# Vertical contracting and price parity agreements: evidence from hotels in Europe

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July 1, 2016

**Abstract**

This paper investigates the effect of "price parity" clauses in contracts between hotels and online travel agencies. These restrictions require a hotel to set its lowest prices for a given room on a travel agency's website and have come under recent scrutiny by antitrust regulators. We study the effect of price parity clauses on hotel prices by exploiting two recent policy changes in Europe: a settlement in 2014 in Germany that banned price parity clauses by the largest online travel agency and subsequent regulatory action in 2015 in Sweden, Italy, and France. Using a differences-in-differences strategy, we find that these regulatory actions were associated with a decrease in prices of between 9% and 15%, with the largest effects on lower quality hotels.

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We would like to thank Liran Einav and Tim Bresnahan for their valuable advice and feedback.

# 1 Introduction

In many online markets, large online platforms charge commission fees to facilitate transactions between buyers and a large number of relatively small sellers. For example, in e-commerce, Amazon mediated purchases of over 2 billion items by 2 million third-party sellers worldwide in 2014.[1]. Apple's iTunes App Store offered over 1.2M apps and counted over 9 million registered developers.[2] In the hotel industry, Booking.com allowed consumers to book rooms at over 200,000 hotels in 2012.[3] In each case, the platform and the upstream sellers negotiate a contract that governs this vertical relationship. If the platform has market power in its dealings with sellers, it may be able to extract terms in these contracts that increase its own profits and limit the ability for buyers and sellers to transact off the platform, increasing downstream prices faced by consumers and reducing output.[4]

This paper studies the effect of a particular contractual provision in the hotel industry known as "price parity" clauses on hotel prices faced by consumers. In this market, a few large online travel agents (OTAs) offer rooms from thousands of hotels. Consumers can search for hotel availability across locations and dates, see available hotel amenities, and book rooms through the travel agent. In exchange for this service, the OTA collects a percentage of the booking.[5] Approximately 22.5% of European hotel bookings are made through OTAs with the highest level at 30% in Italy, according to a survey conducted by HOTREC (Association of European Hotels). The OTA market is highly concentrated; about 90% of bookings are made through the websites of three main players: Priceline (Priceline, booking.com), Expedia (hotels.com, Venere) and HRS (especially active in Germany).

Price parity clauses require that a hotel must set its lowest price on the OTA's website.

[1] https://techcrunch.com/2015/01/05/amazon-third-party-sellers-2014/

[2] https://techcrunch.com/2014/06/02/itunes-app-store-now-has-1-2-million-apps-has-seen-75-billion-downloads-to-date/

[3] https://www.phocuswire.com/How-many-hotels-in-the-world-are-there-anyway-Booking-com-keeps-adding-them

[4] A large literature has examined the economics of two-sided platforms. See, for example, Armstrong (2006) and Rochet and Tirole (2006).

[5] Booking.com, one of the largest OTAs, charges fees in the range of 15-20% (Failte Ireland, 2014).

This provision explicitly prevents a hotel from offering lower rates in other channels, such as on its own website or through a competing OTA that charges lower commissions. Virtually all contracts between hotels and the three largest online travel agencies contain price parity clauses, except where prohibited by recent legal action. Parity clauses come in two forms. "Wide" rate parity clauses between an OTA and a hotel prohibit the hotel from undercutting prices provided to the OTA in any other distribution channel, including competing OTAs, the hotel's own website, and through non-public indirect or offline channels (such as walk-ins, email and phone bookings, and to customers in their loyalty programs). "Narrow" rate parity allows the hotel to offer discounts in these indirect and offline channels, but does not allow the hotel to undercut the OTA's prices on its own website or with competing OTAs.

In recent years, price parity agreements have received significant attention from antitrust regulators. Our paper exploits two recent policy changes in Europe to measure the effect of rate parity on prices. First, a ruling by German regulators banned the use of parity agreements by the biggest OTA in Germany. Second, Booking.com and Expedia reached a settlement with EU regulators that ended wide rate parity agreements in all of Europe. Using a differences-in-differences approach, we test whether these actions lead to lower hotel prices in European markets relative to hotel prices in major US markets. We find that the policy change in Germany was associated with a decrease in prices of about 9% relative to our group of control markets, despite the policy affecting only one intermediary. The Europe-wide settlement was associated with a decline of about 15%. The effect is present for both low and midscale hotels and upscale hotels, though somewhat larger for low and midscale properties. We show that our main result is robust to a range of alternative specifications. A Placebo test using a fake event one year before finds no distinguishable effect. Our results suggest that the actions taken thus far have a substantial impact on prices and may be informative for other policymakers considering action.

Ex ante, the effect of price parity clauses on downstream prices is ambiguous. Regulators have focused on several channels through which price parity clauses may harm consumers.

First, price parity agreements may increase prices by dampening incentives for intermediaries to compete. Consider a hotel that can sell its rooms through several distribution channels with different commission rates. In the absence of price parity, the hotel may set higher prices on platforms that charge lower commissions, given that consumers can buy the same room through several channels. Thus, platforms have strong incentives not to raise commissions, since higher fees may induce hotels to raise prices and drive customers to a competing platform. In the presence of parity agreements between each hotel and intermediary, this incentive is dampened, since the hotel cannot respond by setting different prices. Instead, hotels respond to higher commission fees by setting higher prices for consumers.

