Full Length Article

Delimiting disruption: Why Uber is disruptive, but Airbnb is not☆

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A R T I C L E   I N F O

I offer reasons why disruption theory needs a revamp, define post-adoption then point out the gap between the considerable literature in marketing on post-adoption behavior, and the dearth in its immediate corollary, namely disruption. I then criticize the current definition of disruption and offer one instead, followed by three recent examples - iPhone, Uber, and Airbnb - where the claim is that the first two are indeed disruptive innovations, while the latter is not.
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1. Introduction

Christensen's disruption theory (DST) is a popular concept in business consulting for the last 20 years that has not gained much foothold in the marketing academic discipline (Christensen, 1997; Christensen, McDonald, Altman, & Palmer, 2018; Christensen & Raynor, 2003). One circumstance where we have to confront this theory is in class when teaching about new products, either in the core or in an elective on new products, where we face some resistance from students based on the very specific and narrow definition of disruption used by Christensen. When asking about the disruption of, say, Uber, DST critically asks whether Uber began at the low end in terms of price and quality compared to the then-available service or technology. Most students find this irrelevant to the issue of disruption, and specifically question the assertion of Christensen, Raynor, and McDonald (2015, pp. 4–5) that because Uber did not begin its life at the lower end of the spectrum, it is not a disruptive innovation.

Another major difficulty with DST is its insistence to tie up disruption with a failure of a firm. Thus, for example, Gans (2016) defines disruption centered around a firm's failure: "…disruption occurs when successful firms fail because they continue to make the choices that drove their success." To realize why this coupling is uncalled-for, consider the case of iPhone that will be discussed later. It is clearly a major disruption, in that it has considerably changed the behavior of consumers, and therefore of firms in that

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industry (and in this case firms in related industries as well). Now as a response to the change in the behavior of consumers, Samsung prospered and Nokia failed, both spectacularly so. It is indeed intriguing to find out why two previously successful firms reacted so differently to the change in consumers' behavior, but it is a question that is separate from the issue of whether iPhone has been a disruption. Just suppose Nokia would have taken the risk, time, talent, and treasure required to make the switch from dumbphones to smartphones, and would have succeeded as Samsung did. Now we would have three successful firms producing smartphones, everything would be peachy, but the disruption would still be there, in full force.

It's not the case that failure of firms is unimportant – it is. Yet it cannot be the sole determinant of a disruption. As shown later, Apple itself was radically changed as a result of the introduction of iPhone and this change is just as important as the failure of Nokia. Thus we need a new definition that depends on disruption of the behavior of consumers, and therefore of firms, that decouples the unwarranted alliance between disruption and failure of firms.

The aim of this paper is to present a framework of disruption that follows diffusion theory and in particular post-adoption behavior, define disruption and check, according to this definition, which of three major innovations of last decade, namely iPhone, Uber and Airbnb is disruptive?

The next section presents and criticizes the currently pervasive theory of disruption; the following section presents a brief literature review that has a curious gap between the substantial literature on disruption in strategy journals and almost complete lack of interest in the marketing field, as well as a definition of disruption that follows the path presented above, as in order to learn whether an innovation is disruptive, we have to find out how it changed the behavior of the major stakeholders in that industry. This will be followed by three recent examples – iPhone, Uber, and Airbnb – where the claim is that the first two are indeed disruptive innovations, while the latter is not, at least not yet. The last section concludes the paper by offering several avenues for research that might follow this paper.

2. Disruption theory, your roots are showing

Christensen's disruption theory (DST) has a peculiar way of determining if an innovation is a disruption. To determine disruption one has to find out whether the innovation began its life at the low end in terms of price and quality compared to the then-available service or technology. While we as marketing academics have all but ignored DST at the research level, we have to confront it while teaching in courses such as new products where most students find the question of whether an innovation began its life at the low end or high end irrelevant to the issue of disruption. Specifically students question the assertion of Christensen, Raynor, and McDonald (2015, pp. 4–5) that because Uber did not begin its life at the lower end of the spectrum, it is not a disruptive innovation.

There's a reason for this peculiar assertion that Uber is not a disruptive innovation, and it lies at the very root of Christensen's theory. DST began its life as a theory as to why firms fail, and as Tellis (2006) pointed out, it does provide valuable insights thereto, most notably that the most valuable and profitable consumers might not be a good source of information about a new service. This holds, as this innovative service that might disrupt the industry comes at the low end of the product/service/technology, a place where these high-end consumers have neither interest nor experience. This low-end attack, which initially does not attract much attention, might grow to be a high quality service that supplants the incumbent.

