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Article — Accepted Manuscript (Postprint)

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Journal of European Competition Law & Practice

Provided in Cooperation with:

German Institute for Economic Research (DIW Berlin)

Suggested Citation: Duso, Tomaso; Michelsen, Claus; Schaefer, Maximilian; Tran, Kevin D (2022) : The Assessment of Substitution Through Event Studies - An Application to Supply-Side Substitution in Berlin's Rental Market, Journal of European Competition Law & Practice, ISSN 2041-7772, Oxford University Press (OUP), Oxford, Vol. 13, Iss. 7, pp. 509-515, <https://doi.org/10.1093/jeclap/lpac014>

This Version is available at:

<https://hdl.handle.net/10419/289417>

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The assessment of substitution through event studies – an application to supply-side substitution in Berlin's rental market*

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Key points

- To assess supply-side substitution, one needs to evaluate to what extent a firm that is not yet present in the market but has capabilities to repurpose its production capacity constitutes a competitive constraint to firms operating in the focal market.
- In practice, the empirical assessment is often difficult because any effects observed upon entry of repurposed capacity are not necessarily caused by said entry alone, but potentially also by the specific market conditions in the focal market (so called self-selection).
- Policy interventions that affect entry decisions can alleviate such measurement concerns, as we show by assessing how regulations that limit the diffusion of Airbnb in Berlin affect the long-term rental market by repurposing short-term rentals.
- Supply-side substitution between professional Airbnb hosts and the long-term rental market exists, but the stock of Airbnb apartments is not large enough to constitute a true competitive constraint.

Abstract

One key question that arises when assessing a supply-side theory is to what extent a firm that is not yet present in the market but has capabilities to repurpose its production capacity constitutes a competitive constraint to firms operating in the focal market. The main challenge for identifying and measuring the competitive effects of potential entrants on a focal market of interest is that entry does not occur randomly and that firms select the markets in which to enter. We propose exploiting policy interventions that affect entry decisions to alleviate such concerns. To exemplify our approach, we assess how regulations that limit the diffusion of Airbnb in Berlin, affects equilibrium supply and prices in the long-term rental market by repurposing short-term Airbnb rentals to the focal market. Our results suggest that there exists supply-side substitution between professional Airbnb hosts and the long-term rental market. Yet, the size of Airbnb apartments stock held by professional users is not such to constitute a true competitive constraint on the long-term rental market.

* No interested party had the right to review the manuscript prior to submission. None of the authors received any sources of funding or in-kind support in the context of the preparation of this article.

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I. Introduction

Economic externalities caused by the platform economy are increasingly attracting regulatory attention. One such externality, which is particularly prominent in public debate, is the impact of the short-term rental platform Airbnb on the housing and rental markets. Globally, commentators and policy makers claim that Airbnb, by reducing the supply of long-term rentals, plays a key role in explaining rent increases, especially in those (parts of) cities that are particularly attractive to tourists.

Thus, because of the risk for socially undesirable outcomes through rising rents and house prices and since Airbnb has rapidly expanded over the past decade, the immediate reaction of policymakers is to regulate the short-term housing market. As a result, regulators are faced with the difficult task of designing sensible policies that prevent practices likely to contribute to rising rents and house prices without unnecessarily hindering more innocuous use of the short-term rental platform, which can have beneficial effects.

While primarily being a regulatory challenge, the questions that need to be answered to design sensible policies toward Airbnb are very much the same questions that need to be answered in many merger and/ or antitrust cases. The question of whether Airbnb leads to increasing rental prices by causing a supply shortage of rental units can be considered the negative image of the typical merger/antitrust question of whether supply-side substitution from Airbnb to the rental markets imposes a competitive constraint on already existing rental units.

In the day-to-day practice of competition policy, the question whether or not Airbnb imposes a competitive constraint on long-term rental prices is answered by assessing whether tenants (on the demand side) or landlords (on the supply side) would consider **repurposed** Airbnb units suitable substitutes for rental units.