Second, parity agreements may deter entry in the intermediary market. Like many platform industries, the OTA market is characterized by significant network effects and economies of scale. Network effects come from the fact that the value to both consumers and hotels from using a particular platform is closely related to the scale of the platform - i.e. the number of consumers that the hotel can sell to, and the number of hotels that the consumer can access. Economies of scale here are driven by large fixed costs necessary to develop brand capital through advertising. One way for an upstart OTA to compete in this market would be to offer lower commissions to hotels, inducing them to lower prices and attract customers to the new platform. In the presence of parity agreements, this strategy is no longer available, since hotels cannot set lower prices on the upstart without also lowering their price on the incumbent platform. Indeed, several of the lawsuits challenging rate parity have been initiated by smaller OTAs seeking to compete with the larger established platforms.[6]

Third, parity agreements may facilitate tacit or explicit collusion between hotels. Price parity ensures that the price of a given hotel room listed on an OTA is at least as low as that same room sold in all other channels. Under parity, if hotels enter into a collusive agreement, cheating becomes both easier to observe, since prices are easily viewed on the OTA, and more

[6]In a lawsuit in the US that was eventually dismissed, US District Judge Jane Boyle wrote: "According to the complaint, the rate parity guarantees prevent companies such as Skoosh.com, a UK travel booking site, from entering the market and attempting to gain share by discounting room prices below the price matches as a loss leader" (O'Neil, 2014).

costly, since the lower price may need to be offered to many buyers.[7]

On the other hand, parity agreements may solve an important hold-up problem. OTAs invest in tools that lower search costs for consumers by collecting prices from many different hotels in a single searchable database. In the absence of parity agreements, hotels might offer lower rates on their own websites, where they don't have to pay commission fees. This could induce consumers to use the OTA's platform to conduct a search for different rooms before visiting the hotel's website to book a room. Thus, some form of parity agreements may protect investment incentives for the platform and lower search costs for consumers. The existence of price comparison tools may increase consumer welfare by lowering the cost of information acquisition and by making the hotel market more competitive.

Finally, parity agreements may affect equilibrium prices by limiting the ability of hotels to price discriminate. In the absence of parity, hotels can offer different rates on different channels. If more price sensitive consumers tend to check prices on the hotel's website or even call or email the hotel before booking, relaxing parity agreements may allow the hotel to reduce prices for this group and raise prices for other groups of customers. The effect on prices in equilibrium is ambiguous.

The main contribution of our paper is to provide the first empirical evidence to our knowledge on the effect of price parity clauses in the hotel industry. Our work is related to several other papers on the effects of vertical pricing constraints. De los Santos and Wildenbeest (2014) analyze the market for e-books. They exploit a recent Department of Justice ruling to prevent publishers from interfering with retailers' ability to set e-book prices, and find that the ruling lead to a price decline of 18% on Amazon and 8% on B&N. In the travel industry, Tappata and Cossa (2014) study the role of OTAs in the hotel booking market as providers of a tool for price discrimination, known as opaque booking. Bilotkach et al. (2013) study the effect on prices after American Airlines was delisted from two large OTAs

[7] Albæk et al. (1997) show that legislation that increased price transparency in the Danish concrete market increased prices by between 15 and 20%. See Porter (2005) for a broader discussion of structural factors that facilitate collusion.

in the first quarter of 2011.

A number of papers in the theoretical literature have studied the effects of price parity (also called most favored nations agreements, or MFNs). This literature largely predicts that their use leads to higher prices by dulling incentives for firms to compete. Johnson (2015) analyzes a model with imperfectly competitive upstream and downstream markets and compares the agency model with MFN contracts, in which suppliers set retail prices and share revenue with intermediaries, to the wholesale model, in which intermediaries set prices. He finds that, with revenue sharing agreements, the agency model increases retailer surplus and decreases supplier surplus, and that MFNs raise prices faced by consumers and result in lower consumer surplus. But he also finds that MFNs can encourage competition by promoting retailer entry when profit-sharing contracts are used. Boik and Corts (2013) find that platform MFNs raise platform fees charged to suppliers and retail prices charged to consumers, and that they can discourage entry from low-cost entrants in the platform market.

Baker and Chevalier (2012) point out the main antitrust issues related to MFN clauses. They list some efficiency motives in favor of such arrangements: as a mechanism to solve the "hold up problem" in case of relation-specific investment and potential reduction in transaction costs. Ezrachi (2015) explores the welfare effects of parity clauses and considers possible regulatory interventions.

The remainder of the paper is organized as follows. Section 2 discusses recent regulatory scrutiny of price parity clauses. Section 3 provides details of the data sources we use. Section 4 discusses our empirical strategy. Section 5 shows our main results, as well as a set of robustness exercises. Section 6 concludes.

# 2 Regulatory landscape

In recent years, rate parity clauses in contracts between OTAs and hotels have been the subject of regulatory scrutiny. Rate parity was targeted in multiple lawsuits in the United States against OTAs and large hotel chains (who themselves utilize parity contracts to restrict pricing by franchised properties). Federal courts ultimately ruled that, while the agreements had the potential to be used to facilitate collusion, the plaintiffs were unable to establish that the OTAs and hotel chains were engaged in a conspiracy to fix prices, leaving the agreements in place.[8]

In Europe, however, complaints targeting price parity agreements by OTAs have received more favorable treatment by regulators. Investigations against the largest European OTAs, including Booking.com, Expedia, and HRS, have proceeded in several countries, resulting in substantial cross-country variation in regulations. We outline the most important regulatory changes below.

First, German regulators prohibited the use of rate parity agreements by the largest OTA in Germany. On December 20, 2013, the German Federal Cartel Office ruled that Hotel Reservation Service (HRS), the leading OTA in Germany with more than 50% of OTA bookings, was required to remove all parity clauses from its contracts effective March 2014. Our analysis uses variation around the March 2014 date for the regulation and tests the effect of the action on prices and hotel capacity.