While this is certainly a valuable lesson that explains why firms might fail, consider two points: first, obviously there are other reasons why firms fail. Consider for example the recent bankruptcy of the firearms firm Remington: there was no newcomer, at either the low or high end of price or quality that threatened its existence. Rather, it was bought in a leveraged buyout, and the level of debt proved itself too large: not an unheard of occurrence.[1] Second and more importantly, despite its name, DST is not a theory of disruption, but rather a theory on why firms fail. It was later expanded upon by Christensen et al. as an all-encompassing theory of disruption, and in the effort to defend its roots, they resort to indefensible assertions about whether an innovation is disruptive or not.

Thus according to DST, in order to find out if iPhone is disruptive, you do not have to go via the route of the *Wall Street Journal* that in a series of in-depth articles investigated the effects of iPhone's growth on a number of stakeholders in this industry, including suppliers, competitors, and mobile network operators. Instead, DST asks us to base our decision on whether the first iPhone offered a superior or inferior product compared to the then-available best mobile phones. The students don't buy it, and neither should we as educators and marketing researchers.

3. Literature review

Christensen's disruption theory (DST) began with his best-selling book in 1997, and despite the importance of the subject, as Govindarajan and Kopalle (2006) note, relatively little academic research has been done on this subject in the first decade following this book. This is partly due to the lack of appropriate measures for the disruptiveness of an innovation and partly "…because [DST] is headlong, while critical inquiry is unhurried; partly because disrupters ridicule doubters by charging them with fogyism, as if to criticize a theory of change were identical to decrying change; and partly because, in its modern usage, innovation is the idea of progress jammed into a criticism-proof jack-in-the-box." (Lepore, 2014). The last decade, on the other hand, did see some renewed academic interest in the subject.

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[1] Apparently the demise of Remington was also due to some "financial engineering" by the private equity firm Cerberus, see Barron (2019).
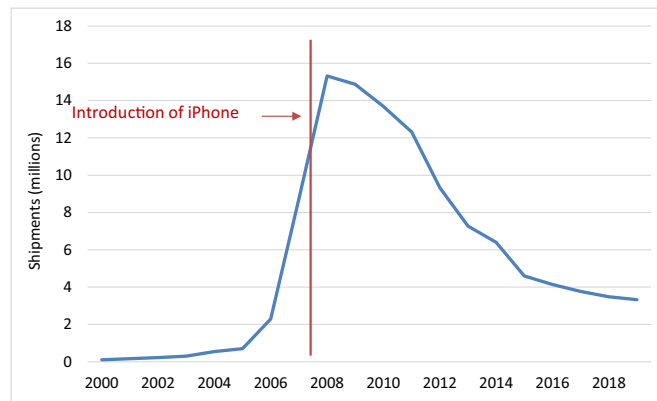
Fig. 1. Shipments of portable satellite navigation systems in the US (in millions of units).
Source: Consumer Technology Association.

One of the most notable criticisms of DST is by Lepore (2014), who offered a careful takedown of the methodology used by Christensen in his original work. Some of the criticisms had to do with the arbitrary definition of failure in Christensen's work that did not distinguish between disappearance of the firm due to bankruptcy, change of name, or change of ownership. However the main point is that DST is a theory about why firms fail, and nothing more. Christensen's response was an embarrassing personal attack on Lepore, in an interview with a *Bloomberg Business* reporter, followed by a partial response by a coauthor of Christensen's second book (Bennett, 2014; Raynor, 2014; see also Krugman, 2014; King & Baatartogtokh, 2015; Weeks, 2015; and the Economist, 2015).

Quite a few of the recent papers on the subject unfortunately fell into the trap of centering disruption on firm's failure, see Schmidt and Druehl (2008); Marx, Gans, and Hsu (2014); Gans (2016). As mentioned earlier this is an issue for two reasons: first, with an innovation that considerably changes the behavior of consumers, some firms prosper (Apple and Samsung) and some fail (Nokia). Concentrating just on the failing one misses the point. Disruption begins with consumers and the firms that serve them come second: some will succeed and some will fail. The disruption had already occurred regardless. Second, the heavy reliance on the initial condition, that is entry below the current offering, is odd. Somehow the theory implies that dynamic economic system of consumers and competing firms reaches an equilibrium depending on this initial condition. There are some dynamic economic systems under which the resultant equilibrium depends (or doesn't) on the initial conditions (see Fershtman & Muller, 1984, 1986), yet this needs some settings and restrictions that are completely missing from the discussion. Some of the notable exceptions, where disruption does not depend only on firm's failure, are the following:

Danneels (2004), Markides (2006), and Govindarajan and Kopalle (2006) offer a definition that only partially depends on the low entry point. An innovation is disruptive if it introduces a new set of features on which the firms now compete. While this is certainly an improvement on DST, this is similar to Blue Ocean Strategy (Mauborgne & Kim, 2005, Kim & Mauborgne, 2017) that refers to marketing strategy that might or might not cause a disruption. Moreover these studies do fall back to the question of initial entry below or above current offering in order to evaluate disruptions.

