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ABSTRACT

THREE ESSAYS ON DIGITAL TRANSFORMATION AND ITS EFFECT ON TRADITIONAL INDUSTRIES

by Tim Meyer

In this dissertation, I study how digital technologies affect the industries that they enter. More specifically, I study how the entry of digital platforms into an industry affects the performance and competitive relationships of incumbent firms. As part of the first two chapters of my dissertation, I use data on the hotel industry in Texas to show that peer-to-peer platforms do not only have a negative effect on incumbents that operate in the same market segment, but also on those that are very differentiated from peer-to-peer platforms and thus should be affected much less. I argue that this is the case because the increasing supply on peer-to-peer platforms forces a broad range of incumbents to adopt digital technologies that act as substitutes for their own complementary assets, which in turn has a negative effect on the performance of these incumbents. Furthermore, I analyze how differences in ownership form and the resulting differences in managerial incentives moderate this relationship. In the third chapter of my dissertation, I use data on the German news media industry to study the effect of online news aggregators such as Google News on traditional newspapers and their related online news websites. I show that being listed in the search results of news aggregators seems to have a positive effect on the traffic of many online news websites and that there are positive spillovers from online news websites that are listed on news aggregators to both the print newspapers that are related to them and to lower-performing competitors. Taken together I argue, and empirically show, that the entry of digital platforms into traditional industries acts as a trigger for digital transformation and thus has an effect on a much broader set of incumbents than has often been assumed.

CONTENTS

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INTRODUCTION

In this dissertation, I study digital transformation and its effect on traditional industries. More specifically, I analyze how the entry of digital platforms into traditional industries acts as a trigger for digital transformation and ultimately affects the competitive relationships and performance of existing players in these industries.

In the first chapter of my dissertation, I focus on the effect that peer-to-peer platforms have on incumbents in the industry that they enter. Over the past years, these platforms have entered several industries and significantly challenged the way in which incumbents do business. Instead of owning any assets directly, these platforms focus on matching buyers with sellers that own the required assets and are willing to share them. Therefore, peer-to-peer platforms are generally considered a competitive threat to traditional businesses, particularly to those that are positioned in the same market segment, which is usually the lower end of the market. In the first chapter of my dissertation, I show that the main threat that peer-to-peer platforms pose to incumbents is not necessarily the direct competition effect on competitors in the same market segment, but rather the shift on the demand-side that they trigger. By shifting consumer habits towards using digital platforms, they force incumbents to increasingly use these platforms to promote their own physical assets as well. For incumbents who have traditionally benefitted from using their own complementary downstream assets to promote their physical assets, this poses a major challenge because digital platforms act as a substitute for these downstream assets and decrease their value. Using data from the hotel industry in the state of Texas, I show that the incumbents which are ultimately affected the most by peer-to-peer platforms are not necessarily the ones operating in the same market segment, but those whose complementary downstream assets will become obsolete as more business is shifted to digital platforms.

After analyzing who is affected the most by the entry of peer-to-peer platforms and the resulting shift towards more business on digital platforms in the first chapter, I use the second chapter of my dissertation to study the reactions of incumbents to this new competitive threat. I focus in particular on the reaction of those incumbents that are affected the most by the entry of peer-to-peer platforms, namely those whose complementary assets become less valuable as more business shifts towards digital platforms. I use fine-grained data on individual units within multiunit organizations and exploit variation in the ownership form across these units to show that the type of ownership form and the resulting managerial incentives might lead units to react in very different ways. Units that are affiliated to the affected organization through franchising react to the entry of peer-to-peer platforms by adjusting their prices and shifting more business onto digital platforms, which ultimately allows them to increase their sales in a way that outweighs the effect of price reductions. On the other hand, units that are owned directly by the company show less reaction to the entry of peer-to-peer platforms and do not shift as much business onto digital platforms, which in turn leads to lower performance compared to their franchise counterparts. Taken together, I show that it pays off for affected incumbents to adapt to the new environment and to adopt new technologies.

In the third chapter, I extend my research to a different setting. More specifically, I focus on online news aggregators such as *Google News*, which have become increasingly popular in the recent past. These websites use short excerpts of other websites' online news articles (so-called snippets) and make them available to users in an aggregate manner. The question of whether such news aggregators are an opportunity or a threat for traditional content producers in the news media industry has been highly debated. On the one hand, traditional content producers claim that the use of small excerpts of their content by news aggregators might prevent users from visiting the full article on their own website and therefore take away

business from them. On the other hand, news aggregators argue that their services might help users to discover content that they would have otherwise not discovered and that news aggregators therefore direct additional business to the content producers' websites. Using data on the German news media industry and exploiting variation in the extent to which different news websites were available on news aggregators after a policy change, I show that being listed in the search results of news aggregators has a positive effect on the traffic of most online news websites. I also show evidence that is consistent with the presence of positive spillovers from online news websites that are listed on news aggregators to both the print newspapers that are related to them and to lower-performing competitors. Taken together, this suggests that content aggregators transform the industry that they enter not only because they are themselves a potentially new type of competitor, but also because they change the mechanisms of competitive interaction between existing competitors in the industry, both online and offline.

CHAPTER 1

For Which Incumbents Are Digital Platforms Really a Threat?

The Role of Asset Ownership

Abstract

In recent years, digital peer-to-peer platforms have entered several industries and challenged the way in which incumbents do business. Instead of owning the core assets directly, they focus on matching buyers with sellers that own the required core assets and are willing to share them. Therefore, these platforms are generally considered a competitive threat to traditional businesses, particularly to those that are positioned in the same market segment, which is usually the lower end of the market. In this paper, we advance a different perspective: the main threat that peer-to-peer platforms pose to incumbents is not necessarily the direct competition effect but rather the shift on the demand side that they trigger. By shifting consumer habits towards using digital platforms, they force incumbents to increasingly do business on these platforms to promote their own core assets as well. For incumbents who have traditionally benefited from using their own complementary downstream assets to promote their core assets, this poses a major challenge because digital platforms act as a substitute for these complementary downstream assets and decrease their value. Using data from the hotel industry in the state of Texas, we show that the incumbents that are ultimately affected the most by peer-to-peer platforms are not necessarily the ones operating in the same market segment, but those whose complementary downstream assets will become obsolete as more business is shifted to digital platforms.

1. Introduction

The entry of peer-to-peer platforms like *Uber*, *Airbnb* and *TaskRabbit* has shaken up several industries. Often described as disruptive, these platforms manage to operate successfully without owning any of the assets that were previously considered necessary to operate, compete and succeed in the given industry. Instead, they focus on matching buyers with mostly non-professional individuals that own the required assets and are willing to share them. As Tom Goodwin, an executive at *Havas Media Group*, recently noted: "*Uber*, the world's largest taxi company, owns no vehicles. *Facebook*, the world's most popular media owner, creates no content. *Alibaba*, the most valuable retailer, has no inventory. And *Airbnb*, the world's largest accommodation provider, owns no real estate" (Goodwin, 2015). While one might concede that this new way of organizing the business activities can allow firms to successfully enter and operate in a given industry, existing research suggests that incumbents holding valuable core and complementary assets are best positioned to appropriate value from their business operations and protect it from competition (Teece, 1986; Tripsas, 1997). This raises the question of why incumbents that own these valuable assets are then negatively affected by the entry of peer-to-peer platforms.

Recent research has shown that market entry by peer-to-peer platforms, such as *Airbnb* in the hospitality industry or *Craigslist* in the newspaper and classified ads industry, has a negative effect on the performance of incumbents that operate in the same market segment as the peer-to-peer platform; often the lower end of the market that represents the majority of consumers (Farronato & Fradkin, 2015; Seamans & Zhu, 2013; Zervas, Proserpio, & Byers, 2017). While these studies are in line with conventional research on competitive interaction, the focus on price and direct competition might mask the real threat that these platforms pose: shifting the rules of the competitive landscape by altering the level and sources of

complementarities (e.g., Jacobides, Cennamo, & Gawer, 2018) and affecting the value of incumbents' core and complementary assets (Cozzolino & Rothaermel, 2018). In this paper, we take this different perspective to analyze how the ownership position on core and complementary downstream assets of incumbents determines the extent to which they are negatively affected by peer-to-peer platforms.

We argue that an increase in supply on peer-to-peer platforms (e.g., *Airbnb*) leads not only to increased competition, but also triggers a shift in consumer preferences towards directly searching for product offerings and transacting online. This demand-side shift, in turn, pushes incumbents to increasingly do business on digital platforms (e.g., *Booking.com*) that compete with peer-to-peer platforms, in order to gain access to consumers and promote their offerings online. Because incumbents are different in their asset ownership position, we argue (and empirically show) that incumbents will be negatively affected by this shift to different extents. Incumbents that owned both core and complementary downstream assets in the past and that might have been reluctant to use digital platforms to reach consumers instead of their own downstream complementary assets, will increasingly need to use digital platforms to gain consumer demand as peer-to-peer platforms take off. For these incumbents, digital platforms will have a substitution effect on their complementary assets, which reduces their value significantly and erodes the competitive advantage that they used to have compared to others. Therefore, an increasing supply on peer-to-peer platforms will ultimately have a negative effect on the performance of these incumbents compared to their competitors. On the other hand, incumbents that only own the core assets will be affected much less by the shift in consumer preferences associated with an increasing supply on peer-to-peer platforms as digital platforms might even offer complementary value to their core assets (Jacobides et al., 2018).

We empirically test these ideas in the hospitality industry. This setting is particularly interesting because a number of digital platforms have recently entered the industry, and because there is high variation in the degree to which different incumbents have control over core and complementary downstream assets. By exploiting temporal and geographical variation in Airbnb's entry over the period 2008-2016, we examine how Airbnb's entry in a city affects the performance of local hotels. We adopt a difference-in-differences approach that compares the hotels that are hypothesized to be affected the most (i.e. those controlling both core and downstream complementary assets) before and after Airbnb's entry to hotels that only own the core assets. The geographic and temporal variation in entry allows us to tease out the effect on the performance of hotels from broader macro trends associated with the diffusion of digital services (and underlying changes in consumers' preferences). Overall, as supply of accommodation on Airbnb increases, the performance of hotels that control both core and complementary downstream assets (i.e. chain affiliated hotels) decreases more than that of hotels that only own the core assets (i.e. independent hotels). Furthermore, this effect varies significantly across hotel classes with chain hotels that operate at the higher end of the market being affect much more than those at the lower end of the market.

We contribute to research on the competitive dynamics between incumbents and new entrants in several ways. While prior research has focused on how demand-side aspects (e.g., consumer preferences) might affect the value of incumbents' offerings relative to the ones of new entrants (Christensen & Bower, 1996; Seamans & Zhu, 2013), we look at how shifts on the demand-side caused by new entrants' offerings affect the value of incumbents' complementary downstream assets, and ultimately their performance. By explicitly assessing how incumbents are affected by entrants depending on their asset ownership position, we show that, contrary to what one would expect, the incumbents who are affected the most by

peer-to-peer platforms are not necessarily the ones that operate in the same market segment, but those that own certain types of assets (i.e. the downstream complementary assets previously needed to reach consumers). Also, somewhat different from prior research arguing that asset ownership can buffer incumbents from the threat of new entrants (Tripsas, 1997), we show that holding a strong position in complementary assets can actually become a liability. We argue that this is the case when competition from new entrants triggers a shift in consumer preferences that pushes incumbents to adopt a technological infrastructure for transacting with customers which substitutes for their own complementary assets. By including other types of digital platforms that compete with new entrant peer-to-peer platforms in our analysis, we are able to analyze effects on incumbents that go beyond performance and are instead related to adoption of digital technologies, which allows us to get a more complete picture of the effect that peer-to-peer platforms have on the industries that they enter.

2. Related Literature

Core and Complementary Assets in the Face of Technological Change

The competitive interaction of incumbents and innovative entrants in the face of technological change has been studied extensively by scholars in innovation management and strategy. The entry of small innovative firms into an industry has often been seen as part of a cyclical pattern, in which incumbents are replaced by the producers of new technologies (Abernathy & Utterback, 1978; Tushman & Anderson, 1986). Several studies have provided explanations for why new entrants often dethrone incumbents. For instance, scholars have argued that incumbents are often unwilling to cannibalize their existing products (Christensen & Bower, 1996) or capabilities (Leonard-Barton, 1992), and that they tend to be limited by their traditional view of the economic environment (Tripsas & Gavetti, 2000). More recently, scholars have challenged the traditional view that incumbents are at a disadvantage compared to new entrants and emphasized that incumbents actually have several advantages. For example, incumbents generally have greater financial and market power (Chandy & Tellis, 2000), more experience (King & Tucci, 2002) and can often combine their accumulated knowledge with new technologies to prevent disruption (Bergek, Berggren, Magnusson, & Hobday, 2013).

An important distinction has been made in the literature between technological change that affects incumbents' core assets and technological change that affects incumbents' complementary assets. We follow Teece (1986) and define complementary assets as those assets from which services such as "marketing, competitive manufacturing and after-sales support" are derived, as opposed to core assets which are directly related to the core product[1].

[1] In this study we are mostly interested in the distinction between core and complementary assets, rather than in the distinction of different types of assets. Similar to previous studies (Amit & Schoemaker, 1993), we therefore use the term "assets" in a broad sense to refer to both physical resources and the required knowledge and capabilities to use and benefit from them.

The majority of research has traditionally focused, explicitly or implicitly, on technological change that affects a firm's core assets. For instance, scholars have studied how technological change can either enhance or destroy incumbents' competences in developing and producing a certain technology (Tushman & Anderson, 1986) and how technologies that initially underperform an incumbent's core technology can eventually surpass and replace it (Christensen & Bower, 1996). As a reaction to technological change in their core assets, incumbents might have to reconfigure their existing capabilities. Depending on the type of technological change and the characteristics of the firm's capabilities, the set of possible reconfiguration modes ranges from slightly reshaping their capabilities to transforming their capabilities by incorporating established and new knowledge, or even substituting their capabilities altogether (Lavie, 2006).

More recently, the focus of research has extended to the effect of technological change that specifically affects incumbents' complementary assets. It has been argued that, in the face of technological change in complementary assets, incumbents reposition themselves in a way that allows them to benefit from their core assets and capabilities (Benner & Waldfogel, 2016), and that they are more likely to cooperate among themselves, rather than cooperating with or acquiring new entrants, to ensure value capture from their core assets and capabilities (Cozzolino & Rothaermel, 2018). If technological change leads to the emergence of new types of complementary assets, this can potentially lead to cannibalization of incumbents' existing complementary assets (which then become so-called conflicting assets) and requires incumbents to make organizational adjustments such as setting up autonomous business units in order to mitigate these conflicts (Kim & Min, 2015).

More importantly, even if complementary assets are not themselves subject to technological change, they play an important role if technological change takes place in the core assets and

capabilities. Previous research has shown that technological change in the core and complementary assets is not always independent from one another (Henderson & Clark, 1990). Instead, technological change in one of the two often has an effect on the other one as well (Ozalp, Cennamo, & Gawer, 2018).

If technological change takes place in the firm's core assets, complementary assets play an important role at different points in time. More specifically, they play a major role ex-ante when firms decide which technology to pursue, during the development of the core technology and during the commercialization of the core technology. Ex-ante, complementary assets will significantly affect incumbents' decision which core technology to invest in. Early research has shown that firms with more complementary assets that "lose value if they are not applied to a specific technology" are less willing to cannibalize their existing technologies and will ultimately be less radical product innovators (Chandy & Tellis, 1998). In fact, in the face of technological change in the core knowledge, it can be a rational decision from an incumbent's perspective to invest in those technologies that allow the incumbent to leverage on its existing complementary assets, even if these technologies are less promising than others (Wu, Wan, & Levinthal, 2014). Similarly, firms will be more likely to enter new markets if they possess complementary assets that will also be valuable in the new market (Mitchell, 1989) or if they have the required abilities to integrate complementary assets that are already available in the new market (Kapoor & Furr, 2015).

Complementary assets do not only determine which technology firms pursue, but they can also help firms to be more successful in the process of innovating their core technology. For instance, complementary technologies that a firm already possesses can significantly improve critical performance features of the core product, especially if the firm also has the required knowledge about user requirements (Roy, Lampert, & Stoyneva, 2018). Additionally,

complementary assets such as a large number of distributors can help reduce uncertainty about required product characteristics as they can provide valuable information about user preferences and competitors' product offerings (Roy & Cohen, 2017).

Lastly, complementary assets are not only beneficial because they help incumbents in creating value (Adner & Kapoor, 2010), but also because they allow them to appropriate value from their innovations in the core technology (Teece, 1986). This is particularly true in settings where the appropriability regime is "weak" and the legal mechanisms to protect innovation are limited (Teece, 1986), or in settings where market-supporting institutions (such as financial analysts, trade associations or auditors) are less developed and firms might be subject to contractual hazards and high contracting costs (Fuentelsaz, Garrido, & Maicas, 2015).

If technological change is instead driven mostly by new entrants rather than by incumbents themselves, ownership of complementary assets can be beneficial as well, as it might prevent incumbents from being dethroned (Tripsas, 1997) even if the new entrants attack the incumbents' core knowledge (Henderson & Clark, 1990; Tushman & Anderson, 1986). For instance, incumbents can be in an advantageous position if their complementary assets are needed by new entrants to commercialize their new technology, as this allows incumbents to enter alliances with new entrants and benefit from their technological expertise through learning (Rothaermel, 2001; Rothaermel & Hill, 2005). Tripsas (1997) shows how complementary assets helped incumbents in the typesetter industry to survive several waves of technological innovation even though their core products were inferior to those of new competitors in terms of their technological performance. In this setting, customer preferences for a certain type of complementary asset (i.e. font libraries) remained unchanged, which

granted the owners of these complementary assets preferred access to customers in each generation of the core technology.

Taken together, the bulk of research has traditionally taken a static view on complementary assets. The underlying assumption of many of the studies discussed above is that the value of complementary assets remains unchanged while technological change takes place in the core asset. On the other hand, our understanding of what drives incumbents to choose one type of complementary asset or another in the face of technological change is still limited. Research that has studied technological change in incumbents' complementary assets has mostly focused on the consequences of this change (Benner & Waldfogel, 2016; Cozzolino & Rothaermel, 2018), rather than understanding the factors that lead to changes in the value of complementary assets or the factors that lead incumbents to replace some of their existing assets.

In this paper we aim to improve our understanding of incumbents' choices of complementary assets in the face of technological change by analyzing how threats to core assets might have an impact on the choice of complementary assets. Contrary to previous research that studies mostly the role of complementary assets in the choice of the core technology, we study the opposite case, in which core assets play a major role in the choice of complementary assets. More specifically, we analyze how competitive threats to an incumbent's core assets can push incumbents to adopt new complementary assets even if they affect the value of their current complementary assets.

Furthermore, we analyze how changes in consumer preferences affect incumbents' choice of complementary assets as well. While most studies on technological change have taken primarily a resource-based perspective, in which new entrants introduce new technologies that substitute for incumbents' assets or capabilities, these studies leave out the demand-side

dynamics. In doing so, they implicitly assume that customer preferences for how to gain access to and consume the product remain unchanged in the wake of the technological discontinuity that affects the value of a core product offering. In other words, technological discontinuities will affect the value of incumbents' offerings and core assets, but not the value of their complementary assets. This assumption might not hold in the case of the entry of digital platforms, where customer preferences and habits about the way to access and consume products and related services are increasingly shaped by platform providers as they shift demand towards their digital infrastructures. This demand-side shift must be accounted for in the analysis to fully understand the competitive effect of new entry, as well as the underlying mechanisms.

The Demand-Side Perspective

While a firm's competitors have traditionally been identified based on similarities in some of their most salient characteristics, such as their products and resources (Porac, Thomas, Wilson, Paton, & Kanfer, 1995), a more demand-side perspective on competition has gained increasing attention in recent years. For instance, Peteraf and Bergen (2003) have highlighted that firms face competitive threats not only from rivals who own resources that are similar in their nature, but also from firms whose resources are similar in terms of their functionality, i.e. that have 'resource equifinality'. According to the authors, the functionality of resources is ultimately determined by their ability to satisfy certain customer needs, which in turn means that firms with very different resources might be competing for the same group of customers. Similarly, it has been argued that businesses which are seemingly unrelated from a firm's perspective might in fact be perceived as complementary in the eyes of consumers when the underlying infrastructure for gaining access to these services is the same (Ye, Priem,

& Alshwer, 2012). In these cases, businesses are related because of complementarities on the demand side, not in production. The way in which firms perceive who their competitors are and for which customers their products are appealing, has a significant effect on their actions, as firms tend to shape their actions in a way that is consistent with the expectations of their main customers (Govindarajan, Kopalle, & Danneels, 2011).

Over time, the extent to which a firm's products appeal to certain market segments, and therefore also a firm's set of potential competitors, might change. These changes can be driven either by changes in the product characteristics, for instance due to technological evolution (Adner & Snow, 2010; Adner, 2002), or by changes in customer preferences themselves (Tripsas, 2008).

As technologies evolve, they may become attractive even for those market segments whose requirements they did not meet in the past, and thus tap into a much larger set of customers than before. If there is sufficient overlap in the preferences of customers in the old and new market segments, the boundaries between these segments will increasingly blur and firms will be confronted with a much broader set of competitors than before (Adner, 2002). Often, the main driver behind this effect is customers' decreasing marginal utility from technological improvements, which makes their valuation of differences between products decline as technologies evolve (Adner & Zemsky, 2006). Furthermore, technological change can reveal heterogeneity in consumer preferences that was previously unknown to incumbents by introducing new options to consider (Adner & Snow, 2010). This in turn gives firms the opportunity to focus on certain subgroups of customers and enter niches that were not visible before.

Changes in the attractiveness of different technologies however might not just occur due to technological evolution and due to the extent to which these technologies match the mostly

static preferences of certain groups of customers. Instead, they might be driven by changes in the preferences themselves. Similar to technological discontinuities, changes in preferences can occur periodically and punctuate long periods of relatively stable customer preferences (Tripsas, 2008). Such changes can be triggered, for instance, by changes in the sociopolitical environment or by evolutions of customers and their experience over time, and are therefore not necessarily related to changes in the technology per se.

In this paper, we build on the demand-side literature and show how incumbent firms are increasingly affected by an entrant that seemingly operates in a different market segment. We argue that this effect is driven at least in part by an increasing shift in consumer preferences towards a new way of accessing the core product, which pushes incumbents to replace their existing complementary assets.

The Effect of Digital Platforms on Core and Complementary Assets

Recently, the value of core and complementary assets of incumbents in many industries has been affected significantly as digital technologies, and digital platforms in particular, have allowed firms to configure their resources in novel ways (Amit & Han, 2017). We build on the work of McIntyre and Srinivasan (2017) and define digital platforms as digital interfaces "that can serve to mediate transactions between two or more sides, such as networks of buyers and sellers or complementors and users". The effect of the entry of digital platforms has been studied in a variety of different settings, including classified ads in the newspaper industry (Seamans & Zhu, 2013), the music industry (Bhattacharjee, Gopal, Lertwachara, Marsden, & Telang, 2007; Liebowitz, 2008), hospitality (Farronato & Fradkin, 2015; Zervas et al., 2017) and car sharing (Abhishek, Guajardo, & Zhang, 2016). While all these digital platforms share some of their characteristics, it is important to distinguish between two main types: peer-to-

firm platforms that match buyers with existing sellers (i.e. incumbents) and peer-to-peer platforms that match buyers with mostly non-professional individuals who make some of their assets available to others, usually in exchange for a fee.

Peer-to-firm platforms such as online travel agents, open online course platforms (Cozzolino & Rothaermel, 2018) or car-renting platforms (Abhishek et al., 2016), bundle the product offerings of different firms and make them available to customers through a single interface. Their main advantage compared to more traditional ways of matching customers with firms' product offerings is increased efficiency due to reduced search costs for customers (Amit & Zott, 2001). Rather than challenging the core assets of incumbents, peer-to-firm platforms challenge the downstream complementary assets of firms (Cozzolino & Rothaermel, 2018), as they offer a novel way for customers to access the firms' core assets, which makes them a potential substitute of firms' existing complementary assets.

On the other hand, so-called peer-to-peer platforms rely on the supply from peers that are willing to share some of their physical assets (Goodwin, 2015), usually in exchange for a fee. In contrast to other types of digital platforms, the supply on peer-to-peer platforms is therefore provided by mostly non-professional individuals, and not by the incumbents that have traditionally been present in a given industry. This particular characteristic allows peer-to-peer platforms to overcome the entry barriers of traditional industries and to be more flexible when it comes to reacting to fluctuations in demand (Einav, Farronato, & Levin, 2016; Zervas et al., 2017). Therefore, they can grow very quickly in a relatively short period of time, which makes them a major threat for conventional firms in the industries that they enter. Moreover, the fact that they do not rely on the supply of core assets by incumbents, but rather base their business on the supply of mostly non-professional individuals increases the supply in the industries that they enter significantly. This means that, compared to peer-to-

firm platforms, peer-to-peer platforms pose a much greater threat to incumbents as they challenge not only the complementary assets, but also the core assets of incumbents.

Several studies have shown that the entry of peer-to-peer platforms has indeed a significant effect on incumbents in the industry that they enter with respect to price structure, sales and positioning (Farronato & Fradkin, 2015; Liebowitz, 2008; Zervas et al., 2017). This negative effect has been argued to be especially pronounced for incumbents in the lower market segments, while more upscale incumbents seem to be less affected (Bhattacharjee et al., 2007; Zervas et al., 2017). Although scholars have argued that incumbents can react to these platforms in a number of different ways (Cusumano, 2015), the majority of studies has focused exclusively on reactions that are related to pricing strategy (Farronato & Fradkin, 2015; Zervas et al., 2017), while only few scholars have laid out other options that incumbents have, such as moving some of their business online (Seamans & Zhu, 2013). Moreover, most studies have either focused on peer-to-peer platforms that rely on the supply by mostly non-professional individuals (e.g. Zervas et al., 2017), or on peer-to-firm platforms that rely on supply by professional incumbents (Cozzolino & Rothaermel, 2018), while the interaction between these two types of digital platforms has received very limited attention.