Next, regulatory investigations in Sweden, Italy, and France prompted Europe-wide settlements by the two largest intermediaries, Booking.com and Expedia (combined market share of 64% in 2012 according to Phocuswright). The settlement institutes so-called "narrow rate parity" across Europe, active on July 1st, 2015. Under narrow rate parity, OTAs are no longer able to restrict the price that a hotel sets on a competing OTA or through the hotel's offline channels, but the price that the hotel sets on its own website is still subject to the

[8] In one significant case, 24 parties across 13 states alleged unfair competition claims against 22 large hotel brands and OTAs. The case was dismissed in federal court in 2014 (O'Neil, 2014).

parity agreement. Hotels are able to discount below the price offered on the OTA to walk-in customers and those who make a reservation over the phone. The effects of this partial ban on rate parity have been widely debated in the travel industry. Some hotels, including Accor, the largest hotel chain in Europe, championed the change as increasing transparency in the market and returning pricing control to hotels. Other operators, such as Intercontinental Group, continued to push for stricter rules, including a complete ban of parity agreements (allowing hotels to control pricing on their own websites).

Investigations continue in some places in Europe, including France, where lawmakers voted for stricter rules governing rate parity than those outlined in the settlements by Booking.com and Expedia. On July 9, 2015, the French National Assembly enacted the "Law Macron", effectively prohibiting any form of rate parity between OTAs and hotels effective August 9th. The decision was condemned by Booking.com and other intermediaries, who threatened that the ruling could ignite a price war and hurt hotel margins.

In the paper's current iteration, we focus on the 2014 ruling in Germany and the Europe-wide settlement. Both the timing of these regulatory actions as well as the variation in intensity of the action provide the opportunity to evaluate these policies with respect to their effects on prices and competition in the OTA market.

# 3 Data

We use data from STR, a data provider for hotels. They conduct a global hotel survey covering approximately 50,000 hotels. They provide us with daily data for eight European cities and seven cities in the United States, broken out by hotel class (quality level) between January 1, 2012 and September 5, 2015.[9] The data includes the average daily rate (ADR) and occupancy rate for the sample of hotels that they survey, as well as the total number of hotel rooms in the market (city-class combination). Price and occupancy are reported daily

[9]The sample cities are Brussels, Amsterdam, Berlin, Dusseldorf, London, Munich, Paris, Vienna, Chicago, Los Angeles, Miami, New York, Orlando, San Francisco, and Washington DC.

while the total number of hotel rooms varies at the month level. Hotels are divided into six classes: economy, midscale, upper midscale, upscale, upper upscale, and luxury.

We supplement the price and occupancy data with Google search volumes data at the city-week level as a proxy for the level of interest in visiting that city. For each city, we record the (normalized) number of worldwide searches for the search terms "<city name> hotels" and "<city name>". We demean each time series and control for a common linear trend. Therefore, the variation captured by the residual is given by both movement around a trend and by the differential time trend across different cities.

We present summary statistics of the key variables in Table 1. The mean of the average daily rate in Europe over the period of study was somewhat higher than our US sample cities (though the medians were similar). Occupancy rates were also comparable across the two groups of cities.

We show graphs of average weekly rates over time in Germany, the US, and the rest of Europe in Figures 1 and 2. In Figure 1, we show Europe and the US. The second red line in the figure marks the effective date of the Booking.com and Expedia settlement. Average prices in Europe appear to drop on the order of 25%, while US prices remain stable. In the period before regulatory action, prices in Europe and the US appear to move together, though prices in the European markets are somewhat more volatile. In Figure 2, we separate Germany, where earlier regulatory action against HRS was already in place, and the rest of the Europe. The first vertical red line marks the effective date of the HRS settlement. While the weekly price data is noisy, prices in Germany appear to remain relatively stable while prices in the rest of the Europe are higher for much of the period.

# 4 Empirical Strategy

We test whether the two policy changes we detail above affected hotel prices. We employ a differences-in-differences (DD) strategy by comparing hotel prices in Germany and the

rest of Europe, which were affected by regulatory settlements with the largest OTAs at different times, with prices in the US, where no policy change was implemented. As in any DD specification, our identification assumption is that hotel prices in the treated groups (Germany and the rest of Europe) and control groups (US markets) would have followed parallel trends in the absence of the policy change. From the weekly price series that we plot in Figure 1, the two series appear to move together in the period before the policy change.

A potential threat to our identification strategy is the existence of time-varying shocks that impact US, German and other European market prices differentially. These could result in changes in prices that are correlated with the timing of the policy changes that may confound our measurement. We address this in two ways. First, in our main specification, we include average daily occupancy rate - a measure of how full hotels were in a particular time period. Our research goal is to measure the effect of the partial ban of price parity clauses on hotel pricing policies. If recent regulatory action had any effect, it should have induced hotels to change their behavior because of changes in contractual agreements with OTAs. Therefore, we are interested in estimating a supply-side equation. Since both occupancy rate and price may be affected by unobservable shocks, we instrument for occupancy rate with Google search volumes. Google search volumes are a valid instrument as long as consumers' search decisions are not influenced by price (for instance, if consumers decide to research a city because they know it has cheap hotels). Second, we show that our primary result is robust to alternative specifications that include city-specific time trends. These time trends should absorb overall trends in prices that are unrelated to the policy change.