Sood and Tellis (2011) offered a definition that does not rely on the source of attack of the newcomer, but rather simply asks if the new technology supplants the previous one by, say, reaching more than 50% market share. This definition by itself is somewhat too general, as it does not require any significant change in the behavior of any stakeholder in the industry. Thus the
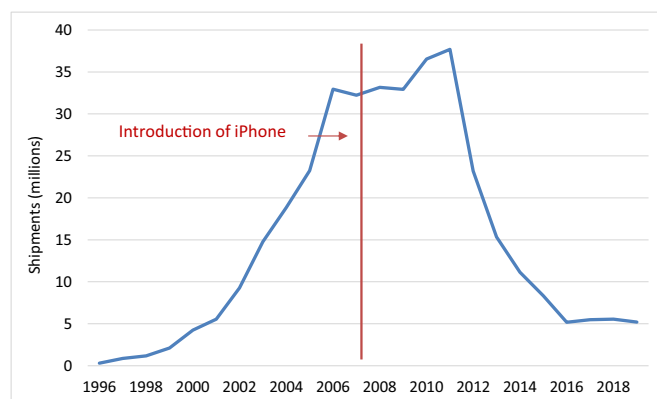

Fig. 2. Shipments of digital cameras in the US (in millions of units).
Source: Consumer Technology Association.

transition from one technology generation to the next could run smoothly without any disruption. For example, the transition from LCD to OLED display monitors in smartphones, which is part of the dataset of Sood and Tellis, does not require any change of behavior on the part of the consumers. While they might enjoy their iPhone's "retina display", they most likely will not change their behavior in any significant manner based on the screen resolution, especially given that the term "retina display" used by Apple can be of either of two types of displays.

Palacios and Tellis (2014), while not specifically defining disruption, refer to a disruptive stage of a technology life cycle, as the dive, or rapid decline, in sales as a result of a growth new generation (see for example Figs. 1 and 2 in this paper). The advantage of this approach is that it relates to category rather than products and thus avoids the pitfall of concentrating on the failure of a firm to define disruption.

4. Post-adoption and disruption

The theory behind disruption as it relates to marketing, follows the diffusion theory and in particular post-adoption behavior.[2] Consider the media streamer Roku: consumers buy the player, and using home network, stream TV shows and movies from various vendors such as Netflix, buy some TV shows and are exposed to ads. Thus an average user begins with adoption of the hardware and shifts to post-adoption behavior in certain proportion with respect to spending. If we take the latest available data in 2018, Roku's revenues from adoption – that is, the sales of the hardware itself – were $326m, while post-adoption sales, mostly of advertising, amounted to $417m. Thus for every dollar that Roku earns from adoption, it gets about $1.3 from post-adoption (Roku 2018 Annual Report, p. 48).

This is not an isolated example: the rise in technology innovation has caused a sustained shift in emphasis from adoption, that is counting units purchased, to the behavior of the consumers and consequently firms, following adoption. Thus consider everyday products such as mobile games, media streamers, and virtual assistants such as Alexa: it's not that their adoption is not important; it is, as without an initial adoption there cannot be any subsequent activities. But the fortunes of Electronic Arts, Roku, and Amazon critically depend on subsequent activities of the consumers that determine the flow of money as well as retention: in short, their customer life-time value (CLV).

A more extreme case, where the traditional reliance on adoption differs considerably from post-adoption, is mobile apps where over 95% of them start as free (AppBrain, 2019). Even in this case, though downloading the game is free, this act of download is an adoption and is necessary for the consumer playing the game to later buy a sword or an avatar as an in-app purchase, or view a video in order to advance to the next stage of the game. Thus the player's CLV is built entirely upon post-adoption behavior. This phenomenon raises certain marketing challenges, such as lack of resources for acquisition, coupled with an alarming decline in engagement that calls for innovative marketing strategy for a sustainable business model (see for example Appel, Libai, Muller, & Shachar, 2020; Haenlein, Libai, & Muller, 2019).

