$, for the difference between France budget and rest of E.U., the t-value is equal to 1.95, which means the null hypothesis is not rejected at the 5% level. For the difference between coefficients for German budget and the rest of the E.U. coefficients, the t-value is equal to 1.29, which means the null hypothesis is not rejected at the 10% level.