As the plots of the price data show, hotel prices are highly volatile, even when aggregated at the week level. To deal with this volatility, we test a number of specifications that include day-of-week effects, trends over time, seasonality, and other demand fluctuations. In our preferred specification, we estimate the following inverse-supply equation:

$$p_{jtc} = \mu_{jd} + \mu_{jc} + \delta_{jm} + \beta Occ_{jtc} + \alpha_1 G_j + \alpha_2 D1_t + \alpha_3 G_j D1_t + \alpha_4 EU_j + \alpha_5 D2_t + \alpha_6 EU_j D2_t + \gamma Olympics_{jt} + \eta_{jtc} \quad (1)$$

$p_{jtc}$ is the average price of rooms in city $j$ on date $t$ belonging to hotel class $c$. $\mu_{jd}$, $\mu_{jc}$, and $\delta_{jm}$ are fixed effects for city-day-of-week combination $jd$, city-class combination $jc$, and city-month combination $jm$ respectively. $Occ_{jtc}$ is the occupancy rate, measured as occupied rooms divided by available rooms in sample hotels, multiplied by 100. $G_j$ and $D1_t$ are dummies equal to 1 if city $j$ is in Germany and date $t$ is after March 1, 2014. $EU_j$ and $D2_t$ are dummies equal to 1 if city $j$ is in Europe and date $t$ is after July 1, 2015. The coefficients on their interactions, $\alpha_3$ and $\alpha_6$, are the DD coefficients that measure the effects of the two policies. A negative coefficient is indicative that the policy change had a downward effect on prices (relative to the control cities). $Olympics_{jt}$ is a dummy variable equal to 1 during the London Olympics in 2012.

# 5 Results on Hotel Prices

In Table 2, we present results from our preferred specification. Columns (1) and (3) show OLS estimates of equation 1, while columns (2) and (4) contain IV estimates, instrumenting for average occupancy rate with country unemployment and Google search volumes. The estimates of $\alpha_3$ and $\alpha_6$, the differences-in-differences coefficients, imply that the ruling in Germany was associated with a price decrease of about 13 euros, or 9%, while the Europe-wide settlement was associated with a decrease of 10-12 Euros, or about 15%. The estimated effects of the policy change in Germany are statistically significant across all specifications, while the effect of the European effect is not significant in the 2SLS specification with the dependent variable measured in dollars. The point estimates are similar across the OLS and 2SLS specifications. As expected, occupancy rate is positively associated with price in all

specifications.

Analysis of price parity clauses in the theoretical literature largely predicts higher prices when parity clauses are in place. Consistent with these predictions, our empirical results suggest that the partial bans of price parity clauses in Europe were associated with lower prices. Further, both of these effects can be observed in a relatively short window following the policy change.

There are several potential mechanisms through which price parity clauses may lead to higher prices in the hotel market. First, parity clauses make it costly for hotels to price discriminate by offering lower prices to its most price-sensitive consumers, who may purchase via different channels than consumers who are less price sensitive. For instance, parity clauses restrict hotels from offering deals to customers who walk in or reserve hotel rooms over the phone, since the hotel must also lower its price on major OTA platforms. Second, parity clauses dampen incentives for OTAs to compete for consumers by offering lower commissions (in the form of revenue shares). If hotels face a downward sloping demand curve (because of horizontal and vertical product differentiation) and have non-zero marginal costs, then the prices set by hotels are increasing in the share of revenues taken by the OTA. In light of this, absent price parity clauses, OTAs might compete for consumers by offering lower revenue shares in order to induce lower prices on the part of hotels. When parity clauses are in place, these incentives disappear, and so intermediaries instead charge higher commissions, leading hotels to set higher prices.

Third, price parity clauses may increase prices by facilitating coordination between hotels. Parity agreements make it more costly for hotels to lower prices, since they must simultaneously lower prices on all platforms. This fact can facilitate price fixing, since it makes deviations from a collusive agreement more expensive for a hotel. Finally, parity clauses may create barriers to entry in the OTA markets. Platforms need a critical mass of consumers and hotels in order to be viable. Incumbent platforms like Booking.com and Expedia have substantial advantages in drawing consumers through brand recognition and large marketing

budgets. In light of this, a potential strategy for entrant OTAs to attract consumers may be to induce lower prices on their platform by taking lower commission. Parity agreements make this strategy impossible, since the hotel must also lower its price on the incumbent platform.

The existing literature on the theory of price parity clauses generally considers a complete ban. However, the policy actions in Europe are only partial bans - in the German ruling, two of the three major OTAs were allowed to continued to use parity clauses, while the Booking.com settlement left some restrictions in place (notably, that prices on the hotel's own website could not be lower than those listed on the OTA). Further, since many hotel rooms are booked in advance, we might not expect prices to immediately adjust, as prices after the policy change may be partially determined by reservations made prior to the change.

Several of the possible channels outlined above may take place over a longer time horizon. For example, the entry of new OTAs into the market that offer a more favorable commission structure to upstream hotels seems unlikely to arise in a few months or even a year after the change in policy. Given that we measure a sizable effect of the policy change in a relatively short period after the change, it seems most likely that lower prices are driven by hotels offering additional discounts through their indirect and offline channels. Our data contain only average prices at the city-market segment level and do not allow us to distinguish prices paid by channel of booking. Thus, the effect we measure should be thought of as a short-run elasticity, and is presumably smaller than the long run effect.