This paper takes a different perspective by describing how the core and complementary downstream assets that incumbents own determine the extent to which they are affected by peer-to-peer platforms. As we argue and show in detail below, it is the extent to which incumbents (are forced to) use peer-to-firm platforms to respond to competition from peer-to-peer platforms that will erode the value of their complementary assets. This in turn will have a stronger negative effect on the performance of incumbents that own these complementary assets than on those that only control the core assets.

3. Peer-to-Peer Platforms and Incumbents' Performance: The Role of Assets

Incumbents in various industries have traditionally benefited over many years from owning both core assets and the complementary downstream assets to promote them. Research has shown for example that hotels which are owned by a hotel chain that has access to marketing and sales capabilities perform significantly better than their competitors (Ingram & Baum, 1997). These incumbents have traditionally been unlikely to shift their business to digital peer-to-firm platforms for a number of reasons. First, the way in which these incumbents do business is tailored to the complementary downstream assets that they possess, and their perception of the economic environment is likely to be focused on the traditional way to do business using these complementary assets (Christensen & Bower, 1996; Tripsas & Gavetti, 2000). Therefore, their awareness of digital peer-to-firm platforms might have been limited. Second, and more importantly, digital peer-to-firm platforms are a major threat for these incumbents, because they are a potential substitute for the complementary downstream assets that they own (Cozzolino & Rothaermel, 2018; Kim & Min, 2015). Using digital peer-to-firm platforms makes their own complementary assets obsolete and erodes the competitive advantage that these incumbents have had over their competitors for many years. Therefore, these incumbents have traditionally had little incentive to shift their business to digital peer-to-firm platforms (Wu et al., 2014). Furthermore, even if they wanted to shift their business to digital peer-to-firm platforms, these incumbents cannot just make minor adaptations to their existing assets and capabilities but would rather need to replace at least some of them altogether. In doing so, they would face not only costs of acquiring these new capabilities, but also the costs of unlearning their previous capabilities (Lavie, 2006). Taken together, this reasoning explains why these companies have traditionally been the least likely to shift their business from their traditional downstream activities to digital peer-to-firm platforms.

However, with an increasing supply on peer-to-peer platforms, the appeal of different options that incumbents have, i.e. whether or not to use digital peer-to-firm platforms to promote their core assets, is likely to change (Adner & Snow, 2010). More specifically, we argue that while the option of using digital peer-to-firm platforms might have existed for a relatively long time, incumbents only start doing more business on digital peer-to-firm platforms as supply on peer-to-peer platforms increases.

The key characteristic of peer-to-peer platforms is that they do not directly own any physical assets (Goodwin, 2015), but rather facilitate matching of buyers to sellers who own the required assets and are willing to share them. By facilitating the entry of a large number of mostly non-professional sellers, they significantly increase the supply of core assets in an industry, and therefore pose a major threat to incumbents in the industry that they enter (Einav et al., 2016; Farronato & Fradkin, 2015; Zervas et al., 2017). The increase in supply on peer-to-peer platforms creates two types of threats for incumbents in the industry that they enter: it creates a direct competition effect in terms of the core assets (Zervas et al., 2017) and at the same time triggers an increasing change in consumer preferences towards a new way of accessing the core assets. These two effects create not only increasing customer demand for transacting through digital platforms, but also an increased pressure on incumbents to take actions and make some of their supply available on peer-to-firm platforms, even if they have resisted to do so before.

The direct competition effect derives from the fact that, compared to peer-to-firm platforms that match existing sellers (i.e. incumbents) with buyers and can even provide complementary value to certain incumbents (Jacobides et al., 2018), peer-to-peer platforms do not offer merely an alternative way to access the service (i.e., through digital platforms), but also a distinct type of product that, albeit different, addresses similar customer needs. Thus, peer-to-

peer platforms challenge not only the complementary downstream assets that some incumbents have traditionally used to promote their own core assets (Cozzolino & Rothaermel, 2018), but also the value of the core assets themselves (Henderson & Clark, 1990; Tushman & Anderson, 1986). Since incumbents in many industries, such as the hotel industry, cannot easily reduce the amount of their core assets in the short run, the increased supply caused by the entry of peer-to-peer platforms is likely to increase the competitive pressure on incumbents. Customers will have more options to choose from, which in turn will result in business potentially being taken away from incumbents. Prior research has found that the entry of peer-to-peer platforms into an industry has indeed a negative impact on the performance of incumbents (Zervas et al., 2017), particularly on those that operate at the lower end of the market. Since this is precisely the market segment that is often addressed by supply on peer-to-peer platforms, the strong negative effect on this segment can be seen as evidence for a direct competition effect of peer-to-peer platforms on incumbents. As a consequence of this competitive threat, we argue that incumbents will be pushed to take action and make more of their own core assets available as supply on peer-to-firm platforms increases.

Furthermore, we argue that an increasing supply on peer-to-peer platforms leads to a shift of customer preferences towards searching for product offerings and transacting directly online through digital platforms. As more and more supply becomes available on digital peer-to-peer platforms, this will increase customers' incentives to look for opportunities to transact online, as the likelihood for them to find a matching product offering increases (Katz & Shapiro, 1986). More importantly, potential customers that are looking online for offerings on peer-to-peer platforms, are likely to look for offers provided online by more traditional incumbents on peer-to-firm platforms as well. While these two types of offerings are very different in the

type of resources that they are based on, they might be seen as potential alternatives from the customer perspective because they are similar in their functionality and therefore address the same customer need (Peteraf & Bergen, 2003). If there is sufficient overlap in the preferences of customers who are in the market for offerings by peer-to-peer platforms and customers who are in the market for offerings by more traditional incumbents on peer-to-firm platforms, these two offerings will be seen as potential alternatives in the eyes of potential customers (Adner, 2002). In other words, increasing supply on peer-to-peer platforms is likely to have a positive effect not only on the demand for transaction on peer-to-peer platforms, but also on the demand for transacting with more traditional incumbents through peer-to-firm platforms.

On the other hand, increasing demand for transactions through digital platforms will also indirectly affect the actions of incumbents. The reaction of customers to the increase in supply on peer-to-peer platforms is likely to reveal customer preferences for doing business online that might not have been as visible for incumbents before (Adner & Snow, 2010). Incumbents will notice that customer preferences do not continue to evolve along the same path as in the past, but that there is a discontinuity in their preferences (Tripsas, 2008). Therefore, incumbents might consider combining some of their core assets with the new technology, namely digital platforms (Bergek et al., 2013), and in turn make some of their own core assets available as supply on peer-to-firm platforms to meet and benefit from increasing demand.

Taken together, we argue that there are several factors, both on the demand side and on the supply side, that lead to an increasing amount of business being done through peer-to-firm platforms as supply on peer-to-peer platforms increases. On the one hand, the increasing supply on peer-to-peer platforms leads to higher incentives for customers to look for possibilities to transact online, which in turn increases demand. On the other hand, the increasing pressure to promote their existing core assets and shifting customer preferences

towards transacting online pushes incumbents to make more of their core assets available as supply on peer-to-firm platforms. Since, both demand for transacting through digital platforms and supply increase, we expect to see an increase in the amount of business that is being done through peer-to-firm platforms as supply on peer-to-peer platforms increases.

We expect to see this effect particularly for those incumbents that own not only core assets but also the complementary downstream assets to promote them. As we argued above, these incumbents most likely have been reluctant to do business on digital peer-to-firm platforms as they are a potential substitute for their existing complementary assets and are only pushed to do so as supply on peer-to-peer platforms increases. On the other hand, we do not expect to see this effect for those incumbents that do not own any complementary assets because peer-to-firm platforms offer complementary value for their business and they therefore have an incentive to do business on those platforms even in the absence of an increasing supply on peer-to-peer platforms.

> *H1: As the supply on peer-to-peer platforms increases, the amount of business being done on peer-to-firm platforms by incumbents that own complementary downstream assets will increase more than that of incumbents that do not own complementary downstream assets.*

As incumbents that own complementary downstream assets do more and more business on peer-to-firm platforms, they will face more head-to-head competition from other incumbents. While they used to shelter from competition by owning their own complementary downstream assets in the past and interact with customers directly through these channels, they will now have to engage in direct price competition with other incumbents on the same digital peer-to-firm platform. The reason behind this is that customers will be able to compare different offerings on the same digital platform much more easily than interacting with each

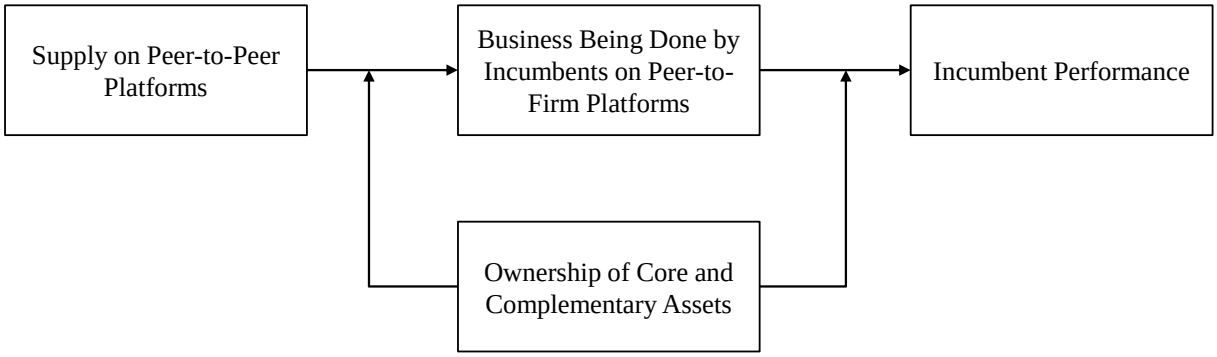
incumbent through its own complementary downstream assets (Amit & Zott, 2001), which in turn pushes incumbents to adjust their prices accordingly. The fact that they are not able to benefit from the exclusivity of their complementary assets anymore, decreases the competitive advantage of these incumbents significantly and will ultimately have a negative effect on their performance compared to other hotels. In addition to increased price competition between incumbents within the same peer-to-firm platform, incumbents will also face competition from the peer-to-peer platforms themselves. While peer-to-peer platforms base their business on very different types of resources, they ultimately compete online for the same customers (Peteraf & Bergen, 2003).

On the other hand, incumbents that own core assets but have limited leeway downstream and therefore had difficulties in finding buyers because of their lack of complementary assets, can actually benefit from using digital peer-to-firm platforms to promote their own core assets. For these incumbents, the peer-to-firm platform's infrastructure offers potential complementary value to their core business activity by providing a large customer base that these incumbents can reach out to (Katz & Shapiro, 1986; Rochet & Tirole, 2006), and which would have been out of their reach otherwise. Thus, we expect the performance of these incumbents to be less affected by the shift towards more online business that comes with the increased supply on peer-to-peer platforms (see FIGURE 1 for a conceptual model).

Therefore, we expect that:

> *H2: As the supply on peer-to-peer platforms increases, incumbents that own complementary downstream assets will increasingly lose their competitive advantage compared to incumbents that do not own complementary downstream assets.*

FIGURE 1
Conceptual Model



4. Data and Methods

Empirical Setting and Data

The empirical setting for this study is the hotel industry, which is particularly suitable because in recent years different types of digital platforms have entered this industry. On the one hand, platforms such as *Booking.com* allow hotels to market their rooms on the internet, while on the other hand peer-to-peer platforms such as *Airbnb* have allowed even non-professional individuals to make their rooms and houses available for rent.

Furthermore, the hotel industry is particularly suitable because there is a high degree of variation in the extent to which incumbents (i.e. hotels) have control over assets and capabilities. In the simplest case, hotels can be run by an individual hotelier who has control over everything related to that hotel, ranging from the building itself to the marketing of hotel rooms to potential customers. Hotels can also be affiliated to a hotel chain, which gives them access to the chain's complementary downstream assets to promote hotel rooms. Traditionally, their strong marketing and sales assets have made it easier for chain affiliated hotels to promote their physical assets and gain a competitive advantage over independent hotels.

An overview of common operation types in the hotel industry can be found in TABLE 1.

TABLE 1
Asset Ownership of Different Players in the Hotel Industry

		Ownership of …	
		Core Assets (e.g. building, operations)	**Complementary Assets** (e.g. sales & marketing, brand)
Hotels	**Independent Hotels**	Hotelier	-
	Chain Affiliated Hotels	Hotelier / Hotel Chain	Hotel Chain
Digital Platforms	**Peer-to-firm platforms (e.g. *Booking.com*)**	Hotelier	Platform
	Peer-to-peer platforms (e.g. *Airbnb.com*)	Mostly non-professional individuals	Platform

From TABLE 1 it can also be seen that peer-to-firm platforms such as *Booking.com* offer complementary value for independent hotels because they provide the complementary downstream assets that these hotels were traditionally lacking. On the other hand, these platforms are potential substitutes for the downstream assets that chain affiliated hotels own and have traditionally benefited from.

By drawing on the supply of physical assets from mostly non-professional individuals rather than supply from hotels, peer-to-peer platforms such as *Airbnb* are a potential substitute not only for the complementary downstream assets that hotels might possess, but also for their physical core assets.

With regards to the hypotheses developed above, we expect that chain affiliated hotels will be affected the most in their performance by peer-to-peer platforms as they will do an increasing part of their business on peer-to-firm platforms such as *Booking.com* after peer-to-peer platforms take off.

To provide empirical evidence for our claims, we use data on the hotel industry in the ten largest cities in the state of Texas. We have chosen this setting for a number of reasons. First, across the largest cities in Texas, *Airbnb* has become popular at different points in time and to different degrees, which leads to both geographic and temporal variation that we can exploit for the identification strategy. Second, all hotels in Texas are required by law to disclose their monthly revenues to both tax authorities and the public. This gives us access to ten years of monthly, hotel-level revenue data for all hotels in the state of Texas. For these reasons, the Texas hotel industry has been the subject of several studies in the past (Vroom & Gimeno, 2007; Zervas et al., 2017). We complement this information with additional hotel-level data on hotel class (low-end hotels, high-end hotels), operation type (independent, chain affiliated) and chain affiliation (e.g. *Hilton*) that we obtained from STR Global, a market research company that focuses on the hotel industry. We also used web scraping techniques to obtain data from the *Airbnb* website, as well as from three of the United States' largest online booking platforms, *Booking.com*, *Expedia.com* and *Hotels.com* that will allow us to get an even more complete picture of the industry. For each hotel in our sample, we manually matched the information gathered from these websites with the data that we obtained from STR Global and the data that we received from the tax authorities. Taken together, this gives us a unique dataset that is suitable to study hotels' reactions to new competitors such as *Airbnb*, and the effect on their performance.

Independent Variables

The main independent variable in this paper is accommodation supply by *Airbnb*, which measures the extent to which incumbents face competition from peer-to-peer platforms. Following Zervas et al. (2017), we collected the date of the first review of each room listed on

Airbnb in the 10 cities in our sample and used this date as a proxy for the point in time when this room became first available to consumers. Based on this data, we then infer the total accommodation supply by *Airbnb* at a given point in time by counting the number of rooms that have received their first review before this point in time.

Dependent Variables

The main dependent variable that we use to measure hotel performance is revenue per room. We obtain this data by dividing the total revenues of each hotel that we obtained from the Texas tax authorities by the total number of rooms of the hotel.

To assess the extent to which hotels make use of digital platforms themselves, we collected the number of reviews that hotels received on *Booking.com*, *Expedia.com* and *Hotels.com*. We used *archive.org* to collect the number of reviews for each hotel at different points in time in the past on each of the three platforms. The number of reviews for a given hotel on *Booking.com, Expedia.com* and *Hotels.com* will be used as a proxy for the number of bookings that have been made through these websites (as opposed to bookings made through other sales channels). We believe that the number of reviews on *Booking.com, Expedia.com* and *Hotels.com* is a reasonable proxy for the number of bookings because it is possible to post a review for a given hotel only for customers who actually made a booking through these websites and only for a limited period of time after the trip. Contrary to many other review websites (e.g., *Tripadvisor.com), Booking.com, Expedia.com* and *Hotels.com* do not allow people to post reviews without having made a reservation for the given hotel through their website. Therefore, the number of reviews allows us to infer the extent to which hotels make use of digital platforms, as opposed to other distribution channels, to promote their physical core assets. We aggregate the number of reviews that a given hotel has received on the three

platforms by taking the average of the reviews on the three platforms and dividing it by the number of rooms of the given hotel.

Control Variables

We control for differences in the hotel class that a hotel belongs to (i.e. low-end class or high-end class) by introducing the dummy variables *LowEndClass* and *HighEndClass*, which are equal to 1 if the hotels belongs to the respective class and 0 otherwise. *LowEndClass* serves as the baseline. Similarly, we also created a dummy variable called *ChainAffiliated* that is equal to 1 if a hotel is affiliated to a chain and 0 if it is independent.

In our regressions, we also include the variable *Demand*, which accounts for differences in the overall demand for hotel rooms across cities and time. This variable represents the number of all hotel bookings made in a given city each month. An overview over the variables that are used in this paper can be found in TABLE 2.

To control for differences in the quality across hotels, we collected information on the ratings that hotels received on *Booking.com*, *Expedia.com* and *Hotels.com* from *archive.org*. ($AverageRating_{it}$). We aggregated the rating of the three platforms by calculating the average rating on *Booking.com*, *Expedia.com* and *Hotels.com*, weighted by the average rating of all hotels on the given platform in the given month.

TABLE 2
Variable Definition and Source

Variable Name	Definition	Source
$CumAirbnbSupply_{jt}$	Cumulative number of rooms listed on Airbnb until time *t* in city *j*	Airbnb.com
$RevenuePerRoom_{it}$	Revenue of hotel *i* in month *t* divided by the number of rooms of hotel *i*	Texas Tax Authorities
$LowEndClass_i$, $HighEndClass_i$	Dummy Variables indicating whether hotel *i* belongs to a low-end class (i.e. economy, midscale) or to a high-end class (i.e. upscale, luxury) respectively	STR Global
$Independent_i$, $ChainAffiliated_i$	Dummy Variables indicating whether hotel *i* is independent or affiliated to a chain	STR Global
$TotalReviews_{it}$	Average of the number of reviews that hotel *i* received on booking.com, expedia.com and hotels.com until time *t* divided by the number of rooms of hotel *i*	Booking.com Expedia.com and Hotels.com
$AverageRating_{it}$	Average rating of hotel *i* in month *t* on *Booking.com*, *Expedia.com* and *Hotels.com*, weighted by the average rating of all hotels on the given platform in the given month	Booking.com Expedia.com and Hotels.com
$AfterEntry_{jt}$	Dummy that is equal to zero in time periods *t* before the entry of Airbnb into city *j* and 0 afterwards	Airbnb.com
$AfterTakeOff_{jt}$	Dummy that is equal to zero in time periods *t* before the ratio of Airbnb supply and population in city *j* exceeds 0.0005 for the first time and 0 afterwards	Airbnb.com
$Demand_{jt}$	Total number of rooms sold in city *j* at time *t*	STR Global

Empirical Models

We use a correlated random effects approach for our baseline estimation instead of a fixed effects approach, so that we can estimate the effect of time-invariant hotel characteristics, such as the operation type or the hotel class (Wooldridge, 2015):

$$\begin{aligned} logRevenuePerRoom_{it} &= \beta_1\, logCumAirbnbSupply_{it} + \beta_2 \overline{logCumAirbnbSupply_i} + \gamma_1\, x_{it} \\ &+ \gamma_2 \bar{x}_i + r_i + u_{it} \end{aligned} \quad (1)$$

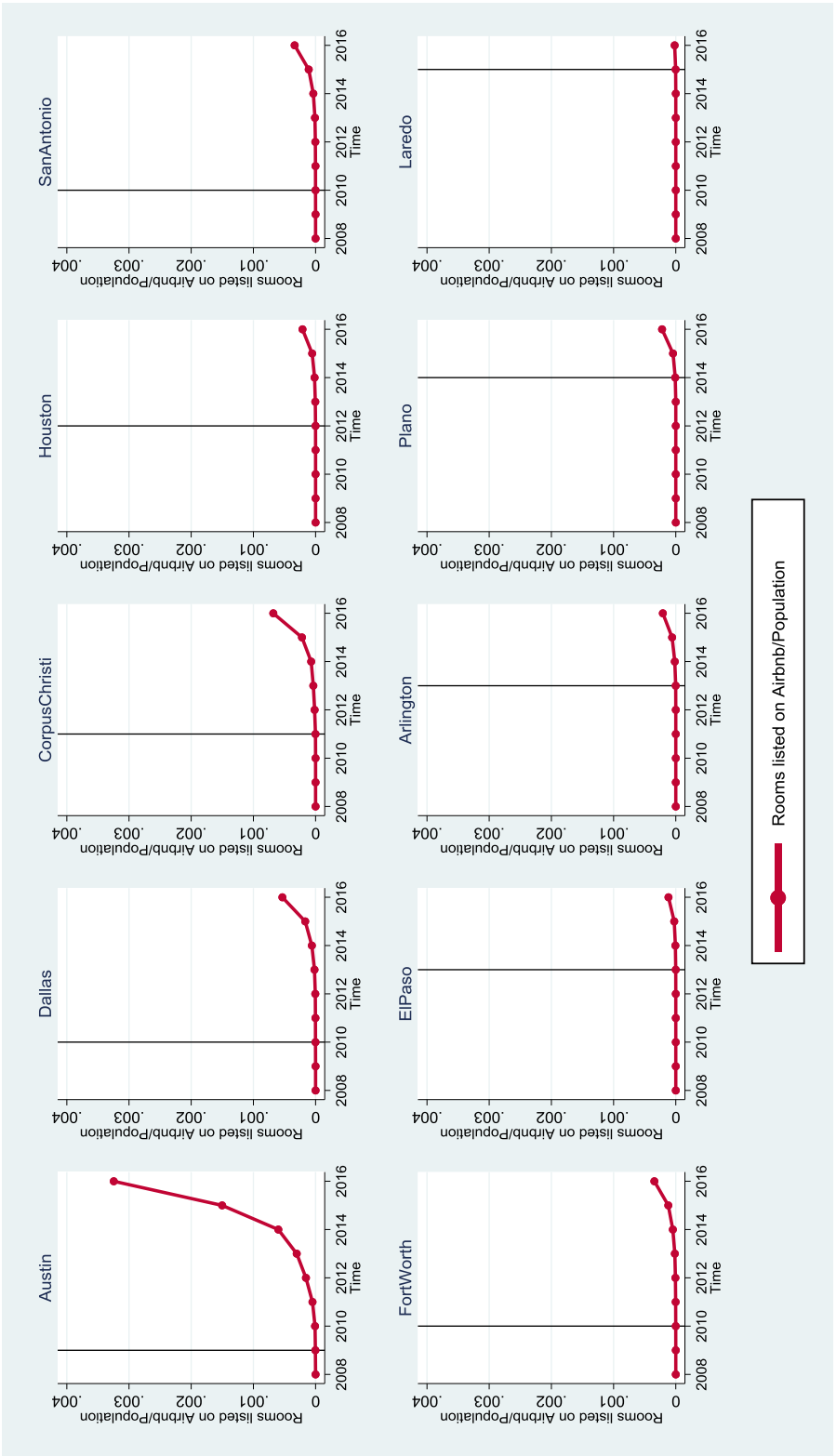
In this model, we regress the logarithm of the revenue per room of hotel *i* at time *t* on the logarithm of the number of rooms listed in the respective city. Since we are using a correlated random effects approach, we also added the unit-specific time-average of all explanatory variables that vary over time *t* and unit *i* (not reported in the tables in the results section), and then ran a random effects estimation of this model. This procedure allows us to interpret the coefficients on the non-time-average variables as fixed-effects estimates (Wooldridge, 2015). We run this model both on the entire sample, i.e. including all hotels, and on subsamples that only contain independent or chain affiliated hotels. This allows us to detect differences in the effect of *Airbnb* on hotels with different asset ownership positions.

In model (2), we also include the interaction effect between *Airbnb* supply and the dummy variable for chain affiliated hotels (*ChainAffiliated*$_i$) described in the previous section. This allows us to get a better understanding of whether the differences that we find across hotels with different operation types are significantly different from zero.

$$\begin{aligned} logRevenuePerRoom_{it} &= \beta_1\, logCumAirbnbSupply_{it} \\ &+ \beta_2 \overline{logCumAirbnbSupply_i} + \beta_1\, logCumAirbnbSupply_{it} \\ &* ChainAffiliated_i + \gamma_1\, x_{it} + \gamma_2 \bar{x}_i + r_i + u_{it} \end{aligned} \quad (2)$$

To analyze the effect that an increasing supply of rooms on *Airbnb* has on the usage of websites such as *Booking.com*, we ran models (1) and (2) using the number of reviews that hotel *i* has received on *Booking.com*, *Expedia.com* and *Hotels.com* as the dependent variable. As has been explained in the previous section, we will use the number of reviews as a proxy for the number of rooms that have been sold through this website. Similarly, we ran model (1) using the number of reviews on *Booking.com*, *Expedia.com* and *Hotels.com* as the independent variable and the revenue per room as the dependent variable to analyze if an increasing amount of online bookings has a negative effect on the performance of hotels.