On the demand side, Airbnb listings and rentals units do not constitute demand-side substitutes because tourists will not consider rentals as accommodations during a visit and tenants will not consider Airbnb listings as a viable long-term living solution. However, Airbnb listings might still exert competitive pressure through supply-side channels because rentals can be repurposed to Airbnb listings and vice-versa.

Because Airbnb listings and rentals do not fulfill the necessary requirements to be considered demand-side substitutes and because the regulatory question at hand can be reframed in terms of common competition policy terminology, studying the impact of Airbnb on rents offers interesting insights for competition policy practitioners interested in pondering supply-side considerations in antitrust or merger cases.

This article discusses the empirical challenges of identifying and measuring the competitive effects of potential entrants on a focal market of interest. This is a necessary prerequisite for any market definition based on a supply substitution theory, which requires, at the very minimum, that a new entrant will exert meaningful competitive pressure on the incumbent. If entry of a new player does not result in the incumbent lowering prices, which will be the case for sufficiently differentiated products, any argument based on supply-side substitution is likely to fall apart. To exemplify this argument, we review the results on the impact of Airbnb on rental markets in Berlin presented in a companion paper (Duso et al., 2021)¹ and discuss them in terms of supply-side substitution.

Note that the method outlined in this paper does not immediately answer the related question of when supply-side substitution warrants a more aggregate market definition. This depends not only on the substitutability between products but also on the ease and profitability

¹ Tomaso Duso, Claus Michelsen, Maximilian Schaefer, Kevin Ducbao Tran, ‘Airbnb and Rental Markets:

Evidence from Berlin’ (2021) CEPR Discussion Paper 16150 available at

https://cepr.org/active/publications/discussion_papers/dp.php?dpno=16150.

of market entry -- an issue on which our method remains silent. Rather, the described method allows us to measure the degree of supply-side substitution and how strongly it affects the prices in the focal market. Thus, this quantification allows us to assess whether supply-side substitution has the potential to exert meaningful competitive pressure irrespective of the ease and profitability of entry.

For instance, in a differentiated product market, entry might be easy, profitable, and universal. Thus, it might fulfill the condition for a broader market definition based on existing competition law practice. However, the degree of substitution might turn out to be so weak that, based on empirical estimates, a broader market definition would not seem appropriate based on a SSNIP test.

The remainder of the paper proceeds as follows. In Section 2, we discuss the idea of using policy interventions as a quasi-exogenous source of variation to assess substitution patterns. In Section 3, we discuss the example of Berlin's housing market, where short-term rentals have been regulated. Section 4 presents the data as well as the methodology and Section 5 discusses our main results. In Section 6, we further explain the implications of our analysis. Section 7 concludes.

II. Policy intervention as a way to assess substitution

One question that naturally arises when assessing a supply-side theory is to what degree an entrant (i.e. a firm that decides to repurpose its production capacity) will affect competition. When considering differentiated product markets, this question might not be trivial to answer. A naive way to empirically assess this question would be to analyze data containing historical information about past instances of market entry and study how these events affected prices and quantities of incumbent firms. Such an analysis might, for instance, reveal that prices and quantities of incumbent firms dropped substantially after entry. Consequently, one might

conclude that entry will lead to increased competition, the necessary condition for any supply-side theory.

The problem with the above argument is that entry does not occur randomly and that firms select the markets in which they enter. For example, firms are more likely to enter markets in which competitors are weak or in which they have another competitive advantage that might be unrelated to product characteristics. As a result, the drop in quantities and prices of incumbent firms observed after entry might indicate more about the type of incumbent firms present in the markets for which we observe entry than about substitutability itself. Will the findings that we observe from the selected sample of market entry generalize? I.e., would the same price and quantity change happen in markets for which we do not observe entry in our historical data? This is likely not the case.

As an illustrative example, consider the case of a competition agency that wishes to assess the degree of substitution between two cement varieties, each exclusively offered by one of two companies. In the past, entry of one company into the geographical markets of the other company has been repeatedly observed. As a result, production quantities of the incumbent firm plummeted, occasionally even resulting in the exit of the incumbent firm. One might be tempted to conclude that the entrant firm offers a superior product. A closer look, however, reveals that the entrant systematically chose to enter markets in which the incumbent had a disadvantage because it was located far away from the major metropolitan areas. The entrant, instead, built its new cement factories in close proximity to these urban centers. As a result, the quantity changes observed after entry are not informative about how consumers perceive the product characteristics of both cement varieties. It might very well be the case that the incumbent firm offers the superior product, but that this advantage was completely offset by its higher transport costs. While the transport costs in the above example can be easily

accounted for, there is always the threat that unobserved factors bias our assessment of product substitutability.