## 5.1 Heterogeneity and Robustness

We use the same framework developed above to investigate potential heterogeneity in the effects of the two policies on hotels of different quality levels. In Table 3, we present results from an additional specification where we allow the treatment effect to vary for low end and high end hotels. We label hotels that fall into the top three classes (Upscale, Upper Upscale, and Luxury) as high end, and hotels in the bottom three classes (Economy, Midscale and

Upper Midscale) as low/medium end. We estimate OLS and IV specifications of equation 1 including the interaction between low/medium and the treatment dummy. We find that the effects of both changes were more pronounced for low end hotels than high end hotels, although prices declined in both segments. The HRS ruling in Germany was associated with a decline of 14-15 euros (9-10%) among low and midrange hotels and about 12 euros (8-9%) among high end hotels. The settlement in Europe was associated with a decline of between 19 and 22 euros (17-18%) in low-end hotels and 6 euros (13%) in high end hotels (although we caution that the effect was not statistically significant for high end hotels in some specifications).

We outline two possible explanations for the stronger observed effect among low-end market segments. First, the rulings affect only parity agreements between hotels and major OTAs, but leave intact parity agreements and retail price management agreements between chains and their franchises. If low end hotels are disproportionately independent, then the effect among high end hotels may be restrained by other contractual clauses that the ruling leaves in place. For example, price parity clauses are also in place between many hotel chains and their franchisees. Second, it could be that consumers in the low quality segment might be more price sensitive and, consequently, allowing prices to adjust more freely has a stronger effect in this submarket. Moreover, from anecdotal evidence we can think that the market power of OTAs is stronger for hotels that are lower quality and lack brand recognition, and thus rely more heavily on OTAs to be found by consumers.

In Table 4, we present several additional robustness tests from specifications with different sets of fixed effects and no demand controls. Columns (1) and (2) report estimates with class-city and day-of-year-city fixed effects. Columns (3) and (4) report results using class-city and month-city fixed effects. Columns (5) and (6) report estimates using only class-city fixed effects. The policies were associated with a substantial decline in prices across all specifications, although the magnitude of the effects of the two policy changes changes depends on the specification used.

As we discuss above, one identification concern is the presence of unobservable time-varying and city-varying shocks that affect prices. In Table 5, we rerun our base specification with the addition of city-specific trends. While the results are slightly weaker, the coefficients in the regression with log prices are still negative and significant. We measure a 2% price decline in Germany and a 5-7% price decline in Europe following the respective policy changes.

An additional concern is that differences in seasonality patterns across markets may contribute to differences in prices. In Table 6, we run a placebo test, using one year before the two policy changes as “fake" policy changes. We also restrict the sample to days before September 2014 to avoid contaminating the placebo treatment with the real treatment. We find small and insignificant effects for both placebos. This suggests that seasonal patterns do not drive the results that we find.

# 6 Conclusion

Our paper provides novel empirical evidence on a question which has received some attention in the theoretical literature, as well as in policy circles: do price parity agreements (or most favored nations clauses) increase prices for consumers? Our results suggest that they do in the European hotel market: recent regulatory actions in Europe governing the relationships between large online travel agencies and hotels had significant effects on prices in the hotel market. We find that the policy changes under study (partial bans of price parity clauses) resulted in a decrease of prices of between 10 and 20%. We also find that these effects are concentrated in low and medium end hotels, and that they are robust to a range of empirical specifications.

Our work has implications for policymakers and antitrust authorities charged with protecting consumer welfare. It suggests that in markets characterized by vertical agreements between a platform and a network of suppliers, contractual restrictions can have important implications for downstream agents.

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Table 1: Summary Statistics

| Region | Statistic | ADR | Log of ADR | Occupancy rate | Searches city + hotels | Searches city |
|---|---|---|---|---|---|---|
| Europe | Mean | 148.0 | 4.8 | 73.4 | 0.00 | 0.00 |
| | Median | 105.1 | 4.7 | 76.4 | -0.41 | 0.14 |
| | SD | 124.5 | 0.6 | 17.0 | 9.19 | 5.53 |
| United States | Mean | 124.8 | 4.7 | 75.9 | 0.00 | 0.00 |
| | Median | 105.1 | 4.7 | 78.1 | -0.41 | -0.09 |
| | SD | 71.0 | 0.5 | 14.5 | 5.07 | 5.75 |
| Total | Mean | 134.9 | 4.7 | 74.8 | 0.00 | 0.00 |
| | Median | 105.1 | 4.7 | 77.4 | -0.41 | 0.00 |
| | SD | 98.6 | 0.6 | 15.7 | 7.18 | 5.66 |

The table shows summary statistics for our primary analysis sample. The first two columns contain daily price and occupancy data at the city-hotel class level between January 2012 and September 2015. ADR is average daily rate and is recorded in Euros. Occupancy rate is the number of rooms sold divided by rooms available, multiplied by 100. The third and fourth columns contain data on Google search volumes that we use as a proxy for demand to visit a city. For each city, we record the normalized number of searches at the city-week level for the search terms "<city name> hotels" and "<city name>". We demean each time series and control for a common linear trend.