FIGURE 2
Penetration of Airbnb across different cities in Texas
(Collapsed to annual data for illustrative purposes, solid black line indicates entry date)



To control for other possible macro trends (e.g., greater use of digital devices) that may affect both the adoption of peer-to-peer platforms and the shift of incumbents' business to digital platforms, we also used a difference-in-differences approach similar in design to the one used by Seamans and Zhu (2013). For this purpose, we defined a dummy variable $ChainAffiliated_i$ that takes the value 1 if hotel *i* is affiliated to a chain and 0 if the hotel is independent. We defined a variable $AfterEntry_{it}$ that is equal to 0 before *Airbnb* enters hotel *i*'s city and 1 afterwards, and a variable $AfterTakeoff_{it}$ that takes the value 0 before *Airbnb* takes off in hotel *i*'s city and 1 afterwards. We define the entry date of Airbnb in a given city as the date when the very first review for any listing on *Airbnb* in the city was posted and the take-off date as the date when the ratio of *Airbnb* supply and population in a given city exceeds 0.0005 for the first time[2]. The dependent variable in our difference-in-differences approach is again either the revenue per room of hotel *i* at time *t* or the number of reviews that hotel *i* has received on *Booking.com, Expedia.com* and *Hotels.com*. The model is as follows:

$$logRevenuePerRoom_{it} = \beta_1 AfterEntry_t * ChainAffiliated_i + \beta_2 AfterEntry_t + \delta_i + \gamma_t + City_j * \gamma_t + u_{it} \quad (3)$$

where δ_i are hotel fixed effects, γ_t are time fixed effects and $City_j*\gamma_t$ are city-time trends. The coefficient of interest is β_1, which indicates the change in revenues (or reviews) of chain affiliated hotels between the two time periods compared to independent hotels.

[2] As a robustness check, we also used a difference-in-differences approach with varying treatment intensity, which can be found in section 7.

5. Descriptive Industry Analysis

Our sample consists of 1,556 hotels, of which 380 are independent hotels and 1,176 are chain affiliated hotels (see TABLE 3 and TABLE 4 for information on sample composition and summary statistics). As can be seen from TABLE 3, the majority of independent hotels belongs to the low-end class, whereas chain affiliated hotels are distributed more evenly among low-end and high-end class.

TABLE 3
Sample Composition

	Independent Hotels	Chain Affiliated Hotels
N	380	1,176
Observations	33,439	107,087
Low-End Class	91.0%	67.7%
High-End Class	9%	32.3%
Monthly Revenues per Room in 2008 (Standard Deviation)	919.66 USD (1325.05)	1777.80 USD (1175.18)
Monthly Revenues per Room in 2016 (Standard Deviation)	988.32 USD (1547.35)	1790.245 USD (1263.63)
Monthly Revenues per Room of Low-End Hotels (Standard Deviation)	607.25 USD (444.52)	1233.51 USD (758.84)
Monthly Revenues per Room of High-End Hotels (Standard Deviation)	3687.85 USD (3599.59)	2561.66 USD (1357.23)
Average Weighted Rating of Low-End Hotels (Standard Deviation)	0.84 (0.18)	0.96 (0.15)
Average Weighted Rating of High-End Hotels (Standard Deviation)	1.05 (0.13)	1.06 (0.08)

Throughout the sampling period, the revenue that chain affiliated hotels generate per room and month is constantly higher than the revenue generated by independent hotels. This can be

attributed at least in part to their superior complementary assets (e.g., marketing and sales, brand) that have traditionally provided them with a competitive advantage over others. However, the monthly revenue per room of independent hotels has increased by 6.9% in the sampling period from 2008 to 2016, whereas the revenue of chain affiliated hotels has only increased by 0.7% in the same period. This provides some preliminary evidence that the competitive advantage of chain affiliated hotels is eroding over the years, while independent hotels are catching up.

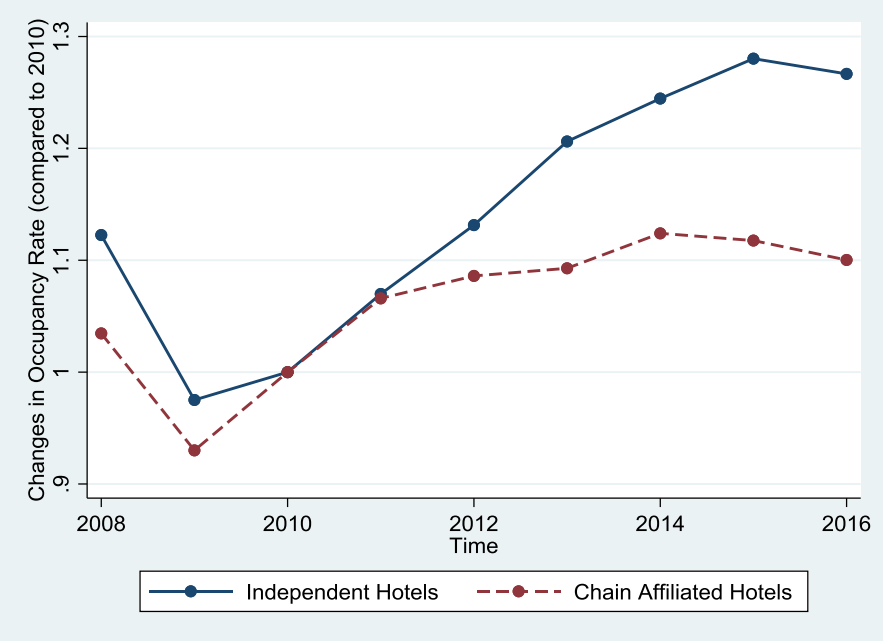
TABLE 4
Summary Statistics

Variable Name	Observations	Mean	Std. Dev.	Min	Max
$CumAirbnbSupply_{jt}$	140,526	138.7723	1277.865	0	4061
$RevenuePerRoom_{it}$	140,526	1463.873	17.13441	.0000783	95637.22
$TotalReviews_{it}$	13,706	1.644219	2.399693	0	26.96078
$Demand_{jt}$	140,526	933781.5	509243.2	51976	1943561
$AverageRating_{it}$	13,236	.9980465	.1416176	0	2.085693
$ChainAffiliated_{i}$	140,526	.762044	.4258336	0	1
$AfterEntry_{jt}$	140,526	.680415	.4663175	0	1
$AfterTakeOff_{jt}$	140,526	.0568151	.2314898	0	1

Our interpretation is that this effect can be caused by the increasing availability of digital platforms that gives independent hotels access to a larger customer base that they can reach through the platform and that was out of their reach because of their lacking complementary downstream assets before. The competitive advantage that chain affiliated hotels used to have in promoting their physical assets because of their strong complementary downstream assets is therefore decreasing over time. Some initial evidence for this reasoning is provided by FIGURE 3. Taking the year 2010 as a baseline, the graph shows the changes in occupancy rates (i.e. the number of rooms sold divided by the total number of rooms in a given hotel) over time for independent and chain affiliated hotels. While both types of hotels follow

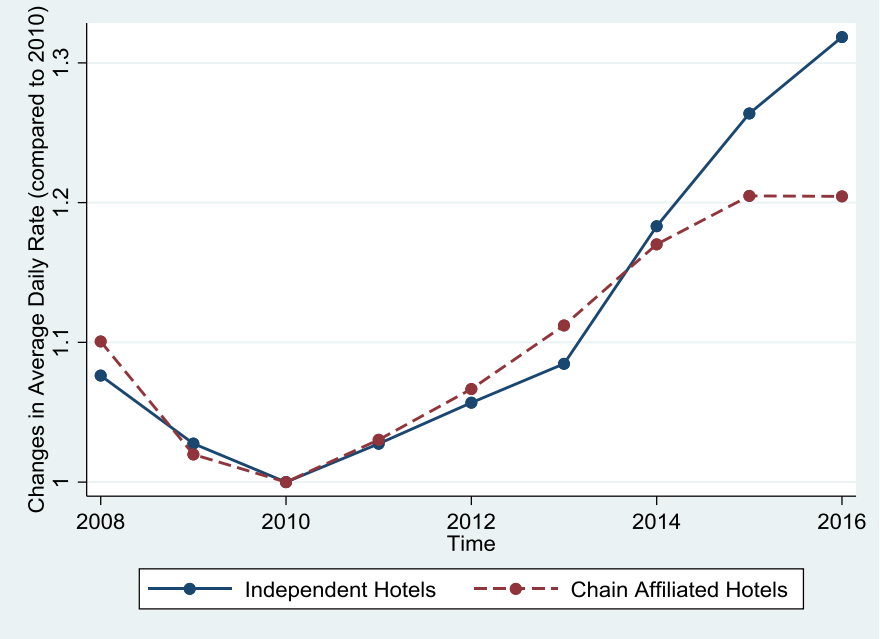
similar economic trends, the occupancy rate of independent hotels has grown much more than the occupancy rate of chain affiliated hotels over the past years.

FIGURE 3
Changes in Occupancy Rate Over Time



As chain affiliated hotels are pushed to do more and more of their business on peer-to-firm platforms, they will face increasing competition. Instead of relying on their own exclusive sales channels, they will now have to compete head-to-head with other hotels on the same platform, which will force them to adjust their prices accordingly. This reasoning is consistent with FIGURE 4. As time progresses, the average daily rate (i.e. the room revenue divided by rooms sold) of chain affiliated hotels grows much less than that of independent hotels, suggesting that it is becoming more and more difficult for chain affiliated hotels to maintain their prices at a comparatively high level.

FIGURE 4
Changes in Average Daily Rate Over Time



6. Results

TABLE 5 shows the results that we obtained from the estimation of model (1) and (2) on both the entire sample and on subsamples that only contain either independent or chain affiliated hotels with *log(TotalReviews)* as the dependent variable.

On average, an increase in supply on *Airbnb* does not seem to be related to the number of reviews that hotels receive on *Booking.com, Expedia.com* and *Hotels.com*. However, independent and chain affiliated hotels seem to be affected in very different ways. While there is a statistically significant negative relationship with the number of reviews that independent hotels receive, the relationship between *Airbnb* supply and the reviews of chain affiliated hotels is positive. These findings are consistent with the theoretical reasoning described in the previous sections. As consumer preferences increasingly shift towards online services due to *Airbnb's* take-off, chain affiliated hotels increasingly do more of their business on peer-to-firm platforms. This, in turn, has a positive effect on the number of reviews they receive on

Booking.com, Expedia.com and *Hotels.com.* On the other hand, independent hotels are likely to have already started doing business on these platforms at an earlier point in time because platforms such as *Booking.com* provide complementary value for their physical assets. Therefore, an increase in the supply on *Airbnb* does not lead to an increase in the number of their reviews on *Booking.com, Expedia.com* and *Hotels.com*. Instead, they might suffer from increasing competition from *Airbnb* which might reduce (among others) the amount of business that they do on peer-to-firm platforms.

In the fourth column of TABLE 5, we can find the results that we obtained from the estimation of model (2). It can be seen that chain affiliated hotels on average receive less reviews on peer-to-firm platforms, which is consistent with the idea that they might be reluctant to use these platforms, as they are potential substitutes for their own complementary assets. As supply on Airbnb increases however, the amount of business that they do on peer-to-firm platforms seems to increase more than the amount of business that independent hotels do on peer-to-firm platforms. Taken together, this provides support for Hypothesis 1.

TABLE 5
Regression Results: *Airbnb* Supply and Hotel Reviews (Subsample Analysis by Hotel Operation Type)

Dependent Variable	log(TotalReviews)			
Sample	All Hotels	Independent Hotels	Chain Affiliated Hotels	All Hotels
lnCumAirbnbSupply	.03422	-.25103***	.06527**	-.00918
	(0.217)	(0.002)	(0.025)	(0.804)
HighEndClass	-.09478	.38838	-.13547**	-.07493
	(0.166)	(0.212)	(0.046)	(0.271)
Demand	-1.1e-07	-1.5e-08	-1.3e-07	-1.1e-07
	(0.506)	(0.979)	(0.444)	(0.509)
ChainAffiliated				-.54299***
				(0.001)
ChainAffiliatedXlnCumAirbnbSupply				.04832*
				(0.076)
Constant	-4.8786***	-5.5676***	-4.8064***	-4.3644***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	13706	1392	12314	13706
R^2	0.4521	0.3546	0.4775	0.4628

p-values in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; Correlated Random Effects specification based on model (1) and (2), contains unit-specific time-average of all explanatory variables, random effects and time fixed effects, standard errors are clustered at the hotel level

TABLE 6 contains the results that we obtained from the estimation of model (1) and (2) with *log(RevenuePerRoom)* as the dependent variable. From the second and third column it can be seen that, as *Airbnb* supply increases over time, the performance of independent hotels increases less than that of chain affiliated hotels, which seems to be consistent with the arguments presented above. However, the model in the fourth column reveals that this difference is not statistically significant from zero.

Taken together, these findings provide only limited support for our hypothesis that incumbents that own complementary downstream assets will increasingly lose their competitive advantage as supply on peer-to-peer platforms increases.

TABLE 6
Regression Results: Airbnb Supply and Hotel Revenues (Subsample Analysis by Hotel Operation Type)

Dependent Variable	log(RevenuePerRoom)			
Sample	All Hotels	Independent Hotels	Chain Affiliated Hotels	All Hotels
lnCumAirbnbSupply	.01597***	.02009*	.01634***	.01107*
	(0.001)	(0.067)	(0.001)	(0.055)
HighEndClass	.92345***	1.3922***	.71848***	.79033***
	(0.000)	(0.000)	(0.000)	(0.000)
Demand	6.7e-07***	4.2e-07***	7.6e-07***	6.7e-07***
	(0.000)	(0.000)	(0.000)	(0.000)
ChainAffiliated				.61771***
				(0.000)
ChainAffiliatedXlnCumAirbnbSupply				.00671
				(0.122)
Constant	6.7842***	6.12***	7.0692***	6.3734***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	140526	33439	107087	140526
R^2	0.3603	0.3584	0.3662	0.4726

p-values in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; Correlated Random Effects specification based on model (1) and (2), contains unit-specific time-average of all explanatory variables, random effects and time fixed effects, standard errors are clustered at the hotel level

In the previous sections, we argued that incumbents who own complementary downstream assets will lose their competitive advantage and face more head-to-head competition as they do an increasing part of their business on peer-to-firm platforms. Based on this reasoning, we expect to see that the performance of chain affiliated hotels is negatively affected as the number of reviews on *Booking.com, Expedia.com* and *Hotels.com*, and therefore the number of bookings made through digital platforms, increases. TABLE 7 shows the results that we obtained by regressing hotel performance on the number of reviews on *Booking.com, Expedia.com* and *Hotels.com*. We find that, on average, there is no statistically significant relationship between an increasing number of reviews and the performance of chain affiliated hotels. However, as can be seen from the last column, hotels are affected very differently depending on the class they belong to. While we find a positive relationship for low-end

hotels, there is a negative relationship between the number of reviews and performance of high-end hotels. We believe that this result is consistent with the idea that for low-end hotels, who are most likely to face direct competition from Airbnb, the negative effect of losing some of their competitive advantage is outweighed by the fact that each additional review represents an additional sale compared to potential competitors. For high-end hotels on the other hand, this is not the case, and the negative effect from losing competitive advantage dominates.

TABLE 7
Regression Results: Hotel Reviews and Hotel Revenues (Subsample Analysis by Hotel Operation Type)

Dependent Variable	log(RevenuePerRoom)					
Sample	All Hotels	Independent Hotels	Chain Affiliated Hotels	All Hotels	Independent Hotels	Chain Affiliated Hotels
lnTotalReviews	0.0046	-0.0169	0.0077	0.0175**	0.0003	0.0220***
	(0.447)	(0.319)	(0.227)	(0.019)	(0.988)	(0.005)
LowEndClass	ref.	ref.	ref.	ref.	ref.	ref.
HighEndClass	.81784***	1.5209***	.71995***	.78915***	1.4984***	.68805***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LowEndClass # lnTotalReviews				ref.	ref.	ref.
HighEndClass # lnTotalReviews				-.02978***	-.06077	-.0315***
				(0.006)	(0.103)	(0.005)
Demand	8.5e-07***	5.6e-07**	8.8e-07***	8.5e-07***	5.5e-07*	8.8e-07***
	(0.000)	(0.041)	(0.000)	(0.000)	(0.051)	(0.000)
Constant	6.8161***	6.302***	6.8619***	6.8272***	7.3882***	6.8743***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	13706	1392	12314	13706	1392	12314
R^2	0.3775	0.4633	0.3771	0.3787	0.4757	0.3775

p-values in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; Correlated Random Effects specification based on model (1) and (2), contains unit-specific time-average of all explanatory variables, random effects and time fixed effects, standard errors are clustered at the hotel level

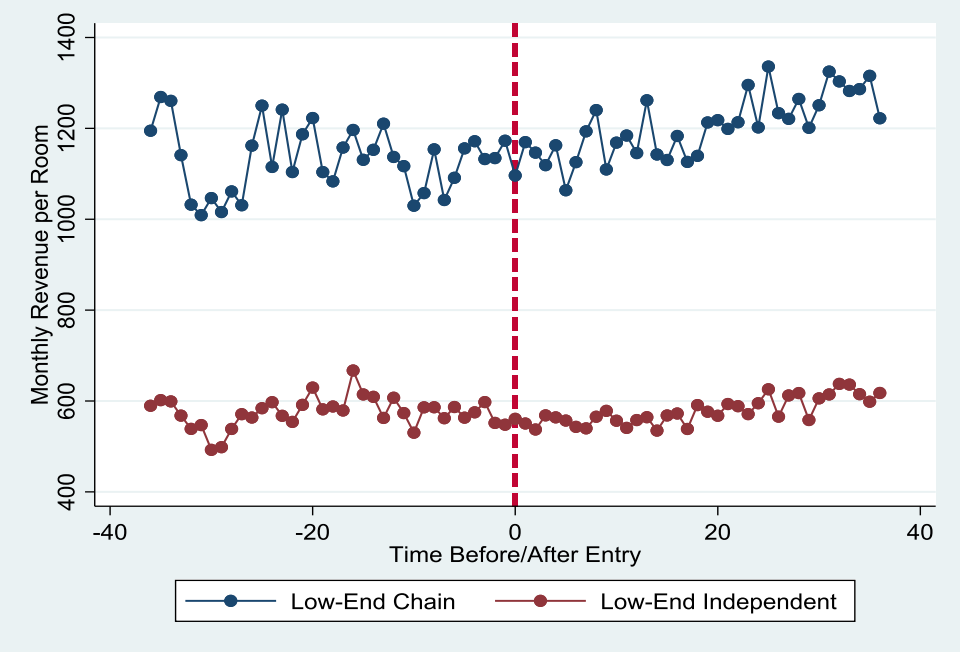
While the results presented above lend some initial support for our claims, it should be noted that we cannot exclude the presence of broader macro trends associated with the diffusion of digital technologies, which might have a confounding effect. For this reason, we next turn to the difference-in-differences analyses, which help us mitigate these concerns at least to some extent.

The results that we obtained by using the difference-in-differences model to estimate the effect of *Airbnb* on the performance of chain affiliated and independent hotels can be found in TABLE 8. As can be seen from the first two columns, both after *Airbnb* enters a given market and after it really takes off in that market, chain affiliated hotels seem to perform significantly better than their independent counterparts, which is contradictory to what we expected. It is important to note however, that in this model we do not control for differences in hotel class, even though there are major differences in the distribution of classes across chain affiliated and independent hotels (see TABLE 3). Since hotel class does not change over time, we cannot include it in our difference-in-differences model with individual fixed-effects. For this reason, we ran additional analyses, which are reported in columns 3 to 6 of TABLE 8, and which provide some insights into what might be driving this result. These columns contain the results that we obtained by running the same difference-in-differences model on subsamples that either contain only hotels that operate at the lower end of the market, or only hotels that operate at the higher end of the market. The idea behind these groups is that low-end hotels are the ones that are most likely to compete directly with *Airbnb* for the same customer segment, whereas high-end hotels operate in a different market segment. By looking at columns 3 to 6, it can be noted that the sample contains many more low-end hotels than high-end hotels, which suggests that the results for the full sample of all hotels is dominated by the effect of low-end hotels. It can also be noted that chain affiliated hotels in the low-end

category perform significantly better than their independent counterparts after the entry and take-off of *Airbnb*, whereas the ones in the high-end category perform significantly worse. These findings are consistent with the pattern displayed in FIGURE 5 and FIGURE 6. It can be seen from FIGURE 5 that in the lower end of the market, chain affiliated hotels seem to be performing slightly better than their independent counterparts both after the entry and after the take-off of *Airbnb*. On the other hand, FIGURE 6 provides additional evidence that, at the higher end of the market, chain affiliated hotels perform significantly better than independent hotels both after the entry and after the take-off of *Airbnb*.

While we cannot directly test the driving forces behind these differences between low-end and high-end hotels, the most likely explanation for these results is related to hotel quality. While all chain affiliated hotels suffer from the increasing devaluation of the chain's complementary downstream assets, low-end hotels also have several benefits derived from chain affiliation, particularly in the face of increasing competition from *Airbnb*. Besides providing access to their downstream assets, chains provide the hotels that are affiliated to them with several other benefits, such as overall higher quality standards or additional services for customers. For hotels at the lower end of the market, which are affected by direct competition from *Airbnb*, providing high quality standards or additional services can be an important way to differentiate themselves from listings on *Airbnb*, which in general offer less service and potentially lower quality standards. This in turn might explain why being affiliated to a chain is actually beneficial for the performance of low-end hotels, particularly in the face of increasing direct competition from *Airbnb*.

FIGURE 5
Monthly Revenue per Room of Independent and Chain Affiliated Hotels in the Low-End Market Segment Before and After the Entry/Take-Off of Airbnb



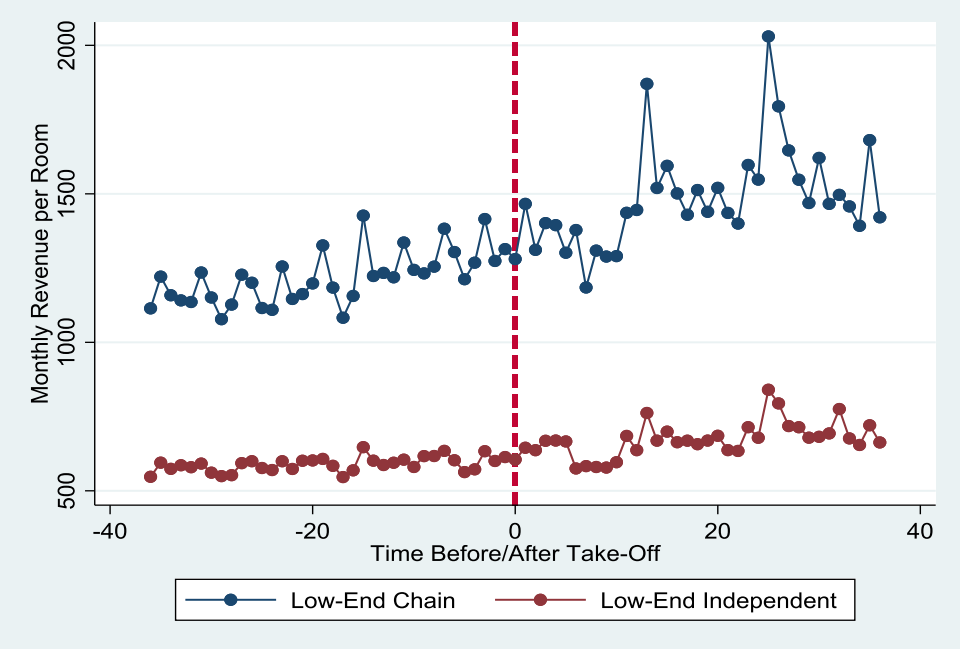
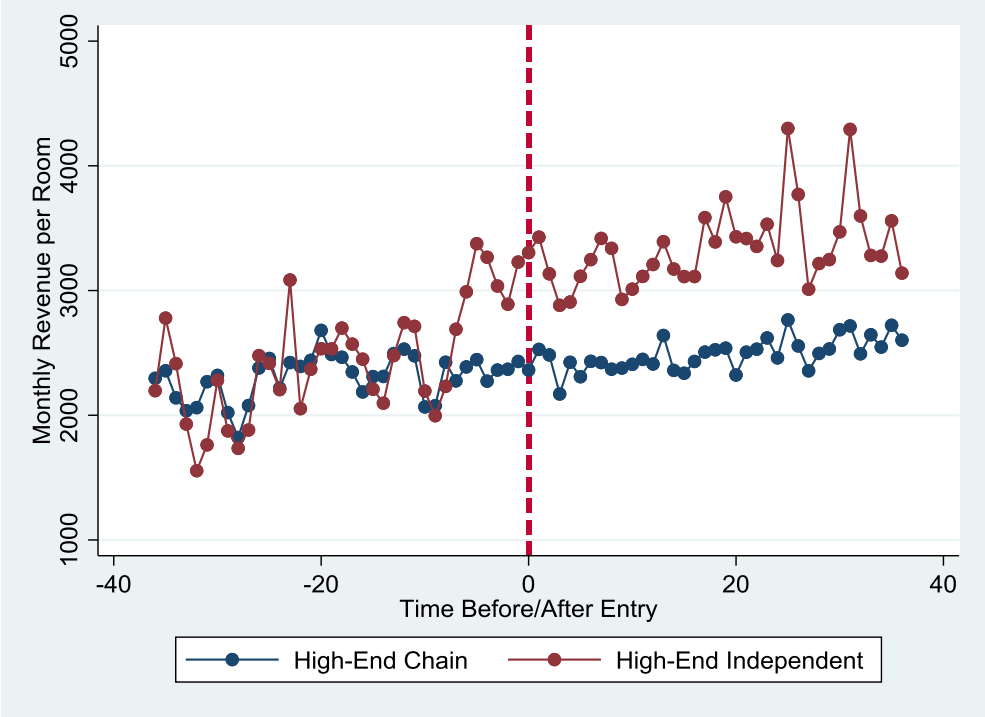
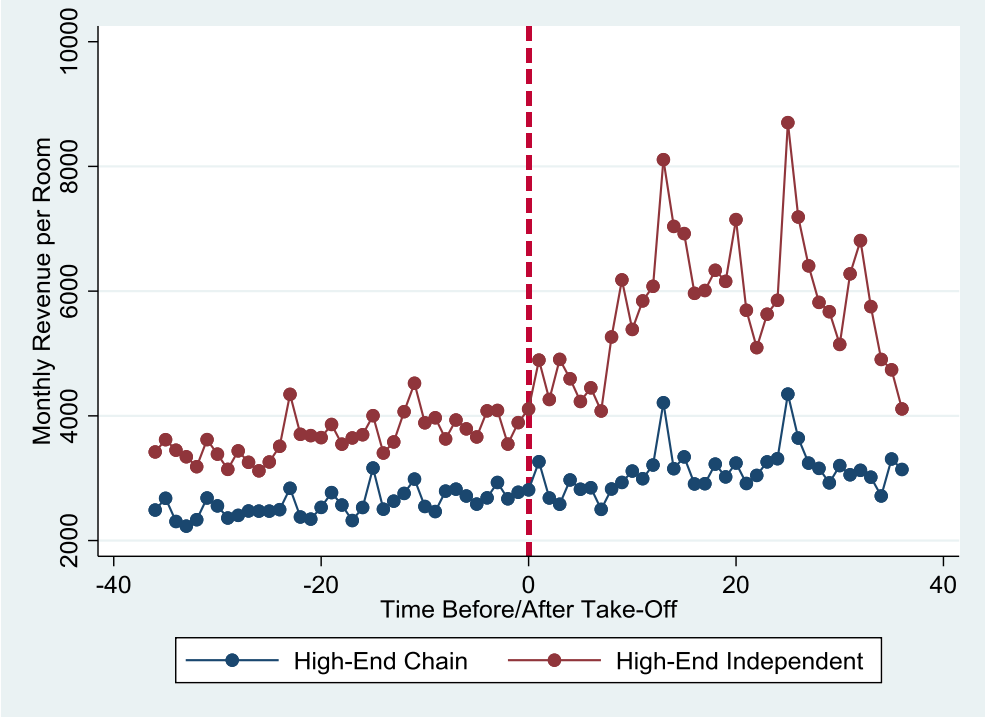


FIGURE 6
Monthly Revenue per Room of Independent and Chain Affiliated Hotels in the High-End Market Segment Before and After the Entry/Take-Off of Airbnb





On the other hand, all high-end hotels, regardless of whether they are affiliated to a chain or not, provide a certain level of service and have in fact traditionally competed on quality, rather than prices, at least to some extent. For this reason, we believe that high-end hotels have no major differentiation advantage to gain from chain affiliation but will at the same time suffer from the increasing loss in value of the chain's complementary downstream assets. Additionally, high-end hotels have traditionally been the ones that charged the highest price premium to customers and are therefore the ones that have the most to lose from the decreasing value of their exclusive downstream assets.