Thus, for example, data obtained from a mobile game developer where the decline in engagement is extremely high, implies that active users are considerably fewer than total adopters. In a typical game, within eight weeks, a total of about 2.5 million consumers adopted the game, while at the same time only about 300,000 still actively play it. Moreover, a deeper look at post-adoption behavior will ask not only if the gamer uses the innovation, but her level of usage as well. This is critical to the game's financial outcome, as the one and only revenue stream comes from post-adoption in the form of advertising and in-app purchases, both correlating with usage. This difference between cumulative and active users also plays a part in Airbnb listings, as discussed later.

Somewhere in between these two extremes – Roku, a hardware with some post-adoption purchases and casual mobile games where all action occurs post-adoption – we find many products and services: for example, fashion, where the initial adoption matters a great deal, yet post-adoption, specifically when and where this item will be used/worn, is critical to the brand's success (e.g., Appel, Libai, & Muller, 2018; Han, Nunes, & Drèze, 2010). Other examples include the three cases addressed in this paper: iPhone, Uber, and Airbnb: in all three cases, while initial adoption is important, post-adoption behavior is crucial to the brand's success.

This shift in emphasis from the act of adoption to subsequent behavior naturally raises the question of how substantial is this change in behavior due to the diffusion and adoption of the innovation. When the change in behavior is substantial, it affects most of the consumers and is sustained over time, firms serving this industry note this change – sometimes painfully so – and react accordingly. In this case, one might be tempted to call the change a disruption.

For the ten-year anniversary of iPhone, Tripp (2017), Morris (2017), and Dou (2017), in a series of three in-depth articles in the *Wall Street Journal* investigated the effects of iPhone's growth on a number of stakeholders in this industry, including Apple itself, competitors, other related product categories, and mobile network operators. Following this path, a new definition of disruption is presented next, namely, that in order to find out if an innovation is disruptive, we have to discover how it changed the behavior of the major stakeholders in that industry. Thus disruption is defined as follows (the term "technology" refers to a service

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[2] On post adoption in marketing see Robertson and Gatignon (1986); Mahajan, Muller, and Srivastava (1990); Jain, Muller, and Vilcassim (1999); Bolton and Lemon (1999); Lemon, White, and Winer (2002); Hogan, Lemon, and Libai (2003); Shih and Venkatesh (2004); Sood and Tellis (2005); Gielens and Steenkamp (2007); Libai, Muller, and Peres (2009); Prins, Verhoef, and Franses (2009); and Healey and Moe (2016).

or technology or a product, or a combination thereof, and a "firm" might be a producer or a service provider depending on the product in question):

> **Disruption**: *A new technology is disruptive to a given industry if it eventually supplants the incumbent technology, and significantly changes the behavior of most of the stakeholders in this industry. The stakeholders include consumers, competing producers, service providers (or retailers), and possibly producers in related industries.*

Note that the definition can be applied to product category rather than to brand level. Though the examples shown later in this paper are on brand level, they can be applied to category: for example the AirDNA data used for Airbnb includes the main competitor (HomeAway) and thus can be applied to the category of short-term rental. One should also note that technological substitution is a slow process due to resistance to change and risk aversion on the part of the adopting consumer or firm (Stremersch, Muller, & Peres, 2010), and thus enough time should pass before we can make a judgment on the level of disruption in a given industry. Also, in the case of a major disruption, related industries are affected as well. This will be expanded upon in the three cases in the next section, which considerably differ on this point.

5. iPhone, Uber, and Airbnb

This section presents three technologies that have the potential to disrupt the industries in which they operate, namely iPhone, Uber, and Airbnb. The first is the quintessential example of disruption of an industry that early on spilled over into other related categories; the second is a disruption in progress, while the last, it is argued, is not a disruption.

5.1. iPhone

iPhone was developed by a team of about 1000 Apple engineers and designers[3] over about three years, before being unveiled in January 2007 and going on sale in June of that year. Since then, it has sold more than 1.3 billion units in about 8 successive generations, and earned Apple more than $800 billion in revenues. Reading the *Wall Street Journal* series that investigated the effects of iPhone on Apple itself, competitors, other related product categories, mobile network operators, and others articles on the subject (Dou, 2017; Morris, 2017; Tripp, 2017), it is clear that iPhone affected these stakeholders in a significant manner. The following is a short summary of these effects:

Consumers have been changing their behavior rapidly. In 2008, less than 150 million smartphones were sold worldwide, five years later they surpassed the sales of dumbphones and five years later, by 2018, they had reached sales of over 1.5 billion units.[4] With respect to apps, it's not so much the number of apps available (2.1m and 1.8m in Google Play and Apple Store respectively), but rather how much we download and use them. Apparently we download a lot and use a little. According to Adjust (2019), on average, 79% of app users are lost within the first week following their download of the app. On the other hand, the few apps that we do keep and use, such as online banking or satellite navigation systems such as Google Maps, have considerably changed our behavior. This sustained transformation has resulted in a number of changes in the firms that produce, or produced, competing products, as summarized below.