Table 2: Price regression: base specification

| VARIABLES | (1) ADR (Euro) | (2) ADR (Euro) | (3) logP | (4) logP |
|---|---|---|---|---|
| After ruling on HRS: March the 1st 2014 | 13.405*** | 14.962*** | 0.098*** | 0.094*** |
| | [1.626] | [2.049] | [0.009] | [0.009] |
| Germany after ruling on HRS (treated) | -13.187*** | -12.883*** | -0.090*** | -0.090*** |
| | [2.402] | [2.366] | [0.012] | [0.012] |
| Olympics | 94.441*** | 98.570*** | 0.411*** | 0.403*** |
| | [17.810] | [21.581] | [0.038] | [0.044] |
| Occupancy rate | 0.965*** | 0.256 | 0.007*** | 0.009*** |
| | [0.057] | [0.502] | [0.000] | [0.002] |
| After Booking settlement | 21.588*** | 21.759*** | 0.176*** | 0.175*** |
| | [2.744] | [2.615] | [0.010] | [0.010] |
| Europe after Booking settlement (treated) | -11.945* | -10.524 | -0.144*** | -0.147*** |
| | [6.279] | [6.593] | [0.020] | [0.020] |
| Estimator | OLS | 2SLS | OLS | 2SLS |
| Observations | 98,219 | 98,219 | 98,219 | 98,219 |
| R-squared | 0.946 | 0.941 | 0.956 | 0.955 |

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

The table shows regression results from estimation of equation 1. The dependent variable in columns (1) and (2) is average daily rate at the class-market-day level, recorded in Euros. In columns (3) and (4), we use the log of average daily rate. The DD coefficients that give our estimated effects of the two policies are shown in rows 2 and 6 of the table, listed as "treated". All regressions in the table include day-of-week, city-class, and city-month fixed effects. Standard errors are clustered by city-class. In columns (1) and (3), we estimate equation 1 via OLS. In columns (2) and (4), we instrument for average occupancy rate with Google search volumes.

Table 3: Price regression: heterogeneity in class

| VARIABLES | (1) ADR (Euro) | (2) ADR (Euro) | (3) logP | (4) logP |
|---|---|---|---|---|
| After ruling on HRS: March the 1st 2014 | 13.359*** | 14.898*** | 0.097*** | 0.094*** |
| | [1.617] | [2.024] | [0.009] | [0.009] |
| Germany after ruling x high (treated) | -12.185*** | -11.938*** | -0.086*** | -0.086*** |
| | [2.963] | [2.975] | [0.011] | [0.011] |
| Germany after ruling x low-middle (treated) | -14.369*** | -14.035*** | -0.095*** | -0.095*** |
| | [2.007] | [1.884] | [0.018] | [0.019] |
| Olympics | 94.823*** | 98.840*** | 0.412*** | 0.404*** |
| | [18.335] | [21.932] | [0.036] | [0.042] |
| Occupancy rate | 0.966*** | 0.268 | 0.007*** | 0.009*** |
| | [0.057] | [0.493] | [0.000] | [0.002] |
| After Booking settlement | 21.614*** | 21.779*** | 0.176*** | 0.175*** |
| | [2.742] | [2.616] | [0.010] | [0.010] |
| Europe after settlement x high (treated) | -6.696 | -5.957 | -0.129*** | -0.131*** |
| | [8.022] | [8.090] | [0.019] | [0.020] |
| Europe after settlement x low-middle (treated) | -21.663*** | -19.037*** | -0.172*** | -0.177*** |
| | [4.085] | [4.422] | [0.031] | [0.032] |
| Observations | 98,219 | 98,219 | 98,219 | 98,219 |
| R-squared | 0.946 | 0.941 | 0.956 | 0.955 |

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

The table shows regression results from estimation of equation 1 allowing the treatment effect for both policies to differ for low-medium and high quality hotels. The dependent variable in columns (1) and (2) is average daily rate at the class-market-day level, recorded in Euros. In columns (3) and (4), we use the log of average daily rate. The DD coefficients that give our estimated effects of the two policies are shown in rows 2-3 and 7-8 of the table, listed as "treated". All regressions in the table include day-of-week, city-class, and city-month fixed effects. Standard errors are clustered by city-class. In columns (1) and (3), we estimate equation 1 via OLS. In columns (2) and (4), we instrument for average occupancy rate with Google search volumes.

Table 4: Price regression: alternate fixed effects

| VARIABLES | (1) ADR (Euro) | (2) logP | (3) ADR (Euro) | (4) logP | (5) ADR (Euro) | (6) logP |
|---|---|---|---|---|---|---|
| After ruling on HRS: March the 1st 2014 | 5.175*** | 0.052*** | 15.541*** | 0.114*** | 17.364*** | 0.128*** |
| | [1.022] | [0.006] | [1.621] | [0.010] | [1.624] | [0.009] |
| Germany after ruling on HRS (treated) | -4.762*** | -0.044*** | -12.762*** | -0.086*** | -14.550*** | -0.099*** |
| | [1.407] | [0.009] | [2.387] | [0.012] | [2.342] | [0.011] |
| Olympics | 113.299*** | 0.498*** | 99.646*** | 0.453*** | 103.730*** | 0.462*** |
| | [28.485] | [0.023] | [20.293] | [0.017] | [24.567] | [0.017] |
| After Booking settlement | 7.243* | 0.074*** | 21.792*** | 0.177*** | 14.391*** | 0.132*** |
| | [3.789] | [0.019] | [2.589] | [0.009] | [4.021] | [0.022] |
| Europe after Booking settlement (treated) | -7.219 | -0.114*** | -10.032 | -0.130*** | -14.085* | -0.187*** |
| | [5.223] | [0.027] | [6.076] | [0.018] | [7.121] | [0.033] |
| Estimator | OLS | OLS | OLS | OLS | OLS | OLS |
| Fixed effects | Class-city, day-of-year-city | Class-city, day-of-year-city | Class-city, month-city | Class-city, month-city | Class-city | Class-city |
| Observations | 98,219 | 98,219 | 98,219 | 98,219 | 98,219 | 98,219 |
| R-squared | 0.904 | 0.896 | 0.931 | 0.929 | 0.900 | 0.891 |

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

The table shows regression results from estimation of equation 1 under alternate configurations of fixed effects. The dependent variable in columns (1), (3), and (5) is average daily rate at the class-market-day level, recorded in Euros. In columns (2), (4), and (6), we use the log of average daily rate. The DD coefficients that give our estimated effects of the two policies are shown in rows 2 and 5 of the table, listed as "treated". Standard errors are clustered by city-class.