TABLE 8
Airbnb Supply and Hotel Revenue (Difference-In-Differences Approach)

Dependent Variable	log(RevenuePerRoom)					
Sample	All Hotels		Low-End Hotels		High-End Hotels	
AfterEntry	-0.1451***		-0.1614***		0.0123	
	(0.000)		(0.000)		(0.822)	
ChainAffiliatedXAfterEntry	0.0328*		0.0418**		-0.1067*	
	(0.077)		(0.038)		(0.061)	
AfterTakeOff		.04984**		.02241		.23119***
		(0.040)		(0.364)		(0.002)
ChainAffiliatedXAfterTakeOff		.04662*		.09891***		-.18375**
		(0.099)		(0.001)		(0.017)
Demand	1.3e-06***	1.2e-06***	1.3e-06***	1.2e-06***	1.2e-06***	1.2e-06***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	6.7154***	7.5098***	6.4149***	7.2899***	7.571***	8.1433***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	140526	140526	104328	104328	36198	36198
R^2	0.1535	0.1475	0.1488	0.1419	0.1726	0.1702

p-values in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; Difference-In-Differences specification based on model (3) , contains hotel fixed effects, time fixed effects and city time-trends, standard errors are clustered at the hotel level

Some support for the idea that differences in service and quality might be driving the results at least in part, is presented in TABLE 9. This table contains the results of running model (3) on a smaller subsample of hotels, for which we have information on hotel ratings. It can be seen that, after adding hotel ratings as a control for hotel quality, the positive effect in the low-end segment becomes insignificant, while the negative effect in the high-end category seems to persist. This suggests that major differences in the quality among hotels in the low-end category might indeed be responsible for the fact that these hotels can benefit from being affiliated to a chain. Taken together, this provides some evidence for Hypothesis 2.

TABLE 9
Airbnb Supply and Hotel Revenue (Difference-In-Differences Approach)

Dependent Variable	log(RevenuePerRoom)					
Sample	All Hotels		Low-End Hotels		High-End Hotels	
AfterEntry	-0.0524		-0.1426		0.2121	
	(0.546)		(0.132)		(0.268)	
ChainAffiliatedXAfterEntry	-0.0040		0.0982		-0.2707	
	(0.962)		(0.321)		(0.132)	
AfterTakeOff		.09028*		.04544		.1551**
		(0.051)		(0.428)		(0.029)
ChainAffiliatedXAfterTakeOff		-.0462		.03406		-.14832**
		(0.291)		(0.539)		(0.026)
Demand	1.5e-06***	1.5e-06***	1.7e-06***	1.7e-06***	1.2e-06***	1.2e-06***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ln(AverageRating)	.27477***	.27746***	.31072***	.31441***	.18342*	.19478*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.067)	(0.056)
Constant	5.9377***	6.2227***	5.3528***	5.7269***	6.474***	6.6302***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	13225	13225	7124	7124	6101	6101
R^2	0.2507	0.2506	0.2956	0.2955	0.2160	0.2147

p-values in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; Difference-In-Differences specification based on model (3) , contains hotel fixed effects, time fixed effects and city time-trends, standard errors are clustered at the hotel level

The results that we obtained by using the difference-in-differences approach described in model (3) to estimate the effect of *Airbnb* on the reviews that chain affiliated and independent hotels receive on *Booking.com*, *Expedia.com* and *Hotels.com*, can be found in TABLE 10. It can be seen that, if we again control for hotel ratings, there is no statistically significant effect if we consider the full sample of all hotels. However, we do find that chain affiliated hotels do significantly more business on digital platforms compared to their independent counterparts, after *Airbnb* takes off. In line with our theoretical reasoning, we would not necessarily expect a positive effect on the number of reviews of chain affiliated hotels deriving from *Airbnb's* entry per se. As we argued earlier, the increasing amount of business that chain affiliated hotels do on digital platforms derives from the increasing shift in consumer preferences towards digital platforms, which will happen once *Airbnb's* supply takes off.

For hotels that operate at the lower end of the market, we find no statistically significant difference between independent and chain affiliated after *Airbnb* takes off. Again, this effect might be due to differences in the extent to which different classes of hotels are affected by direct competition from *Airbnb*. While chain affiliated hotels overall might do more business on digital platforms as *Airbnb* takes off, low-end hotels face direct competition from listings on *Airbnb*, which takes away business from them and thus counterbalances the increasing usage of digital platforms. Hotels that operate at the high end of the market are not directly affected by competition from *Airbnb*, and changes in the number of reviews that they receive on *Booking.com, Expedia.com* and *Hotels.com* are likely to be mainly driven by an increasing shift towards more business on digital platforms.

TABLE 10
Airbnb Supply and Hotel Reviews (Difference-In-Differences Approach)

Dependent Variable	log(TotalReviews)					
Sample	All Hotels		Low-End Hotels		High-End Hotels	
AfterEntry	0.2917		0.3903**		0.0921	
	(0.143)		(0.020)		(0.855)	
ChainAffiliatedXAfterEntry	0.1295		0.0807		0.2570	
	(0.522)		(0.640)		(0.613)	
AfterTakeOff		-.67741***		-.18454		-1.4166***
		(0.010)		(0.212)		(0.000)
ChainAffiliatedXAfterTakeOff		.21173		-.22189		.88282***
		(0.425)		(0.128)		(0.010)
Demand	6.8e-08	1.3e-07*	-1.8e-08	4.2e-08	1.5e-07	1.9e-07*
	(0.350)	(0.075)	(0.853)	(0.675)	(0.176)	(0.071)
ln(AverageRating)	-.10814	-.12625	.13783	.11389	-.7183	-.72563
	(0.660)	(0.607)	(0.614)	(0.680)	(0.162)	(0.148)
Constant	-32.258***	-34.721***	-32.402***	-34.836***	-32.352***	-34.925***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	13210	13210	7115	7115	6095	6095
R^2	0.5638	0.5644	0.5763	0.5743	0.5569	0.5623

p-values in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; Difference-In-Differences specification based on model (3) , contains hotel fixed effects, time fixed effects and city time-trends, standard errors are clustered at the hotel level

7. Additional Analyses

We conducted several additional analyses to assess the robustness of our results and exclude some of the potential alternative explanations.

Hotel Class Time-Trends

An alternative explanation for our findings might be that there are specific market trends in some hotel classes over time, which drive our results. This could in principle lead to an increase in the revenues of hotels in certain segments, as well as to an increase in the amount of business that they do on digital platforms. To rule out this possibility, we extended the difference-in-differences specification described in model (3) by adding class-specific time trends. The results of this analysis can be found in TABLE 11 in the appendix. It can be seen that, compared to the results displayed in TABLE 9 and TABLE 10, the magnitude of the effects changes slightly but the overall pattern of results remains unchanged.

3-Way Difference-In-Differences Approach

As an alternative for conducting the difference-in-differences analysis using different subsamples that only include certain classes of hotels, we also used a 3-way difference-in-differences approach. In this approach (see model (4)), we compare the performance (or number of reviews) of chain affiliated or independent hotels in the lower or higher end of the market before and after the entry/take-off of *Airbnb*.

$$
\begin{aligned}
logRevenuePerRoom_{it} &= \beta_1\, AfterEntry_t * ChainAffiliated_i \\
&+ \beta_2\, AfterEntry_t + \beta_3\, AfterEntry_t * ChainAffiliated_i \\
&* HighEnd_i + \beta_4\, AfterEntry_t * HighEnd_i + \delta_i + \gamma_t + u_{it}
\end{aligned}
\tag{4}
$$

As can be seen from TABLE 12 in the appendix, the results of this analysis are consistent with our previous findings. At the higher end of the market, chain affiliated hotels perform significantly worse than their independent counterparts after both the entry and take-off of *Airbnb*. Furthermore, chain affiliated hotels at the higher end of the market do significantly more business on digital platforms than their independent counterparts after the take-off of *Airbnb*.

Coarsened Exact Matching

As can be seen from TABLE 3, independent and chain affiliated hotels are different not only in terms of their distribution across hotel classes, but also in terms of some key characteristics within each hotel class. More specifically, the average monthly revenues per room and the average rating on *Booking.com*, *Expedia.com* and *Hotels.com* vary across the two types of hotels. This raises the concern that our results might be driven by some underlying difference between the two types, such as differences in managerial ability, which in turn are reflected in hotel revenues and ratings.

While we cannot completely rule out the concern that there might be potentially unobservable differences between independent and chain affiliated hotels, we believe that Coarsened Exact Matching can help us alleviate these concerns. We matched independent and chain affiliated hotels based on their average monthly revenues per room before the entry of *Airbnb* and on their average rating before the entry of *Airbnb*, and replicated the analyses reported in TABLE 9 and TABLE 10. The results reported in TABLE 13 in the appendix are consistent with the results of our previous analyses, which lends additional support to our claims.

Mediation

In the previous chapters, we have analyzed the effect of *Airbnb* on online reviews and the effect of *Airbnb* on hotel revenues in separate models. While we do not expect the effect of

Airbnb on hotel performance to be driven entirely by an increasing shift onto digital platforms, there might be a mediating effect. To test this, we ran an additional analysis in which we first replicate the 3-way difference-in-differences approach described above. We then included reviews on *Booking.com*, *Expedia.com* and *Hotels.com*, as well as interaction terms with the $HighEnd_i$ and $Chain_i$ dummies, as additional independent variables (Baron and Kenny, 1986). It can be seen from the first column in TABLE 14 that chain affiliated high-end hotels perform significantly worse than their non-chain-affiliated counterparts, which is consistent with previous results. Upon inclusion of the hotel reviews as an independent variable, this effect however becomes lower in magnitude and statistically insignificant. On the other hand we find a negative coefficient for the interaction term between hotel reviews, $HighEnd_i$ and $Chain_i$, suggesting that for high-end chain affiliated hotels, receiving additional reviews is more detrimental than for their independent counterparts. This effect however is only marginally significant, which only provides weak evidence for a mediation effect.

Difference-In-Differences Approach with Varying Treatment Intensity

In our difference-in-differences analyses, we have used two threshold values for *Airbnb* supply to study its effect on the dependent variables at different points in time. An alternative approach to do this is to use a difference-in-differences approach with varying treatment intensities, i.e. a difference-in-differences approach that accounts for differences in the level of *Airbnb* supply throughout the time period after its entry. The results that we obtained by using this approach can be found in TABLE 15**.** It can be seen that the pattern of results is consistent with the pattern that we obtained using other specifications.

8. Conclusion

In this paper, we have shown that differences in the ownership of core and complementary assets are an important factor in understanding which incumbents are really affected by peer-to-peer platforms. Previous literature has overlooked this aspect and has often applied conventional logics to study competition between peer-to-peer platforms and traditional firms. However, peer-to-peer platforms have the potential of largely affecting consumer preferences, and thus the value of incumbents' pre-existing downstream complementary assets to tap into consumer demand. Accounting for this potential effect, we have provided evidence that the main threat that peer-to-peer platforms pose to incumbents is not necessarily the direct competition effect, but rather the shift in the demand that they trigger. By shifting consumer habits towards using digital platforms, peer-to-peer platforms push incumbents to do more of their business on peer-to-firm platforms as well. As this shift unfolds, digital platforms act as a substitute for the incumbents' complementary downstream assets and decrease their value significantly. Ultimately, the incumbents that are affected the most by peer-to-peer platforms are not necessarily the ones that operate in the same market segment, but those whose complementary downstream assets will become obsolete.

In contrast to previous research, we show that owning complementary assets does not always help incumbents to protect themselves from new entrants. These assets might actually become a legacy that makes them more vulnerable when the offerings of new entrants also lead consumers to change the way they access and consume these offerings. More concretely, we show that the shift in consumer preferences that is triggered by an increasing supply on peer-to-peer platforms can push incumbents to adopt a technology that acts as a substitute for their own complementary assets, which will ultimately have a negative effect on their performance. We also contribute to the literature by extending the scope of our research beyond peer-to-

peer platforms and including platforms on which incumbents can promote their own physical assets. In doing so, we are able to get a more complete picture of the competitive environment and to study how the interaction between peer-to-peer platforms and incumbents affects the usage of other digital platforms as well.

While the analyses presented above provide evidence for our claims, this study also has a number of limitations. As with many studies, a potential limit to the generalizability is posed by the fact that we focus only on one industry and one geographic region. While we cannot fully rule out all potential concerns, there are a few factors that might alleviate them. The fact that similar phenomena can be observed in other industries (e.g. the entry of *Uber* and the increasing popularity of taxi apps in the transportation sector) and the fact that our sample includes a very diverse set of cities (e.g. touristic and non-touristic cities) makes the results more generalizable. A second limitation of this paper is the fact that we do not directly observe supply and demand of hotel rooms on peer-to-firm platforms. Ideally, we would like to observe how many rooms of a given hotel are made available online and how many potential customers look for hotel rooms online. As this data is unavailable to us, we believe that our proxy is the best possible measure to quantify the amount of business that is being done on peer-to-firm platforms.

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APPENDIX

TABLE 11
Hotel Revenue and Hotel Reviews Before and After *Airbnb* Entry/Take-Off (Difference-In-Differences Approach, controlling for class-specific time trends)

Dependent Variable	log(RevenuePerRoom)				log(TotalReviews)			
Sample	Low-End Hotels		High-End Hotels		Low-End Hotels		High-End Hotels	
After	-0.1597*		0.2111		0.4790***		0.2526	
	(0.088)		(0.306)		(0.004)		(0.631)	
ChainXAfter	0.1191		-0.2693		-0.0213		0.0914	
	(0.223)		(0.169)		(0.902)		(0.862)	
AfterTakeOff		.05623		.15044**		-.20737		-1.338***
		(0.343)		(0.034)		(0.160)		(0.000)
ChainX AfterTakeOff		.02122		-.1427**		-.19425		.7947**
		(0.715)		(0.034)		(0.192)		(0.013)
Demand	1.7e-06***	1.7e-06***	1.2e-06***	1.2e-06***	-1.3e-08	4.5e-08	1.4e-07	2.0e-07*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.894)	(0.649)	(0.181)	(0.068)
lnAverageRating	.32382***	.326***	.18359*	.19086*	.06764	.04287	-.65461	-.66549
	(0.000)	(0.000)	(0.065)	(0.057)	(0.803)	(0.876)	(0.194)	(0.174)
Constant	5.3386***	5.708***	6.4717***	6.625***	-32.34***	-34.76***	-32.39***	-34.97***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	7124	7124	6102	6102	7115	7115	6096	6096
R^2	0.2966	0.2963	0.2160	0.2148	0.5781	0.5761	0.5580	0.5631

p-values in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; Difference-In-Differences specification based on model (3) , contains hotel fixed effects, time fixed effects, city time-trends and class time-trends, standard errors are clustered at the hotel level

TABLE 12
Hotel Revenue and Hotel Reviews Before and After *Airbnb* Entry/Take-Off (3-way Difference-In-Differences Approach, controlling for class-specific time trends)

Dependent Variable	log(RevenuePerRoom)		log(TotalReviews)	
Sample	All Hotels			
After	-0.1605*		0.4608***	
	(0.087)		(0.009)	
ChainXAfter	0.1340		-0.0255	
	(0.170)		(0.889)	
HighEndClassXAfter	.29351		-.1335	
	(0.178)		(0.813)	
ChainXAfterXHighEndClass	-.35804*		.0733	
	(0.098)		(0.898)	
AfterTakeOff		.04025		-.17895
		(0.469)		(0.191)
ChainXAfterTakeOff		.02449		-.17408
		(0.676)		(0.244)
HighEndClassXAfterTakeOff		.12643		-1.2259***
		(0.140)		(0.000)
ChainXAfterTakeOffXHighEndClass		-.16941*		.99707***
		(0.061)		(0.004)
lnAverageRating	.2956***	.29875***	-.11082	-.13484
	(0.000)	(0.000)	(0.646)	(0.576)
Demand	1.5e-06***	1.5e-06***	7.6e-08	1.3e-07*
	(0.000)	(0.000)	(0.292)	(0.070)
Constant	5.9***	6.1852***	-32.297***	-34.773***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	13226	13226	13211	13211
R^2	0.2529	0.2520	0.5658	0.5678

p-values in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; 3-way Difference-In-Differences specification based on model (4) , contains hotel fixed effects, time fixed effects, city time-trends and class time-trends, standard errors are clustered at the hotel level

TABLE 13
Coarsened Exact Matching

Dependent Variable	log(RevenuePerRoom)				log(TotalReviews)			
Sample	Low-End Hotels		High-End Hotels		Low-End Hotels		High-End Hotels	
After	-0.225***		-0.0031		0.2019		0.7181**	
	(0.000)		(0.963)		(0.342)		(0.016)	
ChainXAfter	0.0954***		-0.1362*		0.0815		0.0931	
	(0.010)		(0.074)		(0.705)		(0.734)	
AfterTakeOff		-.02026		.25839***		-.39238*		-1.637***
		(0.663)		(0.000)		(0.051)		(0.000)
ChainX AfterTakeOff		.1784***		-.2353***		-.11295		1.039***
		(0.000)		(0.000)		(0.594)		(0.002)
Demand	1.3e-06***	1.3e-06***	1.2e-06***	1.2e-06***	-1.8e-08	-1.7e-09	2.1e-07*	2.7e-07**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.884)	(0.989)	(0.087)	(0.049)
Constant	6.7359***	7.7407***	7.2322***	7.8842***	-36.22***	-38.173***	-35.526***	-38.641***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	92533	92533	29132	29132	5964	5964	5158	5158
R^2	0.1381	0.1288	0.1625	0.1584	0.5827	0.5852	0.5957	0.6024

p-values in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; Difference-In-Differences specification based on model (3) with weights obtained from coarsened exact matching, contains hotel fixed effects, time fixed effects and city time-trends, standard errors are clustered at the hotel level

TABLE 14
Mediation

Dependent Variable	log(RevenuePerRoom)		
Sample	All Hotels		
AfterTakeOff	0.0413	0.0707	0.0846
	(0.437)	(0.232)	(0.199)
ChainXAfterTakeOff	0.0389	0.0085	-0.0232
	(0.491)	(0.892)	(0.736)
HighEndClassXAfterTakeOff	.1135	.10413	.08272
	(0.164)	(0.206)	(0.366)
ChainXAfterTakeOffXHighEnd	-.1847**	-.1735*	-.11891
	(0.036)	(0.050)	(0.223)
lnTotalReviews		-.01076	-.01915
		(0.421)	(0.350)
ChainXlnTotalReviews		.01867	.03784*
		(0.172)	(0.076)
HighEndClassXlnTotalReviews			.01931
			(0.445)
ChainXlnTotalReviewsXHighEndClass			-.0408
			(0.119)
Demand	1.5e-06***	1.5e-06***	1.5e-06***
	(0.000)	(0.000)	(0.000)
lnAverageRating	.27941***	.28295***	.29264***
	(0.000)	(0.000)	(0.000)
Constant	6.2153***	6.4271***	6.4283***
	(0.000)	(0.000)	(0.000)
Observations	13211	13211	13211
R^2	0.2512	0.2518	0.2531

p-values in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; 3-way Difference-In-Differences specification based on model (4) , contains hotel fixed effects, time fixed effects, city time-trends and class time-trends, standard errors are clustered at the hotel level

TABLE 15
Difference-In-Differences Approach with Varying Treatment Intensity

	log(RevenuePerRoom)				log(TotalReviews)			
Sample	Low-End		High-End		Low-End		High-End	
After	-0.125***	-0.056**	-0.078***	-0.0375	0.416***	0.467***	0.445***	0.321**
	(0.000)	(0.032)	(0.000)	(0.313)	(0.000)	(0.000)	(0.002)	(0.018)
ChainXlnCum AirbnbSupply	0.0108**	0.0165	-0.032**	-0.026*	-0.0023	-0.0127	0.112***	0.0620
	(0.019)	(0.338)	(0.013)	(0.058)	(0.950)	(0.709)	(0.009)	(0.177)
lnCumAirbnb Supply	.0864***	.0892***	.0914***	.0931***	-.4234***	-.3634***	-.4898***	-.3116***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Demand	1.3e-06***	1.7e-06***	1.2e-06***	1.3e-06***	2.7e-08	-1.1e-07	7.6e-09	5.4e-08
	(0.000)	(0.000)	(0.000)	(0.000)	(0.804)	(0.230)	(0.951)	(0.620)
lnAverage Rating		.3030***		.15486		.15158		-.60383
		(0.000)		(0.127)		(0.581)		(0.241)
Constant	10.04***	10.59***	10.06***	9.983***	-55.78***	-51.28***	-54.99***	-45.32***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	104328	7124	36201	6102	7371	7115	6336	6096
r2	0.1724	0.3026	0.1846	0.2191	0.6065	0.5835	0.6115	0.5608

p-values in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; Difference-In-Differences specification with varying treatment intensity, contains hotel fixed effects, time fixed effects and city time-trends, standard errors are clustered at the hotel level

CHAPTER 2

The Effect of Ownership Form and Managerial Incentives on Incumbents' Reactions to the Entry of Peer-To-Peer Platforms

Abstract

In recent years, peer-to-peer platforms have entered several industries. While it has been shown that the entry of these platforms can have a negative impact on the performance of incumbents, the reaction of incumbents to this threat has received much less attention. In this paper, I focus particularly on the reaction of those incumbents that are affected the most by the entry of peer-to-peer platforms, namely those whose complementary assets become less valuable as more business shifts towards peer-to-firm platforms. By exploiting variation in the ownership form across units in multiunit organizations whose complementary assets increasingly lose value, I show that the type of ownership form and the resulting managerial incentives might lead units to react in very different ways. Units that are affiliated to the affected organization through franchising react to the entry of peer-to-peer platforms by adjusting their prices and shifting more business onto peer-to-firm platforms. On the other hand, units that are owned directly by the company show less reaction to the entry of peer-to-peer platforms and do not shift as much business onto peer-to-firm platforms, which in turn leads to lower performance compared to their franchise counterparts. Taken together, I show that it pays off for affected incumbents to adapt to the new environment and adopt new technologies.

1. Introduction

Over the past years, several industries have been shaken up by the entry of peer-to-peer platforms like *Uber*, *Airbnb* and *TaskRabbit*. These peer-to-peer platforms have changed the competitive environment of the industries that they entered in several ways. On the one hand, they have significantly increased the supply of assets in the industry by matching buyers with sellers that own and share the required assets. This has created competitive pressure particularly for those incumbents that operate in the same market segment as the peer-to-peer platforms (Zervas et al., 2017). On the other hand, the increased supply available on digital platforms after the entry of peer-to-peer has shifted consumer preferences and pushed incumbents to do more business on peer-to-firm platforms, such as *Booking.com*. This push towards more usage of peer-to-firm platforms is a major threat for many large established companies, as peer-to-firm platforms are a substitute for the assets and capabilities that these companies have traditionally used to access customers, and which have provided them with a competitive advantage over others (see first chapter of this dissertation).

While it has been shown that the entry of peer-to-peer platforms can have a negative impact on the performance of incumbents, the question of how incumbents react to this threat has received much less attention. In this paper, I aim to address this question by analyzing differences in incumbents' reactions to the entry of peer-to-peer platforms, and how the way in which they react ultimately affects their performance. I focus specifically on the reaction of those incumbents that are affected the most by the entry of peer-to-peer platforms, namely those companies whose complementary assets become increasingly less valuable as more and more business is done through digital platforms. Often, these companies are organized as large multiunit organizations. By exploiting variation in the ownership form across units in these multiunit organizations, I show that the way in which units react depends on their

ownership form and the resulting managerial incentives. While some units face a particularly strong negative effect on their performance, others are able to buffer themselves from the negative effects of an increasing shift towards digital platforms.