Exploiting policy interventions that promote entry can alleviate such concerns. By promoting entry into markets irrespective of such unobservable characteristics of the incumbent firms, policy interventions can lead to quasi-exogenous variation in entry that can be exploited to assess product substitutability. For example, subsidies or tax incentives might lead to firm entry irrespective of the type of incumbent firm. Another possibility might be that changes in the original market of the potential entrant prompts entry into new markets. This is precisely the scenario that we face in our setting. Government intervention targeting Airbnb hosts leads to a repurposing of capacity toward the long-term rental market. In principle, this repurposing should be independent of the unobservable characteristics that would otherwise influence the decision of a landlord to rent through Airbnb or the conventional market.

III. The Berlin' housing market and the regulation of short-term rentals

Since German reunification in 1990, Berlin has continuously gained popularity as a destination for tourists.² In parallel, its population has increased by an approximate ten percent, leading to a population of about 3.7 million people in 2020.³ This has led to rapid increases of rental and house prices and, consequently, triggered political regulation aimed at ensuring affordable housing.

One such regulation is the so-called Zweckentfremdungsverbot-Gesetz (ZwVbG). Taking effect in May 2014, this law aims to prohibit the misuse of housing for purposes other than living; misuse includes speculation, commercial use, or short-term renting. Starting from

² See https://download.statistik-berlin-brandenburg.de/b9ed4cad82728242/7a251fb1b6bf/SB_G04-01-00_2019m12_BE.pdf.

³ See <https://www.statista.com/statistics/1109950/number-of-inhabitants-berlin-germany/>.

May 2016, the law requires all hosts of short-term rentals on platforms like Airbnb to seek permission from local authorities. These permissions were to be granted in exceptions only.⁴ In August 2018, the law received a major amendment that clarified the criteria for legal short-term renting. Simultaneously, the amendment introduced an obligation for hosts to display an official registration number on platforms like Airbnb. Such a registration number can only be obtained from local authorities.

The two policy changes in May 2016 and August 2018 led to substantial changes in the supply of apartments on Airbnb. Figure 1 shows the number of Airbnb listings over time, split by listing categories: Entire homes (i.e. entire houses or apartments), private rooms, and shared rooms. The two vertical lines indicate the two policy dates: May 2016 and August 2018. Around both these dates, the total supply of Airbnb listings decreases substantially. Both of these drops are mainly driven by decreases in the ‘entire home’ category of Airbnb listings.

While Figure 1 suggests that both policy changes had a similarly sized effect on Airbnb supply, Figure 2 adds some nuance. It shows the number of Airbnb listings available for more than 180 days in a year in the different categories over time. Comparing the results from Figure 1 and Figure 2, it becomes apparent that the decreases observed for both policy interventions in Figure 1 are composed of entirely different groups within the ‘entire home’ category.

In terms of assessing supply-side substitution between Airbnb listings and long-term rentals, this preliminary analysis already provides important insights. At first glance, both reforms reduce Airbnb supply in a listing category that is likely to exert competitive pressure on the long-term rental market: entire houses or apartments. However, a closer look reveals a substantial difference between both reforms.

⁴ In the initial version of the law, what constitutes such a permissible case was not clearly defined. This was clarified in later amendments.

The first reform affected hosts for which the long-term rental market is likely to constitute a **profitable** alternative to short-term renting on Airbnb: Namely, hosts who make their houses or apartments available for rent for a substantial part of the year. These hosts can be considered **professional** Airbnb hosts: Their choice between renting full-time on Airbnb or long-term on the conventional rental market is a matter of which option is more profitable.