Table 5: Price regression: controlling for city-specific time trends

| VARIABLES | (1) adreuro | (2) adreuro | (3) logP | (4) logP |
|---|---|---|---|---|
| After ruling on HRS: March the 1st 2014 | 1.305 | 0.852 | 0.019*** | 0.016*** |
| | [1.097] | [1.242] | [0.005] | [0.006] |
| Germany after ruling on HRS (treated) | -1.060 | -1.541 | -0.017** | -0.020** |
| | [1.322] | [1.523] | [0.007] | [0.009] |
| Olympics | 105.099*** | 101.378*** | 0.455*** | 0.428*** |
| | [22.070] | [20.708] | [0.042] | [0.056] |
| Occupancy rate | 0.958*** | 1.692*** | 0.007*** | 0.012*** |
| | [0.059] | [0.276] | [0.000] | [0.001] |
| After Booking settlement | 13.714*** | 14.246*** | 0.111*** | 0.115*** |
| | [2.146] | [2.272] | [0.008] | [0.008] |
| Europe after Booking settlement (treated) | -3.361 | -5.420 | -0.056*** | -0.071*** |
| | [3.830] | [4.126] | [0.013] | [0.016] |
| Estimator | OLS | 2SLS | OLS | 2SLS |
| Observations | 98,219 | 98,219 | 98,219 | 98,219 |
| R-squared | 0.949 | 0.944 | 0.960 | 0.952 |

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

The table shows regression results from estimation of equation 1, with the inclusion of city-specific linear time trends. The dependent variable in columns (1) and (2) is average daily rate at the class-market-day level, recorded in Euros. In columns (3) and (4), we use the log of average daily rate. The DD coefficients that give our estimated effects of the two policies are shown in rows 2 and 6 of the table, listed as "treated". All regressions in the table include day-of-week, city-class, and city-month fixed effects. Standard errors are clustered by city-class. In columns (1) and (3), we estimate equation 1 via OLS. In columns (2) and (4), we instrument for average occupancy rate with Google search volumes.