On the one hand, individual units can be affiliated to a multiunit organization through franchising. In this case, the unit managers can use the multiunit organization's trademarks and processes in exchange for a franchise fee (Combs, Ketchen Jr, Shook, & Short, 2011) and are claimants of all residual profits after paying this fee (Yin & Zajac, 2004). Therefore, their income is directly linked to the performance of the individual unit, which in turn increases their motivation to monitor their competitive environment and react to emerging threats (such as the entry of peer-to-peer platforms) more quickly. I argue, and empirically show, that their strong incentive to increase the performance of their individual unit pushes them to shift more business to peer-to-firm platforms and at the same time reduce their prices in order to attract more customers. While this strategy might seem risky, it actually allows them to generate additional sales that outweigh the price reduction and lead to an increase in revenues.

On the other hand, managers of individual units that are directly owned by the multiunit organization are more bound by guidelines from the headquarter. In general, their income is not solely related to the performance of an individual unit and they have less leeway taking independent actions, such as setting their own prices (Lafontaine, 1999). In other words, both their motivation and ability to react to emerging competitive threats is lower than that of franchise managers. Therefore, they will be less likely to decrease prices and shift business onto peer-to-firm platforms. Ultimately, these units will be more affected in their performance by the entry of peer-to-peer platforms as they are not able to preserve the value of the assets and capabilities that they have traditionally used to access customers, and at the same time are not able to adapt to the new competitive environment.

I hope to contribute to the literature on digital platforms by analyzing not only who is affected by the entry of peer-to-peer platforms such as Airbnb, but also how different ownership forms shape the reactions of incumbents. The strong ability of franchise units to monitor and react to their environment is a particularly strong advantage in the face of the entry of peer-to-peer platforms as it allows them to embrace the new competitive environment and ultimately be buffered from its potentially negative effects. This is the case because peer-to-firm platforms offer them the opportunity to find new customers and increase their sales, which counterbalances potentially risky reactions in terms of pricing. On the other hand, company owned units are more limited in their ability to react and will ultimately suffer the most from the decreasing value of their complementary assets.

The empirical setting for this research is the hotel industry. As will be described in more detail below, this setting is particularly interesting because a number of different digital platforms have recently entered this industry, and because there is high variation in the ownership form of incumbents.

2. Related Literature

The entry of digital platforms has attracted increasing attention in the academic literature over the past years. Scholars have studied their entry in a number of different settings, such as classified ads in the newspaper industry (Seamans & Zhu, 2013), the music industry (Bhattacharjee, Gopal, Lertwachara, Marsden, & Telang, 2007; Liebowitz, 2008), (Farronato & Fradkin, 2015; Zervas et al., 2017) and car sharing (Abhishek, Guajardo, & Zhang, 2016). Digital platforms can be broadly divided into two groups. On the one hand, there are several digital platforms that focus on matching existing suppliers in a given industry with potential buyers, i.e. peer-to-firm platforms. Examples for this type of digital platforms include flight

booking platforms, such as *Skyscanner*, or food deliver platforms, such as *Deliveroo*. On the other hand, peer-to-peer platforms, which have become increasingly popular in more recent years, have taken a slightly different approach as they rely on the supply from peers that are willing to share their physical assets with others, often in exchange for a fee (Goodwin, 2015). In contrast to peer-to-firm platforms, the supply on peer-to-peer platforms is therefore provided by mostly non-professional individuals, and not by the incumbents that have traditionally been present in a given industry. This particular characteristic allows peer-to-peer platforms to overcome the entry barriers of traditional industries and to be more flexible when it comes to reacting to fluctuations in demand (Einav et al., 2016; Zervas et al., 2017). Their quick growth has made them a major threat for conventional firms in the industries that they enter.

Several studies have shown that the entry of peer-to-peer platforms has a significant effect on conventional firms in the industry that they enter (Farronato & Fradkin, 2015; Liebowitz, 2008; Zervas et al., 2017). The extent to which incumbents are negatively affected by these platforms depends on both their market position and their characteristics. On the one hand, previous literature has shown that peer-to-peer platforms have a direct competitive effect on incumbents that operate in the same market segment, which is usually the lower end of the market (Zervas et al., 2017). By providing a product or service that is similar in terms of quality and price, they take away customers from traditional incumbents in these market segments. On the other hand, peer-to-peer platforms have also been shown to be a major threat for large established corporations (Benner & Waldfogel, 2016; Bhattacharjee et al., 2007; see also first chapter of this dissertation). By providing a type of service that is different in terms of the resources that it is based on and in terms of the way customers access it, but at the same time similar in terms of its functionality for consumers, it can affect customer

preferences and slowly erode the value of capabilities (Benner & Waldfogel, 2016) and assets (see first chapter of this dissertation) that incumbents have accumulated over time and traditionally used to access customers.

Although scholars have argued that incumbents can react to peer-to-peer platforms in a number of different ways (Cusumano, 2015), the majority of studies has focused exclusively on reactions that are related to the strategic decisions in existing sales channels (Farronato & Fradkin, 2015; Zervas et al., 2017), while only few scholars have laid out other options that incumbents have, such as moving some of their business online (Seamans & Zhu, 2013). Moreover, most studies have either focused on peer-to-peer platforms that rely on the supply by mostly non-professional individuals, or on peer-to-firm platforms that rely on supply by professional incumbents, while the interaction between these two types of digital platforms has received very limited attention.

In this paper, I try to address this gap by showing how incumbents react to the entry of peer-to-peer platforms and how their reaction is shaped by their ownership form and the resulting managerial incentives. I focus on the reaction of some of the incumbents that have been shown to be affected the most, namely large established corporations that suffer from the fact that the value of their accumulated assets and capabilities is eroding. These corporations are often multi-unit organizations (Greve, 2003), and can be organized in two very different forms of ownership: franchising and company ownership (Yin & Zajac, 2004). Franchising can be defined as "a business arrangement wherein a firm (the franchisor) collects up-front and ongoing fees in exchange for allowing other firms (franchisees) to offer products and services under its brand name and using its processes" (Combs, Ketchen Jr, Shook, & Short, 2011). Compared to company ownership of individual units, franchising allows multi-unit organizations to gain access to additional labor and capital relatively quickly, and can thus

facilitate rapid growth (Combs, Michael, & Castrogiovanni, 2004). However, franchise units differ significantly from chain owned units in terms of both control rights and incentives (Vroom & Gimeno, 2007). In general, ownership of some of the assets grants franchise units a much wider range of decision rights than chain owned units would have (Lutz, 1995). One of the most important rights that franchise units have is the freedom to set their own prices independently from the franchisor. In the U.S., this right is guaranteed to them by the legal framework (Lafontaine, 1999), and constitutes a major difference compared to chain owned units, which are often under much tighter control from the franchisor and can set prices only within an extremely limited range (Vroom & Gimeno, 2007; Yin & Zajac, 2004). Often, the franchisees' freedom to set their own prices has been seen as problematic from the point of view of the franchisor, as it limits the ability of the franchisor to exert control and ensure strategic alignment across units. For instance, franchising has been shown to be less suitable to establish price leadership in an industry compared to chain ownership (Vroom & Gimeno, 2007). Therefore, franchisors often use other strategic actions, such as public advertising of desired prices, to exert indirect influence on franchisees (Ater & Rigbi, 2015). Since franchisees can set their prices freely, they might decide to pass on to customers the additional cost that they face due to the payment of franchise fees. This phenomenon is referred to as "double-marginalization" and has often been argued to be one of the reasons why franchise units sometimes set higher prices than their chain owned counterparts (Lafontaine & Slade, 1997). Recent research has shown that this is the case mostly for units that operate at the lower end of the market (Kalnins, 2016).

Franchise units differ from chain owned units not only in terms of control rights but also in terms of their incentives. In franchise units, managers are the claimants of residual profits after paying their franchise fees to the franchisor (Yin & Zajac, 2004). This circumstance has

been shown to increase their effort and motivation significantly (Bradach, 1997). Moreover, it also makes managers of franchise units more sensitive to changes in local market conditions and allows them to react accordingly (Yin & Zajac, 2004). Therefore, researchers have argued that chains can even learn from the expertise of their franchisees (Bradach, 1997).

In this paper, I build on previous literature and analyze how differences in ownership form across units, and the resulting differences in managerial incentives, determine incumbents' reactions to the entry of peer-to-peer platforms.

3. Ownership Form and Incumbents' Reaction to Peer-To-Peer Platforms

By facilitating the entry of a large number of mostly non-professional sellers, peer-to-peer platforms significantly increase the supply of physical assets in an industry, and therefore pose a major threat to incumbents in the industry that they enter (Einav et al., 2016; Farronato & Fradkin, 2015; Zervas et al., 2017). Compared to peer-to-firm platforms that match existing sellers with buyers and can thus provide complementary value to incumbents (Jacobides, Cennamo, & Gawer, 2018), peer-to-platforms pose a serious disruption threat to the business of incumbents, because they offer not only an alternative way to access the service (i.e., through digital platforms), but also a distinct type of service that, albeit different, addresses similar customer needs. Thus, peer-to-peer platforms challenge both the downstream assets and capabilities that some incumbents use to promote their own physical assets (Cozzolino & Rothaermel, 2018), and the value of the core assets and capabilities themselves (Henderson & Clark, 1990; Tushman & Anderson, 1986).

Since incumbents in many industries, such as the hotel industry, cannot easily reduce their physical core assets in the short run, the increased supply caused by the entry of peer-to-peer

platforms is likely to push incumbents to take actions that allow them to find new ways to promote their physical core assets.

Incumbents in various industries have traditionally benefited over many years from owning both physical assets and the complementary downstream assets to promote them. Research has shown for example that hotels which are owned by a hotel chain that has access to marketing and sales capabilities, perform significantly better than their competitors (Ingram & Baum, 1997). For these incumbents, shifting their business to peer-to-firm platforms is problematic because these platforms are a potential substitute for their own downstream assets. However, the increasing supply on peer-to-peer platforms and the resulting pressure to find additional ways to promote their physical assets, increase the pressure on these incumbents to do so anyway.

In this paper, I argue that the extent to which individual units of a chain react to this increasing pressure depends on their ownership form. As has been described in the previous section, individual units of multi-unit chains can be either chain owned or franchised, which in turn affects the decision rights and incentives of local managers.

Managers of franchise units in general tend to be closer to the local markets and are more sensitive with regards to changes in the competitive environment (Yin & Zajac, 2004). Therefore, I expect them to be more likely to notice the entry of peer-to-peer platforms into their local market and the resulting increase in supply. At the same time, managers of franchise units are not only more likely to notice changes but have also a higher incentive to react to them (Bradach, 1997). Since they are the claimants of residual profits after paying their franchise fees (Yin & Zajac, 2004), their income is directly related to the financial performance of the unit. An increasing supply on peer-to-peer platforms and its potential negative effect on their personal income will push them to take actions that help them to

promote their physical assets to customers. These actions are likely to include an increasing use of peer-to-firm platforms to get access to a broader set of potential customers.

On the other hand, the incentive structure of managers of chain-owned units is very different. Their salaries are usually less dependent on the performance of the individual unit and they are therefore less likely to closely monitor changes in the local competitive environment (Brickley & Dark, 1987). Furthermore, even if they wanted to react to changes, their ability to do so is much more limited than that of franchise manager. Managers of chain-owned units are often bound by corporate guidelines and can only make adjustments to the local strategy to a very limited extent (Vroom & Gimeno, 2007). Therefore, I expect that:

H1: As supply on peer-to-peer platforms increases, franchise units will shift more business to peer-to-firm platforms than their chain owned counterparts.

While shifting more business to peer-to-firm platforms as a reaction to the increasing supply on peer-to-peer platforms can be a way to generate additional sales, these additional sales might come at a cost. As has been mentioned above, chain-affiliated units have traditionally benefitted from owning their own downstream assets, such as sophisticated sales channels (Ingram & Baum, 1997). These sales channels have not only allowed them to get access to potential customers, but they have also buffered them from direct competition with others. The fact that each chain has accessed customers through its own sales channel has made it rather difficult for customers to compare offerings and prices across chains. However, as more units make their products available to customers on the same peer-to-firm platforms, it will become easier for potential customers to make comparisons, which in turn puts more competitive pressure on each of them.

In order to generate additional sales, managers of franchise units will react to increasing competitive pressure by lowering their prices. Given that the legal framework gives them full

discretion over the prices that they want to set (Lafontaine, 1999), they do not need to follow any guidelines from the chain headquarter.

On the other hand, managers of chain owned units are limited by corporate guidelines in their ability to decrease prices in the face of competition. Previous research has shown that, even in the face of strong competition, they maintain their ability to act as price leaders (Vroom & Gimeno, 2007). Ultimately, this will prevent them from reducing their prices. Therefore, I expect that:

H2: As supply on peer-to-peer platforms increases, franchise units will reduce their prices more than their chain owned counterparts.

By lowering their prices more than chain owned units, franchise units face the risk of potentially decreasing their revenues. The potentially beneficial effect of shifting more business to peer-to-firm platforms might dissipate if the increase in sales cannot outweigh the revenues that are forgone by setting lower prices.

In this paper, I argue that shifting more business to peer-to-firm platforms will actually allow them to tap into additional customer demand. Previous literature has consistently found that platforms provide firms with an infrastructure that allows them to access a large customer base that they can reach out to (Katz & Shapiro, 1986; Rochet & Tirole, 2006), and which might have otherwise been out of their reach. Consistent with this reasoning, I expect franchise units to be able to counterbalance their price reductions through additional sales on peer-to-firm platforms. Ultimately, this effect will allow franchise units to buffer themselves, at least to some extent, from the negative effect that is triggered by increasing supply on peer-to-peer platforms. Therefore, I argue that:

H3: As supply on peer-to-peer platforms increases, franchise units will be less affected in their performance than their chain owned counterparts.

If managerial incentives are really one of the drivers of incumbents' reactions to the entry of peer-to-peer platforms, one should observe differences in the reaction of incumbents depending on the costs that managers of franchise units face. One of the major cost components that franchise units face are franchise fees, which have to be paid to the franchisor. These fees have been argued to have an important effect on some of the managerial decisions that franchise units take. For example, it has been shown that franchise fees can lead to double marginalization as franchisees try to pass on their costs to customers by setting higher prices (Lafontaine & Slade, 1997; Vroom & Gimeno, 2007).

However, it is important to distinguish between different components of franchise fees. The main component of franchise fees are generally royalty and marketing fees, which franchisees have to pay to franchisors in exchange for using their trademark, as well as for the benefits they receive from joint advertising and various other services. In addition to that, franchise units often have to pay reservation fees for transactions with customers that are generated through the chain's sales channels. In the hotel industry for example, franchise units often have to pay a reservation fee in exchange for using the chain's hotel room reservation systems. These fees can be thought of as a commission that multiunit organizations charge their franchisees in exchange for connecting them to potential customers. In general, these fees consist of a percentage of the revenue that a franchisee generates through the chain's sales channel.

As has been described above, managers of franchise units generally try to maximize their own income, as they are the claimants of residual profits. If managers face the decision between doing business through their franchisor's sales channels and shifting some of their business to another sales channel (i.e. to a peer-to-firm platform), the reservation fees that they have to pay to their franchisor are likely to play an important role. Managers of franchise units that

have to pay high reservation fees should have a particularly strong incentive to shift more of their business to peer-to-firm platforms, even if this might require a price reduction.

Therefore, I expect these units to shift more business to digital platforms and reduce their prices more as competition from peer-to-peer platforms increases.

H4: As supply on peer-to-peer platforms increases, franchise units that have to pay high reservation fees shift more business to peer-to-firm platforms and decrease their prices more than franchise units that have to pay low royalty fees.

4. Data and Methods

Empirical Setting and Data

The empirical setting for this study is the hotel industry, which is particularly suitable because in recent years different types of digital platforms have entered this industry. On the one hand, peer-to-firm platforms such as *Booking.com, Expedia.com* and *Hotels.com* allow hotels to market their rooms on the internet, while on the other hand peer-to-peer platforms such as *Airbnb* have allowed even non-professional individuals to make their rooms and houses available for rent, and have thus increased the competitive pressure on hotels.

Furthermore, the hotel industry is suitable to study the effect of different ownership forms within multiunit organizations because a large fraction of hotels, especially in the U.S. market, are affiliated to chains. Hotels can be affiliated to a chain either through chain ownership, in which case the hotel is run by a manager that has been delegated by the chain headquarter, or they can be affiliated to a chain through franchising. In the latter case, the hotel is owned by an independent individual who pays a franchising fee to the chain in exchange for the ability to use, among others, the chain’s trade name, logos and reservation

systems (i.e. the chain's downstream assets). An overview of different players in the hotel industry can be found in TABLE 1.

TABLE 1
Different Players in the Hotel Industry

		Ownership of …	
		Core Assets (e.g. building, operations)	**Complementary Assets** (e.g. sales & marketing, brand)
Hotels	**Independent Hotels**	Hotelier	-
	Chain Affiliated Hotels	Hotelier / Hotel Chain	Hotel Chain
Digital Platforms	**Peer-to-firm platforms (e.g. *Booking.com*)**	Hotelier	Platform
	Peer-to-peer platforms (e.g. *Airbnb.com*)	Mostly non-professional individuals	Platform

From TABLE 1 it can also be seen that peer-to-firm platforms such as *Booking.com*, *Expedia.com* and *Hotels.com* are a potential substitute for the downstream assets that chains make available to hotels that are affiliated to them.

By drawing on the supply of physical assets from mostly non-professional individuals rather than supply from hotels, peer-to-peer platforms such as *Airbnb* are a potential substitute not only for the downstream assets that hotels might possess but also for their physical assets, and thus pose a major competitive threat.

With regards to the hypotheses developed above, I expect that all chain affiliated hotels will be negatively affected in their performance after peer-to-peer platforms take off. However, the extent to which this happens will depend on their reactions and thus ultimately on the ownership form.

To provide empirical evidence for my claims, I use data on the hotel industry in the ten largest cities in the state of Texas. I have chosen this setting for a number of reasons. First, across the largest cities in Texas, *Airbnb* has become popular at different points in time and to different degrees, which leads to both geographic and temporal variation that I can exploit for the identification strategy. Second, all hotels in Texas are required by law to disclose their monthly revenues to both tax authorities and the public. This gives me access to ten years of monthly, hotel-level revenue data for all hotels in the state of Texas. For these reasons, the Texas hotel industry has been the subject of several studies in the past (Vroom & Gimeno, 2007; Zervas et al., 2017).

In this paper, I use monthly hotel-level data on revenues, prices and occupancy rates on a sample of hotels in the ten largest cities in the state of Texas. I obtained this data from STR Global, a market research company that focuses on the hotel industry. In order to be able to estimate the effect of different types of ownership within multi-unit chains, I only use the set of chain affiliated hotels for the analyses in this paper. The final sample comprises data on 1667 hotels (1316 franchise and 351 chain owned) for the time period from 2008 to 2016.

I also used web scraping techniques to obtain data from the peer-to-peer accommodation website *Airbnb.com*, as well from *Booking.com*, *Expedia.com* and *Hotels.com*, three of the United States' largest peer-to-firm platforms. For each hotel in the sample, I manually matched the information gathered from these websites with the data that I obtained from STR Global. Taken together, this gives me a unique dataset that is suitable to study hotels' reactions to new competitors such as *Airbnb*, and the effect on their performance.

Independent Variables

The main independent variable in this paper is accommodation supply by *Airbnb* (*$CumAirbnbSupply_{it}$),* which measures the extent to which incumbents face competition from peer-to-peer platforms. Following Zervas et al. (2017), I collected the date of the first review of each room listed on *Airbnb* in the 10 cities in my sample and used this date as a proxy for the point in time when this room became first available to consumers. Based on this data, I then infer the total accommodation supply by *Airbnb* at a given point in time by counting the number of rooms that have received their first review before this point in time.

Furthermore, I manually collected data on franchise fees of all major chains operating in the US from the "*Franchising Fees Guide"*, which is published annually by *Hotel Management* (formerly known as *Hotel & Motel Magazine*), a practitioner magazine that focuses on the hospitality industry. The main component of franchise fees are royalty fees, which franchisees have to pay to the franchisor in exchange for the usage of a brand's trade name, service marks and associated logos. The component of franchise fees that is of more interest in this paper are reservation fees that franchisees have to pay to the franchisor in exchange for using the chain's hotel room reservation system. These fees can be thought of as a commission that chains charge their franchisees in exchange for connecting them to potential customers. Reservation fees generally consist of a percentage of the hotels' revenues that are generated through the hotel chain's reservation.

In the regressions, I also include the variable *Demand*, which accounts for differences in the overall demand for hotel rooms across cities and time. This variable represents the number of all hotel bookings made in a given city each month.

Dependent Variables

To assess the extent to which hotels make use of digital platforms themselves, I collected the number of reviews that hotels received on peer-to-firm platforms: *Booking.com*, *Hotels.com* and *Expedia.com*. I used *archive.org* to collect the number of reviews for each hotel at different points in time in the past. The number of reviews for a given hotel on these three websites will be used as a proxy for the number of bookings that have been made through this website. I believe that the number of reviews on *Booking.com*, *Hotels.com* and *Expedia.com* is a reasonable proxy for the number of bookings because it is possible to post a review for a given hotel only for the customers who actually made a booking through these website, and only for a limited period of time after the trip. Contrary to websites such as *Tripadvisor.com*, which have traditionally focused on allowing users to post reviews of hotels and restaurants, *Booking.com, Expedia.com* and *Hotels.com* do not allow users to post reviews without having made a reservation for the given hotel through their website. Furthermore, it is important to highlight that, on each website, customers can usually only see and book a limited number of rooms that hoteliers have made available for booking through that website. This number of rooms is usually below the total number of rooms that is available in a hotel at a given point in time. Therefore, the number of reviews allows me to infer the extent to which hotels make use of peer-to-firm platforms, as opposed to other distribution channels, to promote their physical assets. To aggregate the reviews that a hotel received on the three websites, I created the variable $AverageTotalReviews_{it}$, which is the average of the reviews on all websites divided by the hotel's number of rooms[3].

[3] Differences in the popularity of the three websites might have an effect on the number of reviews that hotels receive on each of them. To account for this, I created an alternative measure in which the reviews on each website are weighted by the average number of reviews of all hotels on that website in the given month before calculating the average. Using this alternative measure leaves the results qualitatively unchanged.

The main dependent variable that I use to measure hotel performance is monthly revenue per available room ($RevPAR_{it}$), which is defined as the revenue of hotel *i* at time *t* divided by the number of its rooms. Similarly, the variable Occ_{it} is the occupancy rate of hotel *i* at time *t* and is defined as the number of rooms sold divided by the number of available rooms. Lastly, ADR_{it} is the average daily rate of hotel *i* at time *t*, which is defined as the total room revenue divided by the number of rooms sold. ADR_{it} can therefore be thought of as the average price that hotel *i* charges its customers at time *t*.

An overview over the variables that I use in this paper can be found in TABLE 2. TABLE 3 and TABLE 4 contain summary statistics.