By contrast, the second reform mostly affected hosts willing to rent out their houses or apartments for less than 180 days a year on Airbnb. We call these hosts **occasional** hosts. They are likely to live in the apartments or houses they rent out on Airbnb themselves for large parts of the year. This makes long-term renting an unprofitable alternative, both practically and legally.⁵ Thus, for occasional Airbnb hosts, the long-term rental market is not a viable alternative.⁶ One explanation for the larger effect of the August 2018 reform on occasional hosts is that many of these hosts might not have earned particularly high profits from their presence on Airbnb anyway. Thus, the additional burden of applying for a registration number pushed them to leave the platform altogether.

⁵ This is particularly relevant in Germany where tenants are strongly protected and temporary rental contracts for unfurnished flats are generally not allowed.

⁶ We do not directly observe whether hosts engage in professional or occasional short-term renting. Nevertheless, we argue that the 180-day threshold is a good indicator for professional short-term renting as it indicates that the apartment is unlikely to be the main residence of the Airbnb host.



Figure 1: The number of Airbnb listings in Berlin over time, split by types of Airbnb listings. Own calculations based on data from insideairbnb.com.

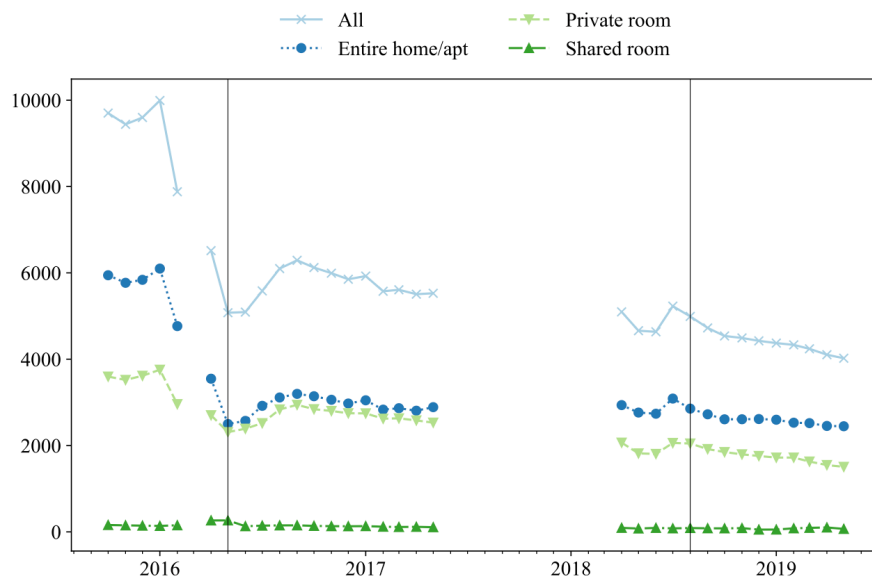


Figure 2: The number of high-availability Airbnb listings in Berlin over time, split by types of Airbnb listings. High-availability is defined as being available for booking for more than 180 days a year. Own calculations based on data from insideairbnb.com.

IV. Data and Empirical Strategy

Our analysis, which is based on the method outlined in more detail in Duso et al. (2021), uses rental data provided by empirica ag.⁷ The data are web scraped from online real estate platforms and contain information on available long-term rentals, including the asked rents, their size, the number of rooms, and their location. We combine these data with data on available listings on the short-term rental platform Airbnb. These data, available from insideairbnb.com, contain information on Airbnb listings, including the type of listing, their ratings, and their location.

To identify the causal impact that a change in Airbnb supply has on the long-term rental market, we estimate how a change in the number of entire homes/apartments listed on Airbnb in a given neighborhood affects the number and asked prices of long-term rental apartments.⁸ We rely on an instrumental variable (IV) approach, which exploits the variation in Airbnb supply that is caused by the policy changes. As explained above, we focus on entry of new apartments in the long-term rental market that is induced by the restrictions imposed on Airbnb hosts and, thus, is not ‘selective.’ This is likely to provide more accurate estimates of the competition exerted by repurposed Airbnb listings. Our method also takes into account a rich set of variables that explain baseline differences in Airbnb supply, which are unrelated to the reform. This further allows for mitigating concerns related to selective entry.