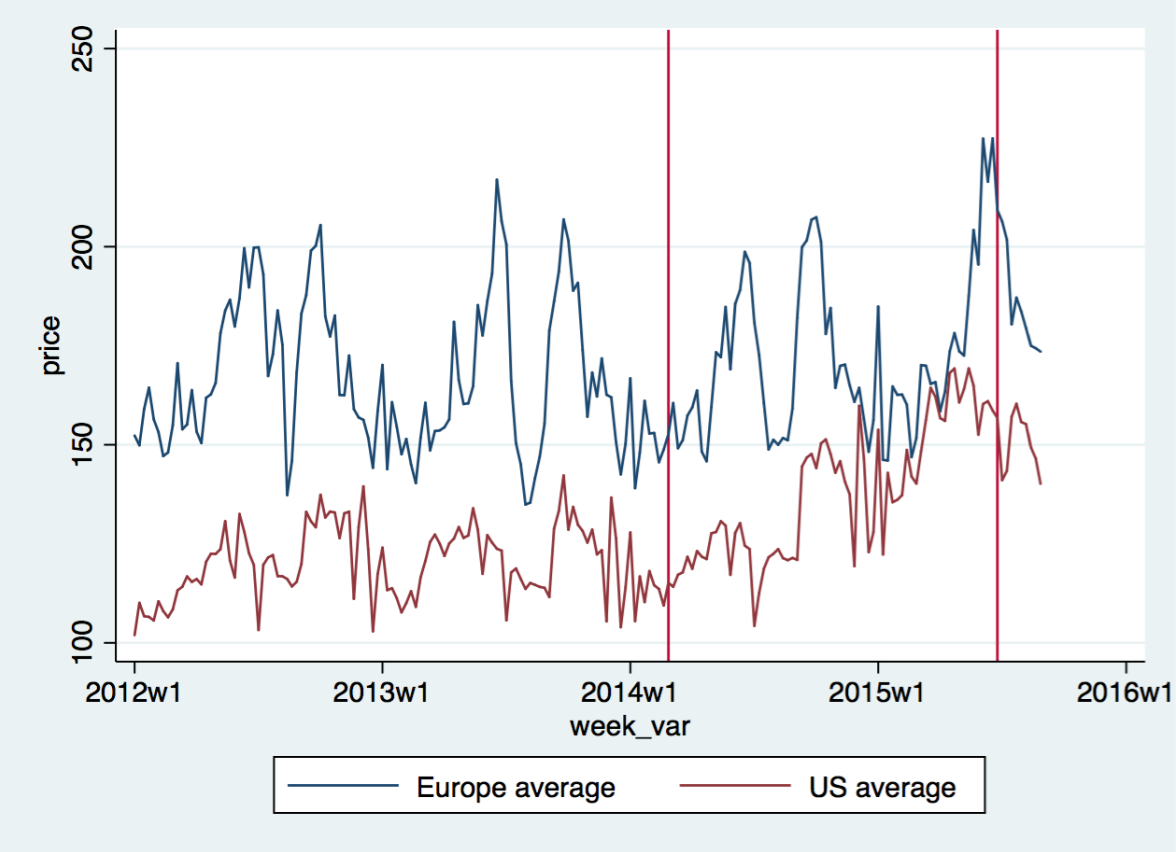
Table 6: Price regression: placebo test

| VARIABLES | (1) adreuro | (2) adreuro | (3) logP | (4) logP |
|---|---|---|---|---|
| Occupancy rate | 0.970*** | 1.123*** | 0.008*** | 0.009*** |
| | [0.053] | [0.250] | [0.000] | [0.001] |
| Germany placebo treatment (1 year before) | -0.248 | -0.208 | -0.001 | -0.000 |
| | [1.793] | [1.819] | [0.008] | [0.008] |
| Olympics | 96.595*** | 95.600*** | 0.402*** | 0.393*** |
| | [20.554] | [20.466] | [0.039] | [0.042] |
| Europe placebo treatment (1 year before) | -1.515 | -1.716 | -0.017 | -0.019 |
| | [1.971] | [2.131] | [0.011] | [0.011] |
| Observations | 71,443 | 71,443 | 71,443 | 71,443 |
| R-squared | 0.953 | 0.953 | 0.960 | 0.960 |

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

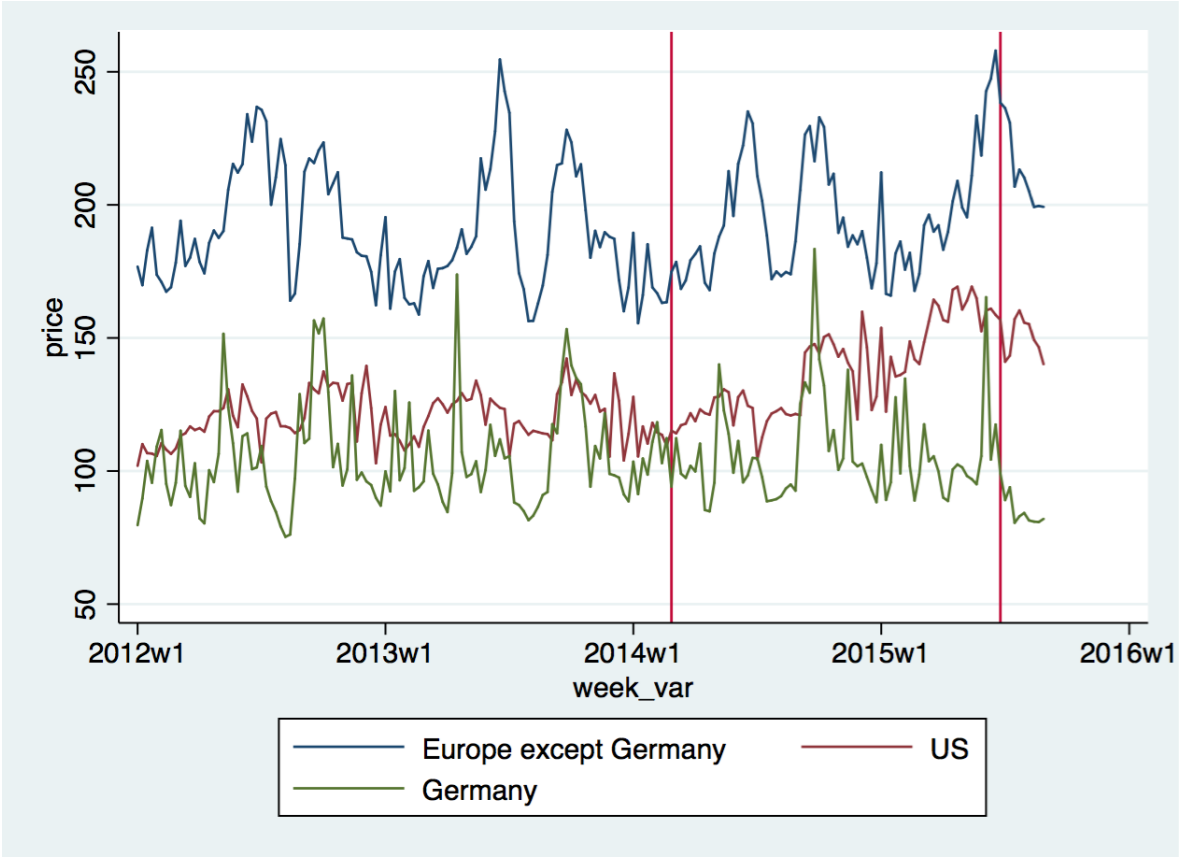
The table shows regression results from estimation of equation 1, with the actual policy changes replaced by placebos one year before. We limit the sample to observations through September 2014. The dependent variable in columns (1) and (2) is average daily rate at the class-market-day level, recorded in Euros. In columns (3) and (4), we use the log of average daily rate. The DD coefficients that give our estimated effects of the two policies are shown in rows 2 and 6 of the table, listed as "treated". All regressions in the table include day-of-week, city-class, and city-month fixed effects. Standard errors are clustered by city-class. In columns (1) and (3), we estimate equation 1 via OLS. In columns (2) and (4), we instrument for average occupancy rate with Google search volumes.

Figure 1: Average daily prices for hotels in Europe and US




The figure shows hotel prices at the week level for European and US markets. Within Europe and the US, each market is weighted by the total number of rooms sold. The first red line marks the effective date of the settlement in Germany, while the second red line marks the effective date of the Europe-wide settlement.

Figure 2: Average daily prices for hotels in Germany, rest of Europe and US




The figure shows hotel prices at the week level for Germany, US, and the rest of Europe. Within each group, each market is weighted by the total number of rooms sold. The first red line marks the effective date of the settlement in Germany, while the second red line marks the effective date of the Europe-wide settlement.