TABLE 2
Variable Definitions

Variable Name	Definition
$RevPAR_{it}$	Revenue per available room (room revenue divided by rooms available) of hotel *i* at time *t*
Occ_{it}	Occupancy rate (rooms sold divided by rooms available) of hotel *i* at time *t*
ADR_{it}	Average daily rate (room revenue divided by rooms sold) of hotel *i* at time *t*
$AverageTotalReviews_{it}$	Average number of reviews that hotel *i* received until time *t* on *Booking.com, Expedia.com* and *Hotels.com*
$ReservationFee_{it}$	Reservation fee that hotel *i* has to pay at time *t* as a percentage of revenues generated from reservations through the chain's reservation systems (only franchise hotels)
$Franchise_{i}$	Dummy that indicates whether hotel *i* is a franchise hotel (as opposed to a chain owned hotel)
$After_{jt}$	Dummy that is equal to zero in time periods t before the entry of Airbnb into city j and 0 afterwards
$CumAirbnbSupply_{jt}$	Cumulative number of rooms listed on Airbnb until time *t* in city *j*
$Demand_{it}$	Total number of rooms sold in city *j* at time *t*

TABLE 3
Summary Statistics: All Chain Affiliated Hotels

Variable Name	Observations	Mean	Std. Dev.	Min	Max
$RevPAR_{it}$	133,180	57.59144	31.20099	.1852903	357.3274
Occ_{it}	133,180	63.94758	17.13441	.2838	107.5714
ADR_{it}	133,180	88.15263	36.68732	18.07263	436.742
$AverageTotalReviews_{it}$	43,834	1.029553	1.477894	0	15
$ReservationFee_{it}$	6,324	1.636267	1.315942	.1	8.5
$Franchise_{i}$	133,180	.7626821	.4254403	0	1
$After_{jt}$	133,180	.7098063	.4538534	0	1
$CumAirbnbSupply_{jt}$	133,180	92.00937	187.0123	0	1,070
$Demand_{it}$	133,180	1,108,304	496,226.3	51,976	1,943,561

TABLE 4
Summary Statistics: Franchise vs. Chain Managed Hotel

Variable Name	Observations	Mean	Std. Dev.	Min	Max
Franchise Hotels, N=1316					
$RevPAR_{it}$	101,574	56.90386	28.32605	.1852903	233.0355
Occ_{it}	101,574	62.37021	17.41331	.2838	107.5714
ADR_{it}	101,574	88.21204	29.52243	18.07263	268.4027
$AverageTotalReviews_{it}$	32,584	1.067881	1.546653	0	15
Chain Owned Hotels, N=351					
$RevPAR_{it}$	31,606	59.80116	38.9504	.2685484	357.3274
Occ_{it}	31,606	69.01684	15.13065	.5918	100.194
ADR_{it}	31,606	87.96171	53.5775	21.65834	436.742
$AverageTotalReviews_{it}$	31,606	.9185411	1.251163	0	10.58527

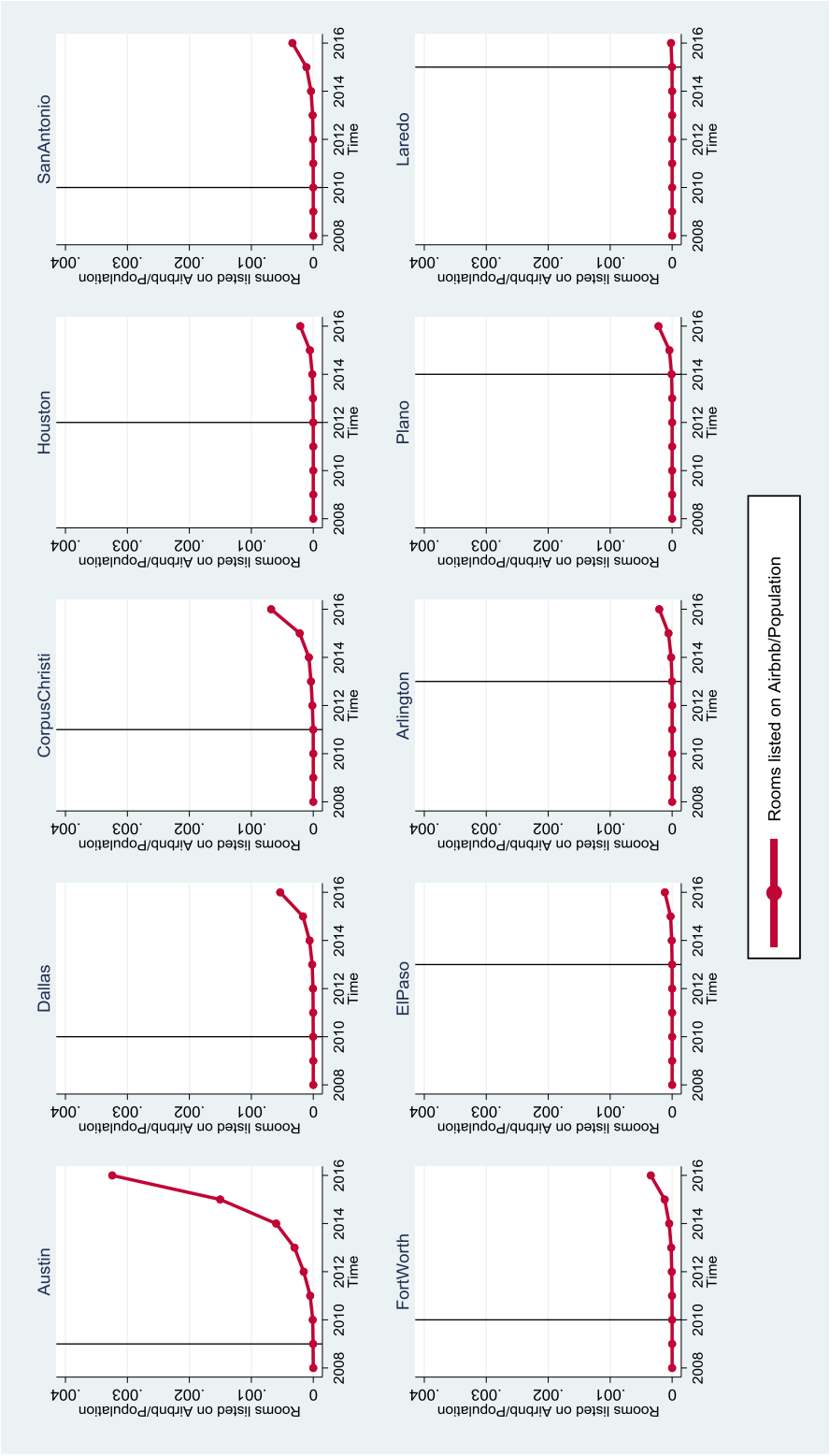
Empirical Models

The main empirical design that I use in this paper is a difference-in-differences approach similar in design to the one used by Seamans & Zhu (2013). This allows me to control for other possible macro trends (e.g., greater use of digital devices) that may affect both the adoption of peer-to-peer platforms and the shift of incumbents' business to digital platforms. For this purpose, I defined a dummy variable $Franchise_i$ that takes the value 1 if hotel i is affiliated to a chain through franchising and 0 if the hotel is chain owned. I also created a variable $After_{jt}$ that is equal to 0 before *Airbnb* enters city j and 1 afterwards. Similar to Zervas et al. (2017), I define the entry date of Airbnb in a given city as the date when the very first review for any listing on *Airbnb* in the city was posted (see FIGURE 1). In the first step, I use the following model:

$$DependentVariable_{it} = \beta_1 Franchise_i * After_{jt} + \beta_2 Controls_{it} + \delta_i + \gamma_t + u_{it} \quad (1)$$

where the dependent variable can be ADR_{it}, Occ_{it}, $RevPAR_{it}$ or $AverageTotalReviews_{it}$. Furthermore, $Franchise_i$ and $After_{jt}$ are the dummy variables described above, δ_i are hotel fixed effects and γ_t are time fixed effects. All regressions use robust standard errors that were clustered at the hotel level. The coefficient of interest is β_1, which indicates the change in the dependent variable of franchise hotels between the two time periods compared to chain owned hotels.

FIGURE 1
Penetration of *Airbnb* across different cities in Texas
(Collapsed to annual data for illustrative purposes, solid black line indicates entry date)



As an alternative model, I use a difference-in-differences approach with varying treatment intensities. This allows me to understand not only the differences between the time periods before and after the entry of *Airbnb*, but also the effect of different extents to which *Airbnb* was present in a given city in a given period of time. In this specification, the model looks as follows:

$$DependentVariable_{it} = \beta_1 Franchise_i * \log(CumAirbnbSupply)_{jt} + \beta_2 Controls_{it} + \beta_3 \log(CumAirbnbSupply)_{jt} + \delta_i + \gamma_t + u_{it} \quad (2)$$

where $log(CumAirbnbSupply)_{jt}$ is the logarithm of the cumulative number of listings available on Airbnb in city *j* up until time *t*. All other variables are the same as in model (1). Again, all regressions use time fixed-effect and hotel fixed-effect, and robust standard errors that were clustered at the hotel level.

5. Results

In the first hypothesis, I argued that, as supply on *Airbnb* increases, one should see an increase in the extent to which business of franchise hotels is shifted to peer-to-firm platforms such as *Booking.com, Expedia.com* and *Hotels.com*. To test this hypothesis, I used model (1) and (2) with $AverageTotalReviews_{it}$ as the dependent variable. As can be seen from TABLE 5, the results are somewhat mixed. On the one hand, the difference-in-differences approach based on the comparison between time periods before and after the entry of *Airbnb* suggests that chain owned hotels shift more business to peer-to-firm platforms and therefore receive more reviews on them. On the other hand, the results that I obtained using the difference-in-differences approach with varying treatment intensity show that indeed franchise hotels shift more business to peer-to-firm platforms as the supply on *Airbnb* increases.

TABLE 5
Results: *Airbnb* Supply and Reviews on Peer-to-Firm Platforms

Dependent Variable	AverageTotalReviews	
Sample	All Chain Affiliated Hotels	
FranchiseXAfter	-0.0743**	
	(0.010)	
FranchiseXlog(CumAirbnbSupply)		0.0209**
		(0.040)
log(CumAirbnbSupply)		-0.0534***
		(0.008)
Demand	-0.000000186***	-0.000000165***
	(0.002)	(0.004)
Constant	0.0166	-0.0130
	(0.919)	(0.940)
Observations	43834	43834
R^2	0.631	0.632

p-values in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

One possible explanation for this is that the increase in reviews on peer-to-firm platforms does not happen immediately after the entry of *Airbnb*, but that the decreases in price take some time to be reflected in an increase in online bookings. If this is true, the simple comparison between time periods before and after the entry of *Airbnb* might also pick up other confounding effects.

If the increase in bookings made through *Booking.com, Expedia.com* and *Hotels.com* really leads to an increase in occupancy rates, one should observe not only a positive effect of $log(CumAirbnbSupply)_{jt}$ on Occ_{it}, but also a mediating effect of $AverageTotalReviews_{it}$. To provide empirical evidence for this reasoning, I first estimated model (2) using Occ_{it} as the independent variable. The results in the first column of TABLE 6 show that an increasing supply on *Airbnb* leads to significantly higher occupancy rates of franchise compared to chain

owned hotels. In the second and third column of TABLE 6 I then added $log(AverageTotalReviews)_{it}$, as well as an interaction term of $log(AverageTotalReviews)_{it}$ and $Franchise_i$ to the model. As these variables are added to the model, the coefficient on the interaction term between $Franchise_i$ and $log(AverageTotalReviews)_{jt}$ gradually decreases in terms of both magnitude and statistical significance. According to Baron and Kenny (1986), this can be seen as evidence for a mediating effect of $log(AverageTotalReviews)_{it}$, which in turn is consistent with the reasoning described above.

TABLE 6
Results: Mediation Effect

Dependent Variable	Occ		
Sample	All Chain Affiliated Hotels		
FranchiseXlog(CumAirbnbSupply)	0.00720**	0.00635*	0.00624
	(0.036)	(0.059)	(0.183)
log(CumAirbnbSupply)	-0.0199**	-0.0177**	-0.0176*
	(0.026)	(0.044)	(0.051)
log(AverageTotalReviews)		0.0411***	0.0405**
		(0.000)	(0.020)
log(AverageTotalReviews)XFranchise			0.000726
			(0.973)
Demand	0.000000636***	0.000000643***	0.000000643***
	(0.000)	(0.000)	(0.000)
Constant	3.228***	3.229***	3.229***
	(0.000)	(0.000)	(0.000)
Observations	43834	43834	43834
R^2	0.324	0.326	0.326

p-values in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In the second hypothesis, I argued that franchise hotels should react to an increasing supply on *Airbnb* by decreasing their prices more than their chain owned counterparts. To test this hypotheses, I estimated models (1) and (2) using $log(RevPAR)_{it}$ as the dependent variable. The results of this estimation can be found in TABLE 7.

TABLE 7
Results: *Airbnb* Supply and Average Daily Rate

Dependent Variable	ADR	
Sample	All Chain Affiliated Hotels	
FranchiseXAfter	-0.0101***	
	(0.009)	
FranchiseXlog(CumAirbnbSupply)		-0.00998***
		(0.000)
log(CumAirbnbSupply)		0.00248
		(0.366)
Demand	0.000000267***	0.000000270***
	(0.000)	(0.000)
Constant	4.157***	4.155***
	(0.000)	(0.000)
Observations	133180	133180
R^2	0.329	0.334

p-values in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

It can be seen from the table that the results are consistent across both models. In both cases, an increasing supply on Airbnb leads to a stronger price reduction (reflected in the average daily rate) by franchise hotels than by chain owned hotels. These results are consistent with the reasoning described in the previous sections and provide support for Hypothesis 2.

In *Hypothesis 3*, I argued that the increased occupancy rates should allow franchise hotels to counterbalance their price reductions and ultimately increase their revenue compared to chain owned hotels. To test this hypothesis, I used model (2) with $RevPAR_{it}$ as the dependent variable. It can be seen from the first column in TABLE 8 that the empirical results provide support for the theoretical reasoning because franchise hotels are able to generate higher revenues compared to chain owned hotels as supply on *Airbnb* increases.

Columns 2, 3 and 4 contain the results that I obtained from running additional analyses which are not based on a difference-in-differences approach, but rather on simple fixed-effects regressions with different subsamples that include only franchise hotels, only chain owned

hotels, or both. The results show that indeed both franchise and chain owned hotels are negatively affected by an increase in supply on *Airbnb*, albeit to different extents.

TABLE 8
Results: *Airbnb* Supply and Revenue Per Available Room (RevPAR)

Dependent Variable	log(RevPAR)			
Sample	All Chain Affiliated Hotels	All Chain Affiliated Hotels	Franchise Hotels	Chain Managed Hotels
FranchiseXlog(CumAirbnbSupply)	0.00874***			
	(0.000)			
log(CumAirbnbSupply)	-0.0200***	-.01329***	-.01322**	-.01756**
	(0.000)	(0.003)	(0.014)	(0.021)
Demand	8.1e-07***	8.1e-07***	8.0e-07***	8.2e-07***
	(0.000)	(0.000)	(0.000)	(0.000)
Constant	3.064***	3.065***	3.0608***	3.0629***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	133180	133180	104850	28330
R^2	0.407	0.4068	0.4073	0.4364

p-values in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In the last hypothesis, I argued that franchise units shift more business to peer-to-firm platforms and decrease their prices more if they have to pay high reservation fees to their franchisor. To test this hypothesis, I used a variation of model (2) in which I included an interaction term between $Reservationfee_{it}$ and $log(CumAirbnbSupply)_{jt}$. I estimated this model using data on a sample of franchise hotel for which I have information on the reservation fees that they have to pay. As can be seen from TABLE 9, the results are overall consistent with the reasoning described above. It can be seen that, as the supply on *Airbnb* increases, hotels with high reservation fees have a significantly higher occupancy rate and a marginally significantly higher number of reviews on the three peer-to-firm platforms that I studied. At

the same time, their prices decrease more than those of hotels that have to pay lower reservation fees. While the results point into the right direction, it should also be acknowledged that I only have reservation data for a subsample of franchise hotels in the state of Texas. Since this subsample might not be representative of the entire population, the results should be interpreted with some caution.

TABLE 9
Results: Reservation Fees

Dependent Variable	Occ	AverageTotalReviews	ADR
Sample		Franchise Hotels	
Reservationfee Xlog(CumAirbnbSupply)	0.00755*	0.0204	-0.00435*
	(0.054)	(0.104)	(0.093)
log(CumAirbnbSupply)	-0.0295	-0.0691	0.0301**
	(0.126)	(0.201)	(0.032)
Reservationfee	-0.0122*	-0.0267	0.00941*
	(0.093)	(0.257)	(0.082)
Demand	0.000000648***	-4.85e-08	0.000000423***
	(0.000)	(0.520)	(0.000)
Constant	3.795***	0.206*	4.338***
	(0.000)	(0.085)	(0.000)
Observations	6321	6324	6321
R^2	0.381	0.496	0.309

p-values in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

6. Additional Analyses

Coarsened Exact Matching

Similar to the previous chapter, a potential concern is that the results might be driven by some unobservable difference between the two types of hotels, such as differences in managerial ability. It can be seen from TABLE 4 that franchise and chain owned hotels are similar in

some aspects, but somewhat different in others, which might reflect some underlying unobservable differences. To reduce the concerns about other confounding effects, I again used Coarsened Exact Matching to match the two types of hotels on average revenue per available room and average rating on *Booking.com, Expedia.com* and *Hotels.com* before the entry of *Airbnb*. I then replicated the analyses reported in TABLE 5 and TABLE 7. The results of this alternative approach can be found in TABLE 10 in the appendix. Again, it can be seen that, as supply on *Airbnb* continually increases, franchise hotels receive more reviews on peer-to-firm platforms and at the same time charge lower prices, which is consistent with the theoretical reasoning described above.

7. Conclusion

Incumbents in many industries have traditionally benefitted from owning their own distribution channels. However, as supply on peer-to-peer platforms increases, incumbents are often pushed to use peer-to-firm platforms instead of their own distribution channels to promote their physical assets. This in turn not only decreases the value of their downstream assets, but it also forces them to compete more openly with other firms.

In this paper, I have shown that incumbents might be able to protect themselves at least to some extent from this threat depending on the ownership form that they choose for their local units. More specifically, I have shown that franchise units react to increasing supply on peer-to-peer platforms by shifting more of their business to peer-to-firm platforms than their chain owned counterparts. While the level of competition that franchise units will face on peer-to-firm platforms is higher than the level of competition that they would have faced using the chain's own sales channels, peer-to-firm platforms also allow them to tap into a larger customer base that would have otherwise been out of their reach. These additional sales in

turn allow franchise units to counterbalance the required price reductions and ultimately perform better than chain owned units. Taken together, I show that it pays off for affected incumbents to adapt to the new environment and adopt new technologies.

With this paper, I hope to contribute to both the literature on digital platforms and to the literature on franchising. Regarding the literature on digital platforms, I hope to provide additional insight by analyzing not only who is affected by the entry of peer-to-peer platforms such as Airbnb, but also the reaction of incumbents. The empirical results provided in the previous sections show that, as supply on peer-to-peer platforms increases, incumbents are able to buffer themselves to some extent from the negative effect if they react in the right manner. Regarding the literature on franchising and ownership forms more generally, I hope to provide additional insights by showing that chain ownership is suitable to ensure alignment of units in terms of the chain's pricing strategy, but that it can actually prevent units from reacting appropriately and adapting to newly emerging competitive threats.

Similar to the first chapter, this study suffers from potential threats to generalizability and from the fact that I cannot directly observe supply and demand on peer-to-firm platforms. More importantly for this paper, it is not possible to directly measure the motivations that push managers to take one action or another. The fact that franchise fees and concerns about profitability have been shown to be a major factor in managerial decision making alleviates concerns related to these issues at least to some extent.

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APPENDIX

TABLE 10
Coarsened Exact Matching

Dependent Variable	AverageTotalReviews		ADR	
Sample	All Chain Affiliated Hotels			
FranchiseXAfter	-0.116***		-0.00553	
	(0.001)		(0.176)	
FranchiseX log(CumAirbnbSupply)		0.0241**		-0.00802***
		(0.031)		(0.000)
log(CumAirbnbSupply)		-0.0567**		0.00208
		(0.025)		(0.530)
Demand	-0.000000134*	-0.000000127*	0.000000284***	0.000000286***
	(0.051)	(0.055)	(0.000)	(0.000)
Constant	0.194	0.186	4.151***	4.150***
	(0.183)	(0.330)	(0.000)	(0.000)
Observations	36203	36203	119689	119689
R^2	0.619	0.619	0.340	0.343

p-values in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

CHAPTER 3

News Aggregators and Their Impact on Online and Offline Print Media

Abstract

Online news aggregators such as *Google News* have become increasingly popular in the recent past. These websites use short excerpts of other websites' online news articles (so-called snippets) and make them available to users in an aggregate manner. The question of whether such news aggregators are an opportunity or a threat for traditional content producers in the news media industry has been highly debated. On the one hand, traditional content producers claim that the use of small excerpts of their content by news aggregators might prevent users from visiting the full article on their own website and therefore take away business from them. On the other hand, news aggregators argue that their services might help users to discover content that they would have otherwise not discovered and that news aggregators therefore direct additional business to the content producers' websites. Using data on the German news media industry and exploiting variation in the extent to which different news websites were available on news aggregators after a policy change, I show that being listed in the search results of news aggregators seems to have a positive effect on the traffic of at least some online news websites. I also show evidence that is consistent with the presence of positive spillovers from online news websites that are listed on news aggregators to both the print newspapers that are related to them and to lower-performing competitors. Taken together, this suggests that content aggregators transform the industry that they enter not only because they are themselves a potentially new type of competitor, but also because they change the mechanisms of competitive interaction between existing competitors in the industry, both online and offline.

1. Introduction

News aggregators such as *Google News*, *Apple News* or *Flipboard* have become increasingly important players in the news media industry. These news aggregators provide users who search for a given news-related topic with a list of short excerpts (so-called snippets) of news articles related to this topic. These news articles are not produced by the news aggregator itself but are taken from other online news websites. The full article on the original content producer's website can usually be accessed directly through a link in the list of search results on the news aggregator's website.

The effect of news aggregators on producers of media content has been subject to extensive debate among both academics and practitioners. Supporters of news aggregators have generally argued that news aggregators help users in finding news articles that they might otherwise not have discovered. In this case, news aggregators and online news website can be seen as complements because news aggregators increase the web traffic on online news websites. Content producers on the other hand have expressed their concern that users might decide to simply read the excerpts of their articles on the news aggregator's website without accessing the full article on the content producer's website. This reasoning is more in line with the idea that news aggregators might be substitutes for online news websites.

The results of academic studies on this issue are somewhat mixed. On the one hand, several studies provide evidence that news aggregators might actually direct additional traffic to online news websites and therefore act as a complement because they allow users to discover content that they would otherwise not have discovered (Athey & Mobius, 2012; Athey, Mobius, & Pál, 2017; Calzada & Gil, 2017; Chiou & Tucker, 2017; George & Hogendorn, 2013). On the other hand, some studies have also found that news aggregators might act as substitutes for the online news websites that they list (Dellarocas, Sutanto, Calin, & Palme,

2015). These latter studies however analyze the behavior of users that have already accessed the news aggregator's website and do not consider factors, such as network effects, that drive users to visit those sites in the first place.

At the same time, online news websites do often not exist in isolation but are related to a print newspaper, with which they share, at least to some extent, their editorial staff, content and potential readership. It has been shown that the performance of online news websites and their offline counterpart is strongly interrelated, even though there have been contrasting results with regards to the direction of the relationship. While early studies have often found a negative relationship between the performance of online and offline products, (Filistrucchi, 2005; Gentzkow, 2007; Kadiyali & Simon, 2006), more recent evidence suggests that the availability of free online versions of a product can actually have a positive sales effect on related offline products (Kretschmer & Peukert, 2017; Zhang, 2016). Even though the performance of online news websites and print newspapers have been shown to be strongly related, the effect of news aggregators on print newspaper sales has received limited attention so far. In this paper, I want to fill this gap and analyze not only the effect of news aggregators on online news websites but also the effect of news aggregators on the print newspapers related to them.

To address this question, I exploit variation in the extent to which German online news websites were available on news aggregators in the aftermath of a policy change. In March 2013, the German parliament passed a bill that allows print media outlets to charge royalty fees for the reuse of their content. The legal dispute between news aggregators and *VGM*, an association of German print media outlets, about whether this law applies to reuse by news aggregators as well, led some news aggregators to remove content of *VGM* members from their website while still listing outlets of non-*VGM* members. This setting allows me to

compare the performance of online news websites that were removed from certain news aggregators to those that were not, before and after the policy change. I find that most online news websites that are removed from some news aggregators perform worse in terms of the number of visits they receive after the policy change, compared to online news websites that were not removed. Furthermore, I show that the print versions of the online news websites that are removed from some news aggregators are negatively affected in their sales as well. Interestingly, I find similar effects on web traffic and newspaper sales if a competitor's online news website, rather than the focal website itself, is removed from some news aggregators.

With this paper, I hope to contribute to existing literature in several ways. With regards to the particular empirical setting, I hope to contribute to the debate on whether news aggregators are beneficial for the producers of original content or not. As will be explained in more detail below, the results in this regard are still somewhat mixed, and my research aims to provide some additional insights to this ongoing debate. Second, I provide new insights into how the presence of content aggregators changes the competitive mechanisms in the industry that they enter. Content aggregators have often been seen as a new competitor in the industry that acts as a potential substitute for the products or services of existing players. What has received less attention in previous literature, is the way in which content aggregators affect the mechanisms of competitive interaction between exiting players in an industry. While existing players still compete for customers in the given industry, content aggregators add a positive link between the presence of competitors on the given content aggregator and the performance of the focal firm. In the specific setting of this paper, contrary to what one would expect, news media outlets do not necessarily benefit from the fact that their competitors are not listed on news aggregators anymore, but actually receive less web traffic if their competitors are removed from news aggregators. I also show that these changes in the competitive interaction between

existing firms can not only be found in online competition but are also reflected in more traditional offline activities. Previous research has largely overlooked this potential effect of content aggregators on offline products, and has focused exclusively on the realm of online activities instead.

2. Related Literature

News Aggregators

The question of whether being listed on news aggregators has a positive or negative effect on the performance of online news websites has attracted significant attention. For instance, Dellarocas et al. (2015) use a field experiment to address this question and find evidence for a substitution effect between news aggregators and online news websites. By manipulating the interface of a news aggregator, they show that the propensity of users to visit the website with the original content depends to a large extent on the way that news snippets are displayed on the news aggregator. More specifically, they find that every kind of text beyond the headline decreases the proportion of users that click on the original content significantly, and therefore leads to a substitution effect. However, the authors in this study focus on decisions made by users once they are on the news aggregator's website and therefore do not consider factors such as network effects that drive users to visit a news aggregator's website in the first place.

Rather than finding evidence for a broad substitution effect, several scholars have shown that news aggregators have a negative effect mostly on content creators with specific characteristics. For instance, some researchers have used theoretical models to study how content quality determines whether news aggregators take away web traffic from online news websites or direct additional traffic to them (Dellarocas et al., 2013). It has been found that news aggregators generally take away traffic from all content providers and redistribute traffic

only to high quality content providers because news aggregators allow users to choose the highest quality content out of a broad set of options. This finding is more consistent with the idea that news aggregators shift traffic from some content producers to others, rather than taking away business from all of them. Ultimately, news aggregators are therefore argued to increase the overall quality of content that is available to consumers as it will be difficult for low-quality content providers to attract readers. A similar, quality-related reasoning has been provided by Jeon and Nasr (2016) who study the effect of news aggregators on the quality choices of online news websites. The authors find that, under certain conditions, quality choices of online news websites become complements in the presence of news aggregators, while they are substitutes in the absence of news aggregators. According to their study, an increase in the quality of one online news website increases traffic to the news aggregator, which in turn has a positive effect on the marginal advertising revenue from quality increases that other online news websites can obtain. In other words, an increase in quality of one online news website increases the incentive for other online news websites to increase their quality as well, which ultimately leads to an increase in overall quality.