Because policies can only plausibly explain changes in Airbnb supply around their effective dates, we focus the analysis on two seven-month windows around the two policy

⁷ Empirica ag (<https://www.empirica-institut.de/>) is an independent research and social science consultancy focusing on the housing market.

⁸ We use a granular geographical market definition and only consider Airbnb listings and long-term rentals in the immediate vicinity of each other as sharing the same market. Typically, two housing units are considered to share the same geographical market if they are located within a distance of 250 meters of each other. For details see Duso et al. (2021) (n5).

dates. For longer time-horizons, the total variation observed in the data is less driven by the policy intervention, which reinforces concerns of selective entry. The restriction also ensures that the policies have sufficiently strong explanatory power for the changes in Airbnb supply, a necessary condition for the instrumental variable estimation to work.

Our analysis focuses on the Airbnb listing category most affected by the reforms: entire homes and apartments. As professional Airbnb hosts would be more likely to see the long-term rental market as a viable alternative, we only expect to find evidence for supply-side substitution for the first policy change in May 2016. Instead, the mandatory registration number display introduced in August 2018 mostly affected occasional hosts and had no sizable effect on professional hosts.

V. Main results

Our results suggest that supply-side substitution between the short-term and the long-term rental market is relevant. Focusing on the May 2016 reform, we find that each additional professionally operated Airbnb house/ apartment that **leaves** Airbnb leads, on average, to 0.6 additional apartments/houses **appearing** in the long-term rental market. Thus, the evidence suggests that approximately 60 percent of professional Airbnb hosts see the long-term rental market as a viable alternative to the short-term rental market.⁹ Consistent with our hypothesis, that only professional Airbnb hosts substitute back to the long-term rental market, we find that

⁹ One would expect a one-to-one substitution from professionally operated Airbnb listings to the long-term rental market. Note that we do not directly observe if a listing is professionally operated. Our proxy-measure might misclassify listings as professionally operated. Additionally, it appears plausible that some Airbnb hosts substitute away to other short-term rental platforms that are subject to less legal scrutiny than Airbnb. Further, our long-term rental data might not cover all apartments available for rent in Berlin. Similarly, some hosts might also simply decide to offer their property for sale, which is not covered by our data.

the August 2018 reform did not affect supply on the long-term rental market: we estimate null effects during this period.

If supply-side substitution does indeed take place, we would also expect a price effect. We address this question in the second part of our analysis. Using a similar identification strategy as discussed above, we find that one fewer entire home listed on Airbnb reduces asked rents of nearby apartments by approximately 17 cent per square meter. At an average rent of 9.26 euro per square meter, this corresponds to a 1.8 percent increase in asked rents. Again, we only find significant results for the May 2016 reform, which is further evidence in line with the hypothesis that only professional Airbnb hosts switch to the long-term rental market.¹⁰

VI. Discussion

Our analysis enables us to assess the cumulative effect of the 2016 reform on rental prices. To do so, we conduct the analysis described above separately by district. For each district, we estimate the total increase in rental capacity by multiplying the average reduction in Airbnb supply due to the reform with the marginal price effect that additional Airbnb listings have in the long-term rental market. We further consider the average size of rentals in each district. The obtained measure can be thought of as the monthly rent reduction for an average apartment in each district due to the additional entry of apartments in the long-term market. While the

¹⁰ The reader might wonder why we do not assess the hypothesis that occasional Airbnb do not affect the long-term rental market directly, i.e. by focusing on the number of Airbnb entire homes of occasional hosts and showing a null effect for the 2016 reform when doing so. This is not feasible because there is a very high correlation between the drop observed for occasional and professional hosts in 2016. Statistically speaking, this does not allow for disentangling the effect of occasional and professional hosts. In the 2018 reform, nearly all the variation stems from listings of occasional hosts only. This allows us to test our hypothesis by comparing the results across both reforms.

estimated effect is heterogeneous across districts, the rent reduction corresponds to up to 30 euro per month in the most affected district. Compared to the average rents in this district, this reduction means an average reduction in rents of 3.5 percent.