Several other authors have also found evidence which is more consistent with complementarity between news aggregators and online news websites, rather than substitution between them (Athey & Mobius, 2012; Athey et al., 2017; Calzada & Gil, 2017; Chiou & Tucker, 2017; George & Hogendorn, 2013). The magnitude of this effect again depends on a number of different factors. For instance, researchers have analyzed the web traffic pattern after *Google* temporarily removed content of *The Associated Press* and have found evidence that news aggregators can guide users to new content, which ultimately increases web traffic of the original content producer (Chiou and Tucker, 2017). This effect is especially strong not only for producers of high-quality content, but also for producers of highly unusual content,

which attracts particular user attention. Evidence for complementarity has also been found by Calzada & Gil (2017) who analyze the effect that the shutdown of *Google News* after a policy change in Spain has had on the visits of news websites. In their study, the authors find that, while there is generally a negative effect on the web traffic of news websites after the shutdown, this effect is particularly strong for lower-performing websites. Online news websites with more loyal readers on the other hand seem to be less affected. In a related paper, Athey et al. (2017) use a quasi-experimental design with Windows users during the same policy change in Spain and find similar results. While there is an overall negative effect on website traffic after the shutdown of *Google News*, this effect is "concentrated around small publishers while large publishers do not see significant changes in their overall traffic".

The presence of news aggregators has been shown to affect not only the amount of web traffic that online news websites receive, but also the way in which web traffic reaches these online news websites. Usually, the additional traffic from news aggregators is not directed to the homepage of the online news website but rather to the specific article (Athey and Mobius, 2012). For the original content producer, this can be problematic because visits on the homepage are generally more attractive in terms of their potential to generate revenue from advertising than pages which only contain individual articles.

Furthermore, news aggregators might have different effects on direct visits (i.e. direct visits to a given online news website) and indirect visits (i.e. visits through news aggregators). While some researchers find that the presence of local newspapers on news aggregators has a positive effect on both direct and indirect visits (George and Hogendorn, 2013), others show that the positive effect on direct visits is only present in the short run, while the positive effect on indirect visits persists (Athey and Mobius, 2012). Consistent with these results, Calzada and Gil (2017) find that the shutdown of *Google News* in Spain leads to a decrease in search

visits and an increase in direct visits. The authors interpret this as evidence for the existence of both market expansion and substitution effects, albeit to difference extents.

Previous research has also analyzed the effect that news aggregators have on the variety of news media outlets that users visit. In their study on the adoption of the localization feature on *Google News*, Athey and Mobius (2012) find that the usage of news aggregators leads to a broader range of news outlets that are visited. Somewhat different from that, George and Hogendorn (2013) find that that "increases in local news consumption arise from more frequent visits to familiar news outlets rather than visits to additional news providers".

While previous literature has shown evidence for both substitution and complementarity effects between news aggregators and online news websites, the majority of studies seems to point towards complementarity rather than substitution. The magnitude of the effect appears to depend on a number of characteristics of the content provider. More importantly however, previous literature has shown that news aggregators generally shift consumption from some content providers to others rather than substituting them altogether. News aggregators seem to help directing traffic to less popular content providers or content providers that are more focused in terms of their content. From a theoretical point of view, this is particularly interesting, as it adds a positive link between the performance of different newspapers. While traditional reasoning on competitive dynamics suggests that more successful firms often take away business from less successful firms, news aggregators seem to allow less successful firms to benefit, at least to some extent, from the performance of more successful ones.

While the effect of news aggregators on online news websites has been studied extensively, the extent to which news aggregators might affect print newspaper sales has not received any attention yet. Even if online news websites have gained increasing popularity over the past years, print newspapers still remain a major source of information for many consumers. While

print newspapers are distinct from their digital counterparts in many ways, they often share at least some of their content and potential readership. This raises the questions if some of the mechanisms that have been used to describe the effect of news aggregators on online websites apply to print newspapers as well. To get a better understanding of the potential mechanisms at play, I will next turn to the literature on online and offline channels.

Online and Offline Channels

The second stream of literature that this paper draws on is the literature on the relationship between different sales channels. More specifically, this paper draws on research that has tried to understand whether online sales are a complement or a substitute for offline sales. Several studies have shown that competition between online and offline channels can indeed be problematic for firms. Brynjolfsson et al. (2009) for instance have found evidence that online retailers are significantly affected by more traditional offline retailers, unless they focus their activities on selling niche products.

Competition between online and offline sales channels is especially relevant for companies that use both online and offline channels to make their content available to consumers. This is particularly true because online content can often be accessed by users more easily and is at the same time priced at a significantly lower rate, or even accessible for free. For this reason, a number of different studies have been conducted in such contexts. Scholars have analyzed for instance the potential substitution effect that broadcasting content available on *YouTube* has on television viewing (Waldfogel, 2009). In this setting, the evidence suggests that the total amount of content consumption by consumers increases after television networks make some of their content available on *YouTube*.

More importantly for this paper, several scholars have studied the relationship between the availability of online and offline content in the newspaper industry. Most early studies on the relationship between online and offline channels in this industry find evidence that is more consistent with the idea that providing newspaper content online is a substitute for traditional physical newspapers. For instance, Filistrucchi (2005) uses data on Italian news media to show that adding online versions has a significant negative effect both on the sales of the newspaper itself and on the sales of its competitors, suggesting that physical newspapers are replaced at least in part by their online counterparts. Similar results have also been found by Gentzkow (2007) who uses data on the news media market in Washington D.C. to show that print and online newspapers are substitutes rather than complements, and by Kadiyali and Simon (2006) who find evidence for substitution effects in a sample of US consumer magazines. The magnitude of the substitution effect depends on a number of different factors. For instance, several authors (Deleersnyder, Geyskens, Gielens, & Dekimpe, 2002; Kadiyali & Simon, 2006) show that print media outlets are more likely to suffer from substitution effects if the online version is more similar to the print version in terms of the comprehensiveness of the content that is available. Other authors have highlighted that increasing web traffic on news websites has a negative effect on sales of print newspapers, but that subscriptions are not affected, thus indicating that loyal users are unlikely to switch to online content (Kaiser & Kongsted, 2012).

On the other hand, several studies have also found evidence that does not support the idea that online versions of newspapers may cannibalize print versions. In a study of the news media industry in the UK and The Netherlands, Deleersnyder et al. (2002) find that only few newspapers experience a negative effect on their performance after the introduction of online versions. Consistent with other studies, the authors show that substitution only takes place if

the content of both online and offline version is highly similar. Evidence related to the temporal dynamics suggests that cannibalization between online and offline versions of newspapers has mostly been present around the year 2001, when the growth rate of internet usage was highest and user excitement might have been at its peak (Kaiser, 2006). After that era, the degree of cannibalization has become much lower.

A related, yet somewhat distinct stream of research has examined the relationship between the availability of content on digital platforms where it can be accessed for free and the performance of related offline products. The results of these studies generally suggest that free access to digital products can stimulate sales of related non-free offline products. For instance, Kretschmer and Peukert (2017) use a quasi-experimental setting where music videos were temporarily unavailable on the German *YouTube* website to assess the effect of online content availability on record sales. The authors find strong evidence for complementarity between the two, as availability of music videos on *YouTube* has a positive effect on of both digital and physical record sales. These results are also supported by the studies of other scholars who found that relaxing sharing restrictions in the music industry has a positive effect on record sales, particularly of those records that are considered niche products (Zhang, 2016).

Interestingly, evidence for complementarity of online content on digital platforms and related offline products has even been found in the case of illegal platforms. For instance, Peukert et al. (2017) analyze which types of movies benefitted from the shutdown of the illegal hosting platform *Megaupload*. The authors find that the shutdown of the illegal hosting platform on average has a negative effect on the box office performance of movies, and that only mainstream movies that were released in a wider range of theaters benefited from the

shutdown. Similarly, it has been shown that online piracy in the movie industry does not have a negative effect on DVD sales (Smith and Telang, 2009).

As can be seen from the previous paragraphs, the effect of online availability of content, and more specifically the effect that content availability on sharing platforms has on sales through offline channels, has been studied extensively. On the other hand, the effect that content availability on news aggregators has on the sale of physical newspapers has received far less attention. News aggregators share some of the characteristics of online sharing platforms in that they make a wider set of content available to consumers in an aggregate manner, but they are also different in many regards. More specifically, news aggregators generally do not provide the full content on their website but only display a limited excerpt. Furthermore, they provide direct links to the website of the original content producer, where the full content (rather than just an excerpt) can be found. Therefore, previous insights on the effect of sharing platforms on offline sales cannot necessarily be transferred to news aggregators.

The question of how news aggregators affect the performance of offline products has been addressed to some extent by Calzada and Gil (2017), who compare the revenues from online and print advertising before and after the shutdown of *Google News* in Spain. The results show that revenues from online advertising increase compared to those from print advertising, which can be seen as indirect evidence that print sales are affected at least to some extent, since advertising revenues are generally proportional to the potential audience. In this paper, I aim to contribute to the literature by directly testing the effect of news aggregators not only on online news websites, but also on related print newspapers and by showing that both are actually affected in a similar way.

3. Hypotheses

As has been described in the previous sections, news aggregators play an increasingly important role in the news media industry and have been the subject of political debates as well as academic studies. In principle, news aggregators could have two types of effects on online news websites. On the one hand, they might take away business from online news websites, as users might start to use news aggregators as a substitute for online news websites and decide to simply read small text excerpts instead of accessing the full content on the online news website that created it. On the other hand, news aggregators might help users to find news content that they would otherwise not have discovered, which could ultimately lead to additional traffic that is directed to online news websites. Several researchers have attempted to understand which one of these two effects is more dominant. While some studies find that news aggregators might act as a substitute for the online news websites that they list (Dellarocas et al., 2015), the majority of studies provides evidence that news aggregators might actually direct additional traffic to online news websites and therefore act as a complement (Athey & Mobius, 2012; Athey et al., 2017; Calzada & Gil, 2017; Chiou & Tucker, 2017; George & Hogendorn, 2013). Therefore, consistent with previous research, I expect websites to experience higher traffic if they are listed in the search results of news aggregators, as opposed to if they are not.

> *Hypothesis 1: Websites will experience higher traffic if they are listed in the search results of news aggregators (compared to when they are not listed in the search results of news aggregators).*

Online news websites often do not exist in isolation but are related to an offline news outlet (i.e. a print newspaper). In general, the editorial staff, content and potential readership will be shared at least to some extent between the news website and its related print version. In the

previous section, I have shown that the question of whether print newspapers and their related news websites are complements or substitutes has been studied by several scholars. Early studies have often found a substitution effect between print newspapers and their related websites, which suggests that an increase in traffic on news websites should result in lower newspaper sales (Filistrucchi, 2005; Gentzkow, 2007; Kadiyali & Simon, 2006). More recent studies however show that this substitution effect was mostly present in the early days of internet (Kaiser, 2006) and that the availability of free online versions of a product can actually have a positive sales effect on related offline products (Kretschmer & Peukert, 2017; Zhang, 2016). This in turn is more consistent with the idea of complementarity between the two.

If news websites and their related print newspapers are complements rather than substitutes, an increase (or decrease) in the readership of one of them should also result in an increase (or decrease) in the readership of the other one. As has been shown in the previous section, an increase in readership of news websites can for instance be the result of their presence in the search results of news aggregators. Based on the idea that there is complementarity between news websites and print newspapers, this should in turn lead to increasing sales of print newspapers as well.

Hypothesis 2: Newspapers will experience higher sales if their related websites are listed in the search results of news aggregators (compared to when their related websites are not listed in the search results of news aggregators).

In this paper, I argue that being listed in the search results does not only affect a given website itself, but also its competitors. If websites are listed in the search results of news aggregators and receive more web traffic as a result, conventional theory on competitive interaction would suggest that this harms the performance of other competing websites. Users might have

limited resources in terms of time and attention, and will therefore only be able to visit a limited number of websites.

At the same time, the mechanism which is generally offered to explain why news aggregators are actually complements for online news websites rather than substitutes is related to attention spillover effects. For instance, Chiou and Tucker (2017) show that news aggregators direct user attention towards highly unusual content that would otherwise be difficult to discover. Similarly, Athey et al. (2017) show that small local newspapers are hurt the most by the shutdown of *Google News* in Spain, suggesting that these websites used to benefit from user attention that was directed to them before the shutdown. If competitors of a focal online news website, which overlap with the focal online news website in terms of their potential readership, are not listed in the search results of a news aggregator anymore, this will attract less web traffic to the news aggregator and in turn allow for less traffic to be redirected to the focal website. Therefore, I argue that websites will experience higher traffic if their competitors are listed in the search results of a news aggregators. Due to the complementarity between online news websites and the print newspapers related to them, I expect to see the same effect for print newspapers as well.

Hypothesis 3a: Websites will experience higher traffic if their competitors are listed in the search results of news aggregators (compared to when their competitors are not listed in the search results of news aggregators).

Hypothesis 3b: Newspapers will experience higher sales if websites related to their competitors are listed in the search results of news aggregators (compared to when websites related to their competitors are not listed in the search results of news aggregators).

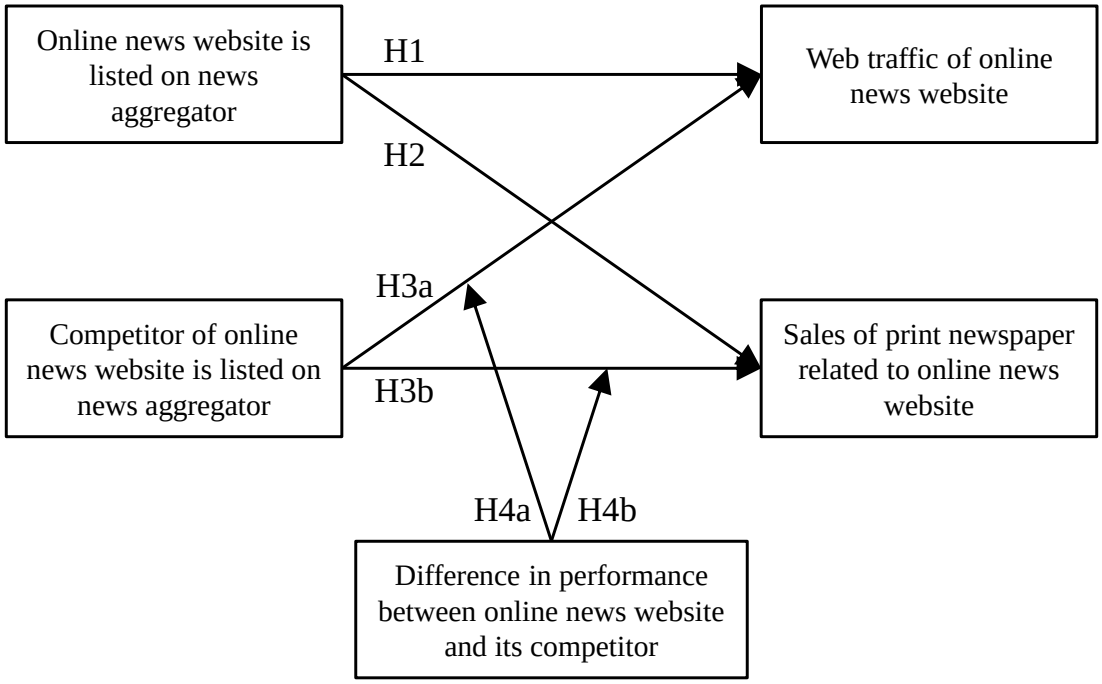
If the websites whose competitors are listed on news aggregators really experience an increase in traffic because of attention spillover effects, the magnitude of the effect should depend on the level of attention that these competitors can provide. More specifically, the presence on news aggregators of competitors that perform significantly better than the focal newspaper in terms of their web traffic should be more beneficial than the presence of lower-performing competitors. Previous research in the field of online advertising has provided evidence that is consistent with this reasoning. For instance, Sahni (2016) has shown that advertising on online search websites invokes memories of the product category as a whole in the mind of users, and therefore has significant spillover effects on the advertiser's competitors as well. This is particularly true for those that were not as popular before the advertising took place. While newspapers do not engage in purposeful advertising on news aggregators, I expect the mechanism to be similar. Higher-performing competitors might create interest in users for a certain topic, and some of this attention might spill over to other online news websites listed on the same news aggregator. Therefore, I argue that:

Hypothesis 4a: Websites will experience higher traffic if higher-performing competitors are listed in the search results of news aggregators (compared to when lower-performing competitors are listed in the search results of news aggregators).

Hypothesis 4b: Newspapers will experience higher sales if websites related to higher-performing competitors are listed in the search results of news aggregators (compared to when websites related to lower-performing competitors are listed in the search results of news aggregators).

A conceptual model with an overview of the hypotheses can be found in FIGURE 1.

FIGURE 1
Conceptual Model



4. Data and Methods

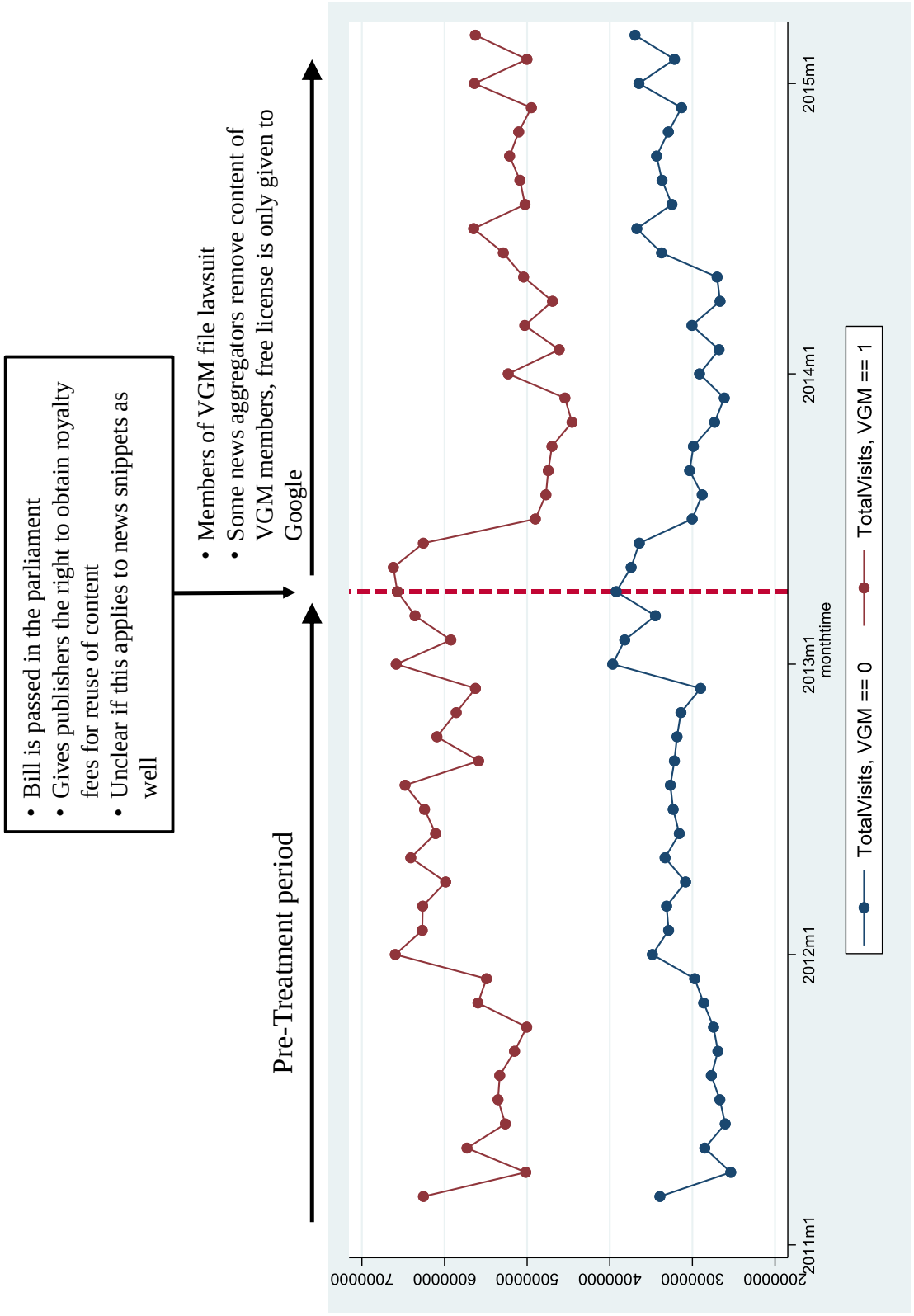
Empirical Setting

The empirical setting of this paper is the German newspaper industry. Like newspaper industries in many other countries, the German newspaper industry has undergone increasing digitization over the past years. Most print media outlets do not just produce physical newspapers but generally make some of their content available on online websites as well. This online content in turn is often combined by news-aggregators such as *Google News*, which make short excerpts (so-called snippets) of this content available on their own website for consumers who search for specific topics in the news. News aggregators have often been seen as a potential threat for traditional content producers, as consumers may decide to just read the news snippet instead of clicking on the related link and reading the full article on the original content producer's website. For this reason, the German government decided to introduce the so-called "ancillary copyright for press publishers" (*Leistungsschutzrecht für*

Presseverleger), which allows print media companies to ask for the payment of royalty fees if other companies reuse their content. The bill was passed by the German parliament on March 22, 2013 (Bundesrat, 2013) and came into force on August 1, 2013 (Bundesanzeiger, 2013).

While the bill was intended to protect print media companies and allow them to benefit from reuse of their content, it actually created confusion with regards to how it has been interpreted. More specifically, the fact that the wording of the law explicitly exempts "very short text excerpts" from the payment of royalty fees has led to opposing views on whether the new law applies to news snippets such as the ones used by *Google News* or not. While news aggregators have been reluctant to pay fees and have highlighted the potential benefits from their service, many print media companies have insisted that they should be paid royalty fees. In particular, *VGM* (*VG Media, Gesellschaft zur Verwertung der Urheber- und Leistungsschutzrechte von Sendeunternehmen und Presseverlegern mbH*), an association that represents a subset of German newspapers urged aggregators to pay royalty fees for the reuse of the content that its members produce, and threatened to file lawsuits against news aggregators that refused to do so (Kuri, 2014). As a result, several search engines (e.g. *gmx.de*, *web.de* and *t-online.de*) decided to remove content of *VGM* members from their search results to avoid the payment of royalty fees or potential lawsuits, while continuing to include content of Non-*VMG*-members in their results (Kruse, 2014). In this paper, I use the passage of the bill as an exogenous shock that reduces the extent to which the content of some print media companies appears in the search results of news aggregators, while other print media companies remain unaffected. See FIGURE 2 for an overview of the events.

FIGURE 2
Event Overview



A similar setting has been used by Calzada and Gil (2017) to study the effect of news aggregators on news websites. In their study however, the authors focus on a more limited period of time in 2014, in which *VGM* members where not listed on *Google News*, and eventually allowed *Google News* to use excerpts of their content for free.

Policy changes can often not be considered completely exogenous because they can be the result of lobbying activities by individual firms and because they are often predictable at least to some extent, which allows firms to react even before a bill is passed. While I cannot completely rule out these concerns, there are a few circumstances that reduce the potential confounding effect from these factors in my setting. In the present case, the bill has undergone major changes in the week before it was passed in the parliament, which limits the extent to which actors could have anticipated the changes and reacted accordingly. More specifically, the passage of text which exempts "very short text excerpts" from the law, and which has led to the conflicting interpretations described above, has been added during the last week before the bill was passed. Second, *VGM* has been founded in 1997 and most print media companies have decided whether or not to join *VGM* long before the bill came into action. Therefore, the risk of individual firms self-selecting into treatment is significantly reduced.

Data

To analyze the effect of the policy change on the performance of newspapers and their related websites, I gathered data from the website of the *German Audit Bureau of Circulation IVW* (*Informationsgemeinschaft zur Feststellung der Verbreitung von Werbeträgern e. V.*). The *IVW* is an independent, non-commercial organization, that collects circulation data on print media outlets (e.g. newspapers), as well as traffic data on digital advertising media (e.g.

online news websites) and makes it available to advertisers and advertising agencies. The aim is to create transparency in the market for advertising and to provide advertisers with reliable data that allows them to monitor the performance of the media in which their advertisements appear. The quality of the collected data is ensured through standardized measurement, as well as continuous auditing under the supervision of representatives of both advertising media (e.g. publishers) and advertisers (e.g. advertising agencies). The data collected by the *IVW* includes information on most German media outlets and can be accessed by the public through the *IVW* website. Compared to other web traffic data that can be obtained from sources like *SimilarWeb* or *Alexa*, this data is not based on web traffic estimations but represents the actual traffic on a given website.

In this paper, I use quarterly circulation data on 180 newspapers contained in the *IVW* dataset, as well as monthly web traffic data on the related online news websites over a period of 4 years (from March 2011 to March 2015). I complement this data with additional information gathered from *Onlineatlas der Zeitungen*, a website that provides information on the geographic region in which each newspaper is available for purchase. I use this information to calculate the measures of competitive overlap described below.

Dependent Variables

The two main dependent variables that I use to measure the performance of a website that is related to newspaper *i* are $PageVisits_i$ and $PageImpressions_i$. $PageVisits_i$ indicates the number of times a given website has been accessed by users in a given month. In contrast, $PageImpressions_i$ describes the total number of pages of the given website that have been accessed by users in a given month. If, for instance, a user accessed the website of the *New*

York Times and opened three different pages within this website (e.g. to read three different articles), this would count as one page visit and three page impressions.

The main dependent variables that I use to assess the performance of a physical newspaper *i* are $Sales_i$, $Subscriptions_i$ and $PrintedCopies_i$. $Sales_i$ is the total number of copies of newspaper *i* that have been sold in a given quarter. In contrast, $Subscriptions_i$ is the number of copies of newspaper *i* that have been sold through subscriptions in a given quarter. Furthermore, $PrintedCopies_i$ is the number of copies of newspaper *i* that have been printed by the publisher (without necessarily being sold).