The calculation of cumulative effects highlights that the effect of Airbnb on rental prices depends not only on the marginal price effect but also on the total number of Airbnb listings that can be repurposed. With approximately 10,000 entire homes or apartments listed on Airbnb in 2020, the potential stock of Airbnb listings that could be repurposed for the long-term rental market amounts to only approximately 0.5 percent of the total long-term rental supply. Even if all professional Airbnb listings were converted to housing, they would only make up a low share of the total housing stock.

This is consistent with the high degree of fragmentation observed in the German long-term rental market. For example, in June 2021, the German Cartel Office cleared the proposed acquisition of shares of Deutsche Wohnen AG by Vonovia SE, the two largest German real estate companies: Together, they own ca. 150,000 out of the over 1.6 million rental apartments, i.e., less than 10 percent of the total rental stock.¹¹

Nevertheless, our results suggest that the supply-side substitution observed between Airbnb listings owned by professional hosts and the long-term rental markets is substantial: for each professionally operated Airbnb listing leaving Airbnb, 0.6 rental units appear on the long-term rental market. Thus, any attempt of a hypothetical monopolist to raise prices in the long-term rental market could be severely undermined by supply-side substitution, if the Airbnb stock is sufficiently large. The question under which conditions switching would be profitable can be addressed by analyzing the relative profitability of short- and long-term renting.

¹¹See

https://www.bundeskartellamt.de/SharedDocs/Meldung/EN/Pressemitteilungen/2021/28_06_2021_Vonovia_DW.html?nn=3591568

In terms of regulation our findings have important implications as they show that policymakers concerned with the impact of Airbnb on the long-term rental market need to carefully design legislation: only professionally operated Airbnb listings are a concern for rising rents. A one-size-fits-all approach that treats occasional and professional Airbnb hosts in the same way does not seem appropriate in light of our findings.

VII. Conclusion

The role of supply-side substitution in market definition remains controversial. While some jurisdictions, like the US and Canada, almost exclusively focus on demand-side substitution for market definition, others, like the EU and the UK,¹² consider supply-side substitutability whenever supply-side effects effectively impose a competitive constraint on the behavior of suppliers of the focal products and these effects are of comparable size and importance to those of demand substitution.

Some commentators criticized the asymmetric use of demand- and supply-side substitution for market definition, claiming that an approach solely focusing on the former might lead to an overly restrictive market definition.¹³ This might be especially true if products

¹² The Guidelines refer to this paragraph when discussing supply substitution for geographic market definition.

See CMA ‘Merger Assessment Guidelines’ (2021) CMA129 CON.

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/970322/MAGS_for_publication_2021_.pdf.

¹³ See for instance O’Donoghue Robert and Jorge Padilla, ‘The Law and Economics of Article 102 TFEU’ (2021) Hart Publishing, 3rd edition; Elzinga Kenneth and Howel Vandy ‘Geographic Market Definition in the Merger Guidelines: A Retrospective Analysis’ (2018) 53 Review Industrial Organization 453–475; Röller, Lars-Hendrik ‘Challenges in EU competition policy’ (2011) 38 Empirica 287-314. See also the “Support study accompanying the Commission Notice on the evaluation of the definition of relevant market for the purposes of

are differentiated and in (high-tech) sectors where network effects and economies of scale are substantial.¹⁴

Using an example motivated by a regulatory question, the impact of Airbnb on long term rental prices, we show how data from (quasi-)natural experiments can be used to assess supply-side substitution. We first explain how our setting translates to a typical supply-side substitution theory. Subsequently, we discuss why natural experiments are needed to identify substitutability based on the characteristics of the product offered by the firms. Finally, we present our results and discuss them against the backdrop of typical questions arising in cases relying on a supply-side theory.

Community competition law” https://ec.europa.eu/competition-policy/system/files/2021-06/kd0221712enn_market_definition_notice_2021_1.pdf for a discussion.

¹⁴ Padilla Jorge ‘The Role Of Supply-Side Substitution In The Definition Of The Relevant Market In Merger Control,’ (2001) A Report for DG Enterprise, European Commission, 65–78.