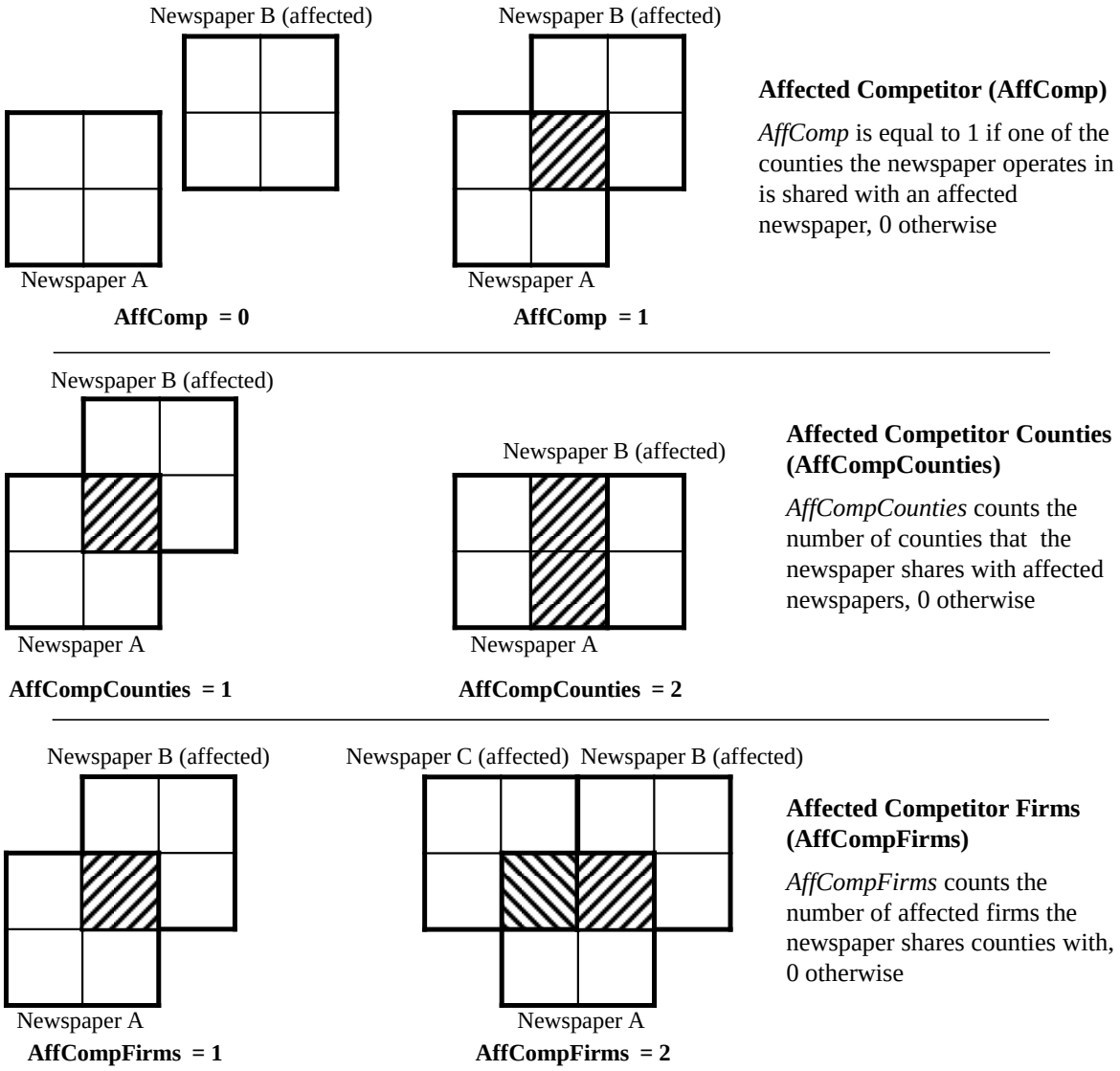
Independent Variables

In order to implement the difference-in-differences approach and be able to compare the performance of *VGM* members and non-members before and after the policy change, I created two dummy variables, *VGM* and *After*. *VGM* describes whether newspaper *i* is a member of *VGM* and is equal to 1 if newspaper *i* is a member of *VGM* and equal to 0 if it is not. Similarly, *After* is equal to 0 in the period before the policy change (i.e. until March 2013), and equal to 1 afterwards.

Using the data that I collected from *Onlineatlas der Zeitungen*, I created three variables that measure the extent to which competitors of the focal newspaper *i* have been affected by the policy change. More specifically, I created a variable named $AffComp_i$ that is equal to 1 if one of the counties (*Landkreise und kreisfreie Städte*) that newspaper *i* operates in is shared with an affected newspaper (i.e. a newspaper that is a member of *VGM*) and 0 otherwise. Additionally, I created the variable $AffCompCounties_i$, which counts the number of counties that newspaper *i* shares with affected newspapers and the variable $AffCompFirms_i$, which

counts the number of affected newspapers that newspaper *i* shares counties with. See FIGURE 3 for an overview of how these measures have been constructed.

FIGURE 3
Measures of Competitive Overlap



To test Hypotheses 4a and 4b, I created two variables that measure the difference in popularity between the focal newspaper *i* and the affected newspapers that it shares counties with. More specifically, I created a variable $DeltaAvgCompVis_i$, which is defined as the difference between the average page visits of newspaper *i*'s website and the average page

visits of the websites of its competitors before the treatment (i.e. before the policy change occurred). Similarly, the variable $DeltaMaxCompVis_i$ is defined as the pre-treatment difference between the average page visits of newspaper *i*'s website and the average page visits of its competitor with the highest number of page visits. An overview over the variables that I use in this paper can be found in TABLE 1. TABLE 2 contains summary statistics.

TABLE 1
Variable Definitions

Variable Name	Definition
Dependent Variables	
$PageVisits_{it}$	Monthly visits of the website related to newspaper *i*
$PageImpressions_{it}$	Monthly page impressions of the website related to newspaper *i*
$Sales_{it}$	Quarterly sales of newspaper *i*
$Subscriptions_{it}$	Quarterly subscription sales of newspaper *i*
$Printed\ Copies_{it}$	Quarterly printed copies of newspaper *i*
Independent Variables	
VGM_i	Dummy that indicates whether newspaper *i* is a member of *VGM*
$After_t$	Dummy that indicates post-treatment period
$AffComp_i$	Dummy that indicates if newspaper *i* shares counties with affected newspapers
$AffCompCounties_i$	Number of counties that newspaper *i* shares with affected newspapers
$AffCompFirms_i$	Number of affected newspapers that newspaper *i* shares counties with
DeltaAvgCompVis	Pre-treatment difference between the average page visits of newspaper *i*'s website and the average page visits of the websites of its competitors
DeltaMaxCompVis	Pre-treatment difference between the average page visits of newspaper *i*'s website and the average page visits of its competitor with the highest number of page visits

TABLE 2
Summary Statistics

Variable Name	VGM = 1 (affected)					VGM = 0 (unaffected)				
	Observations	Mean	Std. Dev.	Min	Max	Observations	Mean	Std. Dev.	Min	Max
$PageVisits_{it}$	2,890	5,539,765	2.63e+07	2,543	2.73e+08	4,263	3,143,677	1.71e+07	4,490	2.14e+08
$PageImpressions_{it}$	2,890	4.62e+07	2.70e+08	2,3509	2.82e+09	4,263	1.65e+07	8.73e+07	35,620	1.14e+09
$Sales_{it}$	937	153,576.6	296,343	2,691	2,908,334	1,351	83,472.46	124,242.6	3,991	971,524
$Subscriptions_{it}$	937	179,492.5	372,557.2	2,364	3,718,167	1,351	95,199.49	149,581.1	4,297	1,180,477
$Printed\ Copies_{it}$	937	105,241.8	138,822.3	1,295	941,144	1,351	69,943.98	83,815.78	3,796	465,415
$AffComp_{i}$	63	.8571429	.3527378	0	1	117	.7350427	.4432086	0	1
$AffCompCounties_{i}$	63	19.80952	69.86712	1	401	117	22.36752	80.67598	1	401
$AffCompFirms_{i}$	63	5.269841	10.39883	0	60	117	4.649573	12.38486	0	61
$DeltaAvgCompVis_{i}$	54	3,510,512	2.23e+07	-1.47e+08	3.27e+07	86	576,499	9075471	-7.73e+07	2.18e+07
$DeltaMaxCompVis_{i}$	54	1.50e+07	2.45e+07	-7.92e+07	7.50e+07	86	6,725,301	1.58e+07	-9675184	7.40e+07
Number of Counties per Newspaper	63	19.80952	69.86712	1	401	117	22.36752	80.67598	1	401
N			63					117		

Empirical Models

To estimate the effect that being listed in the search results of news aggregators has on the performance of newspapers and their related websites, I compare the performance of members and non-members of *VGM* before and after the policy change described above. In the first step, I use the following model:

$$logPageVisits_{it} = \beta_1 After_t * VGM_i + \delta_i + \gamma_t + u_{it} \quad (1)$$

where $logPageVisits_{it}$ is the logarithm of the monthly page visits of the website related to newspaper i, $After_t$ is a dummy variable indicating the time period before or after the policy change, VGM_i is a dummy variable indicating whether newspaper i is a member of *VGM*, δ_i are newspaper fixed effects and γ_t are time fixed effects. The coefficient of interest is β_1, which indicates the change in $logPageVisits_{it}$ of *VGM* members between the two time periods compared to non-*VGM* members. To estimate the effect on the number of page impressions, I use the same model and replace the dependent variable with $logPageImpressions_{it}$. Similarly, I replace the dependent variable with $logSales_{it}$, $logSubscriptions_{it}$ and $logPrintedCopies_{it}$ to estimate the effect on the performance of physical newspapers.

In the second set of regressions, I estimate the effect that having an affected competitor has on the performance of newspaper i and its related website:

$$logPageVisits_{it} = \beta_1 After_t * AffComp_i + \delta_i + \gamma_t + u_{it} \quad (2)$$

Compared to the previous model, I replace the dummy variable VGM_i either with the dummy variable $AffComp_i$, which indicates whether a competitor of newspaper i has been affected, or with the continuous variables $AffCompCounties_i$ and $AffCompFirms_i$, which measure the extent to which newspaper i shares counties with affected competitors. This model allows me to get an understanding of whether newspaper i can benefit from the fact that its competitors are affected. I estimate the model using subsamples that contain either only *VGM* members or

non-*VGM* members, which allows me to understand if there are differences in the effect between the two groups. Furthermore, I remove national newspapers from the sample. National newspapers are available throughout the country and might therefore confound my measures of competitive overlap. Again, I use different performance measures of physical newspapers and their related websites to assess the effect of the policy change.

To estimate the extent to which differences in the popularity between the focal newspaper *i* and its competitors lead to changes in performance after the policy change, I used the following model:

$$logPageVisits_{it} = \beta_1 \, After_t * DeltaAvgCompVis_i + \delta_i + \gamma_t + u_{it} \quad (3)$$

Compared to the first model, I replace the dummy variable VGM_i with the variables $DeltaAvgCompVis_i$ and $DeltaMaxCompVis_i$ that represent the difference in page views of the website related to the focal newspaper *i* and the average (or maximum) value of its affected competitors. Since values for $DeltaAvgCompVis_i$ and $DeltaMaxCompVis_i$ can only be calculated for newspapers that have affected competitors, I use a limited sample, which only consists of newspapers that have affected competitors, to estimate this model.

5. Results

The results from estimating Model 1 can be found in TABLE 3. As can be seen from the table, the results depend on the model specification that I use to analyze the effect. When using the baseline specification (see column 1), I find a statistically significant change in the number of page visits of *VGM* members between the two time periods compared to non-*VGM* members using the. If I use an alternative specification of Model 1, in which I cluster standard errors by newspapers (see column 4), the coefficient still points into the expected direction but is not statistically significantly different from zero anymore. Taken together, this provides

only weak evidence for *Hypothesis 1*, in which I argued that not being listed in the search results of news aggregators will have a negative effect on the traffic of newspaper-related websites. At the same time, the results also show that there is no statistically significant effect on the number of page impressions, which in turn leads to a higher ratio of page impressions per visit after a given news website is removed from news aggregators. This suggests that being listed on news aggregators might lead to more page visits, but that these additional visitors will spend relatively little time on the website to which they are directed.

TABLE 3
Regression Results Model (1) - Websites

Dependent Variable	Page Visits	Page Impressions	P. Impr./Visits	Page Visits	Page Impressions	P. Impr./Visits
AfterXVGM	-0.0308***	0.00852	0.0393***	-0.0308	0.00852	0.0393
	(0.002)	(0.480)	(0.000)	(0.443)	(0.857)	(0.132)
Constant	13.10***	14.91***	1.805***	13.10***	14.91***	1.805***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Sample	All Newspapers					
Observations	7153	7153	7153	7153	7153	7153
Website FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Clustered SE	No	No	No	Yes	Yes	Yes
R^2	0.236	0.124	0.338	0.236	0.124	0.338

p-values in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

To get a better understanding of how different types of online news websites are affected by being removed from news aggregators, I conducted a subsample analysis. In this analysis I grouped online news websites into different subsamples based on the number of counties in which their related print newspaper is available. This categorization is based on the idea that the number of counties in which they are available is related to the size of their potential readership. The results of this analysis can be found in TABLE 4. The first column contains the regression results that I obtained by using the entire sample, while columns two through six contain the results that I obtained by dividing the sample based on ranges of 20%

compared to the mean number of counties of the entire sample. The results suggest that there seems to be no effect on online news websites at the very top and very bottom of the distribution, while there is some evidence for a negative effect on online news websites that are located at the center of the distribution. A potential explanation for these findings is that online news websites at the very top already have a large number of potential readers and thus have little to gain from being listed on news aggregators. On the other hand, the content of very small online news websites might be so narrowly focused on a small set of readers that it is of little interest to a broader audience, which again limits the potential benefits from being listed on a news aggregator.

TABLE 4
Regression Results Model (1) – Websites – Subsample Analysis by Number of Counties

Dependent Variable	Page Visits					
afterXVGM	-0.0308	0.0447	-0.0707	-0.149*	-0.140	0.0108
	(0.443)	(0.488)	(0.300)	(0.081)	(0.126)	(0.913)
Constant	13.10***	12.03***	13.51***	14.39***	13.99***	15.86***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Sample	All Newspapers	Below 20% of Mean Number of Counties	Between 20% and 40% of Mean Number of Counties	Between 40% and 60% of Mean Number of Counties	Between 60% and 80% of Mean Number of Counties	Above 80% of Mean Number of Counties
Observations	7153	3580	1622	774	577	600
Website FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Clustered SE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.236	0.194	0.453	0.339	0.409	0.394

p-values in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

To test *Hypothesis 2*, I use a variation of Model (1), in which the logarithm of quarterly sales of print newspaper *i* is the dependent variable. Again, I compare the performance of newspapers that are members of *VGM* to the performance of newspapers that are not members of *VGM* before and after the policy change. The regression results can be found in TABLE 5. It can be seen that there is a statistically significant negative effect on the number of sales of

newspapers that are *VGM* members compared to non-*VGM* members. Similarly, there is a marginally significant negative effect on the number of subscription sales and on the number of printed copies. Overall, these results are consistent with *Hypothesis 2* and provide evidence that being removed from the search results of news aggregators has a negative effect not only on the performance of websites, but also on the performance of the print newspapers to which they are related.

TABLE 5
Regression Results Model (1) – Print Newspapers

Dependent Variable	Newspaper Sales	Printed Copies	Subscriptions
AfterXVGM	-0.0361*	-0.0399	-0.0257
	(0.050)	(0.115)	(0.142)
Constant	10.91***	11.02***	10.73***
	(0.000)	(0.000)	(0.000)
Sample		All Newspapers	
Observations	2288	2288	2288
Website FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Clustered SE	Yes	Yes	Yes
R^2	0.127	0.125	0.0978

p-values in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The results that I obtained by estimating different versions of Model (2) are displayed in TABLE 6 and TABLE 7. In TABLE 6, I estimate the effect of different degrees of competitive overlap between the focal newspaper *i* and newspapers that are affected by the policy change on the page visits of newspaper-related websites. While the results are somewhat mixed, the overall pattern suggests that the page visits of newspaper-related websites actually decrease if their competitors do not appear in the search results of news aggregators anymore. More specifically, for the websites of newspapers that are themselves not affected by the policy change, I find a statistically significant effect if I use $AffCompFirms_i$ to measure competitive overlap, a marginally significant negative effect for

the simple binary variable and no statistically significant effect if I use $AffCompCounties_i$ as a measure. Similarly, for the websites of newspapers that are affected themselves, I find a statistically significant negative effect if I use the two continuous measures of competitive overlap, but no statistically significant effect if I use the binary measure.

TABLE 7 contains the results of similar regressions, in which I use quarterly sales of the physical newspapers as the dependent variable. While the results are again somewhat mixed, the overall pattern is similar to the results that I obtained for newspaper-related websites in that it points toward a negative effect. For newspapers that are not members of *VGM* and are therefore not directly affected by the policy change, I find a statistically significant negative effect when using the two continuous measure, but only a marginally significant effect when using the binary measure. For newspapers that are members *VGM* and therefore affected themselves, I find a statistically significant negative effect when using the binary measure and only marginally significant effects when using the two continuous measures. The overall pattern that emerges from TABLE 6 and TABLE 7 appears to be consistent with the theoretical reasoning described above and with Hypotheses 3a and b.

TABLE 6
Regression Results Model (2) – Websites

Dependent Variable	Page Visits					
AfterXAffComp	-0.120			0.0147		
	(0.217)			(0.834)		
AfterXlogAffCompFirms		-0.0382*			-0.0738***	
		(0.079)			(0.002)	
AfterXlogAffCompCounties			-0.00627			-0.0577***
			(0.722)			(0.000)
Constant	12.78***	13.08***	12.78***	13.58***	13.63***	13.54***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Sample	Non-affected Newspapers			Affected Newspapers		
Observations	4263	2999	3967	2890	2370	2706
Website FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Clustered SE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.233	0.305	0.328	0.274	0.307	0.309

p-values in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The results from estimating Model 3, which are displayed in TABLE 8 and TABLE 9, shed some light on the reason why the performance of newspapers and their related websites might suffer if their competitors are affected by the policy change. As has been described in the previous section, I use $DeltaAvgCompVis_i$ and $DeltaMaxCompVis_i$ to measure the extent to which newspapers and their related websites might have benefitted from spillovers that come from more popular newspapers in the past. Since these two variables can only be calculated for newspapers that have at least one affected competitor, the sample that I use is restricted to those newspapers and to the websites related to them.

TABLE 7
Regression Results Model (2) – Print Newspapers

Dependent Variable	Newspaper Sales					
AfterXAffComp	-0.0145			-0.0449**		
	(0.155)			(0.028)		
AfterXlogAffCompFirms		-0.0185**			-0.117	
		(0.021)			(0.108)	
AfterXlogAffCompCounties			-0.0131***			-0.0697
			(0.006)			(0.119)
Constant	10.64***	10.82***	10.64***	11.29***	11.40***	11.31***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Sample	Non-affected Newspapers			Affected Newspapers		
Observations	1351	1013	1326	937	804	920
Website FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Clustered SE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.428	0.436	0.450	0.101	0.148	0.142

p-values in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

It can be seen from TABLE 8 and TABLE 9 that newspapers and newspaper-related websites which are less popular than their competitors which have been removed from the news aggregators tend to be more negatively affected in their performance. Irrespective of the measure that I use, all coefficients point into the expected direction and, except for the sales of newspapers that are not affected themselves, they are at least marginally significant. Taken together, these results provide support for the idea that newspapers might have benefitted from spillover effects from more popular competitors in the past and will suffer in terms of their performance once these spillover effects are not present anymore. The results are therefore consistent with Hypotheses 4a and b.

TABLE 8
Regression Results Model (3) – Websites

Dependent Variable	Page Visits			
AfterXlogDeltaAvgCompVis	-0.00374		-0.0637***	
	(0.896)		(0.000)	
AfterXlogDeltaMaxCompVis		-0.0110		-0.0541***
		(0.570)		(0.000)
Constant	12.68***	12.85***	13.46***	13.51***
	(0.000)	(0.000)	(0.000)	(0.000)
Sample	Non-affected Newspapers		Affected Newspapers	
Observations	2309	2421	2293	2321
Website FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Clustered SE	Yes	Yes	Yes	Yes
R^2	0.302	0.291	0.333	0.336

p-values in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE 9
Regression Results Model (3) – Print Newspapers

Dependent Variable	Newspaper Sales			
AfterXlogDeltaAvgCompVis	-0.0148		-0.0146***	
	(0.170)		(0.000)	
AfterXlogDeltaMaxCompVis		-0.0152**		-0.0248*
		(0.044)		(0.062)
Constant	10.55***	10.63***	11.35***	11.37***
	(0.000)	(0.000)	(0.000)	(0.000)
Sample	Non-affected Newspapers		Affected Newspapers	
Observations	802	835	785	796
Website FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Clustered SE	Yes	Yes	Yes	Yes
R^2	0.365	0.410	0.198	0.112

p-values in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

6. Conclusion

News aggregators have attracted significant attention from both industry experts and academics who have tried to understand their effect on online news websites. While some have argued that news aggregators take away business from news websites, others support the idea that news aggregators might actually direct additional traffic to the online news websites that are listed on them.

In the previous sections, I have provided evidence that is more consistent with the idea that news aggregators have a beneficial effect on the performance of some of the news websites that they list. On the one hand, online news websites with a particularly large or small range of potential readers do not seem to be able to benefit from being listed on news aggregators. This might be explained by the fact that online news websites have little to gain from their presence on news aggregators if they are already known to a wide range of potential readers or if they are narrowly focused on a small set of potential readers. On the other hand, online news websites with average-sized potential readerships appear to perform worse in terms of the web traffic they receive after they are removed from news aggregators, compared to those online news websites that are not removed.

Furthermore, I also show that being removed from news aggregators does not only have a negative effect on the news websites themselves, but also on the sales of print newspapers that are related to them. This suggests that news aggregators do not only help news websites in directing additional attention to them, but also increase consumer attention to print newspapers.

Interestingly, I find similar effects if the news website of a competitor (rather than the website of a focal newspaper itself) is removed from news aggregators. If news websites of competitors are removed from news aggregators, this appears to have a negative effect on the

focal website's visits and on the sales of the print newspaper that is related to the focal website. This effect is stronger if there is greater distance in terms of popularity between the focal website and its competitor, suggesting again that news aggregators might redirect attention from some websites to others.

From a more theoretical point of view, this suggests that the entry of news aggregators can potentially transform the competitive environment in two parallel but distinct ways. On the one hand, their presence introduces a new type of competitor (i.e. the news aggregator itself) as users will have to decide if they are satisfied with reading the short excerpt provided by the news aggregator or if they prefer to read the full article on the website of the original content creator. On the other hand, news aggregators change the mechanisms of competitive interaction between existing players in the industry as well. While these players are still competing for the same customers, the presence of competitors on news aggregators actually has a positive effect on the performance of a focal firm. This new mechanism is not only present in online competition but is also reflected in the more traditional offline setting.

While the broad pattern of results is consistent with my expectations, a few limitations remain. First, the data that I use in this study is based on a single geographic region, which might limit the generalizability of the results. However, since the news industry in most other countries has undergone similar developments and since the key players in the industry are similar in other countries as well, this concern is alleviated to some extent. Secondly, I do not have access to direct information on the web traffic that flows from news aggregators to an online news website and its competitors. My ability to test the proposed mechanisms directly is therefore limited.

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CONCLUSION

In this dissertation, I have studied how the entry of digital platforms affects traditional industries. More specifically, I have shown that the entry of digital platforms into traditional industries can act as a trigger for digital transformation and ultimately affect the competitive relationships and performance of existing players in these industries.

In the first chapter, I have argued that digital platforms, and peer-to-peer platforms in particular, are not simply a new competitor that only poses a threat to incumbents in a specific market segment, but that their entry can lead to a broader shift towards more business on digital platforms. This shift in turn pushes incumbents to adopt new technologies that act as a substitute for their existing complementary asset, which have traditionally buffered them from direct competition with others. Ultimately, this means that the incumbents that are affected the most by the entry of these platforms are not necessarily the ones that operate in the same market segment as the platform, but those whose complementary assets become less valuable.

The second chapter has shown that the way in which incumbents react to this shift can be explained at least in part by the ownership form of individual units and the resulting managerial incentives. If managers of individual units have more leeway in their strategic actions and a strong incentive to maximize the performance of individual units, they are more likely to take the risk of doing more business on digital platforms. While this poses the risk of being exposed to more direct competition and therefore being forced to engage in price competition, the fact that more potential customers can be accessed, ultimately outweighs this risk. Taken together, this suggests that adapting to the new environment and embracing the new technology (i.e. the digital platform), can reduce the negative effect on the performance of those incumbents that are.

In a similar way, the third chapter has shown that incumbents might actually benefit from their presence on digital platforms. While platforms that aggregate the content of original

content providers are often seen as threat, they can have a positive effect on the performance of content creators as they increase their potential audience. More interestingly, this effect appears to be present not only for content creators' digital products, but also for their more conventional offline products. The third chapter has also shown that content aggregators have a major impact on the relationship between competing content producers. While these players are still competing for the same customers, content aggregators add a positive link between them, as the presence of competitors on news aggregators actually has a positive effect on the performance of the focal firm as well.

Overall, in this dissertation I have tried to show that the effect of digital platforms on incumbents in traditional industries is much more nuanced than has often been assumed. While there is often a direct competitive effect of digital platforms on their traditional competitors, the real threat comes from the changes in the competitive landscape that are triggered by the entry of digital platforms. As we have seen in the previous chapters, the entry of digital platforms can for instance push a wide set of incumbents to adopt technologies that act as substitutes for their existing assets, or it can add positive links between the performance of competing companies. Ultimately, the entry of digital platforms can therefore have several indirect effects on the performance of incumbents that cannot be explained with the conventional logics of competitive interaction between firms.