Producers: The striking change in the industry is the radical shift in the composition of firms producing mobile phones, such as Samsung, Apple, Microsoft, and Nokia. While the first two prospered, the latter two failed. Within five years of the introduction of iPhone, Samsung became the largest manufacturer of mobile phones by surpassing Nokia; and within ten years Apple has completely transformed itself as demonstrated in Table 1.

Microsoft and Nokia, on the other hand, proved once more that merging two failed ventures rarely produces a successful one. The industry has changed not only because of the demise of the slow, but also the entry of the fast – Huawei and Xiaomi – between which have more than 25% of global market share in 2019 (Statista, 2019b). The change in related industries will be discussed shortly.

Service providers, **aka mobile network operators**, did not fare that well with the smartphone's growth. As Morris (2017) put it, the smartphone was expected to change telecom providers' fortunes for the better. Instead, it helped make data services a commodity, and most of the growth went to Apple itself. Not only that, but as Apple earned (and kept) net cash of almost a quarter trillion USD, the network operators in the US, mainly AT&T and Verizon, amassed a similar sum, but in net debt, as they bid to buy wireless spectrum that was needed to fuel the new abilities of the smartphones.

Producers in related industries fared even worse than mobile network operators as a result of iPhone's growth.[5] Observe Figs. 1 and 2, which depict the growth of two related product categories: digital cameras, and portable satellite navigation systems. There are two main reasons why an innovation reaches such a decline in sales: the first is that it reaches its market potential, which is the entire population that is the target market for the innovation. There is simply no one left in the target market who has not yet adopted the innovation. The second reason for growth stagnation of a new product is the intrusion of a

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[3] Not before criticizing "design by committee". Apparently 1000 people is not a committee. Now we know.

[4] Dumbphones are not quite dead yet, but even in sub-Saharan Africa, one of the poorest areas on earth, with average GNI per capita of about $1500, smartphones overtook dumbphones in 2015. See Lomas (2013), Bogost (2017), and Statista (2019a).

[5] Several innovations though, have done extremely well in smartphones' wake: Arguably, Spotify would have never taken off without the wide diffusion of smartphones.

Table 1
Apple before, and a decade after, the introduction of iPhone.Source: Tripp (2017).

	2006	2016
Employees	18,000	116,000
Sales ($ billion)	$19.3	$215.6
Profits ($ billion)	$2.0	$45.7
Cash ($ billion)	$6.4	$237.6
R&D ($ billion)	$0.7	$10.0
Southeast Asia sales ($ billion)	$1.4	$48.5
iPod/iPhone units (millions)	39.4	212

competing innovation, or a new generation of the same base technology (see Muller & Peres, 2019 for a recent review paper on innovation diffusion).

Examples of the first reason for stagnation in the growth of an innovation – i.e., reaching the entire market that is the target for the innovation – are few and far between. Mobile phone service is certainly one example whose growth has been slowing down in the developed world in the past few years due to the natural limit of the population size.[6] Twitter might also be another example (see Wei, 2018 for a fascinating argument on the stagnation in Twitter's growth).

Examples of the second type of decline in sales, that of a new generation coming in and replacing an older version, are digital cameras and portable satellite navigation systems depicted in Figs. 1 and 2. How do we know what the cause is of the stagnant growth of these innovations? We look at adoption and post-adoption (active users) of the generation that supplanted it. In the case of navigation systems, for example, while sales of stand-alone dedicated units of satellite navigation systems such as Garmin were less than 3 million units in 2018 (mostly to commercial fleets), there were more than 20 million **new** active users of navigations apps such as Google Maps or Apple Maps, to reach a total of about 150m active users that year (Wurmser, 2018).

5.2. Uber

In 2010, Uber began offering ride-hailing service in San Francisco under the name UberCab. Following a cease-and-desist order of the SFMTA board and consistent with the definition of the modern-day pirate (see Section 6), Uber dropped the "Cab" from its name and continued operation undisturbed by the MTA. Uber continued entering cities while subsequently lobbying for policy changes so as to make it viable, not to mention legal. It went into a somewhat disappointing IPO in May 2019, yet its share price partially rebounded (as of Q2, 2019). The following is a short summary of the effects of Uber's growth on the main stakeholders in this industry:

Consumers have been changing their behavior rather rapidly. Uber entered New York City in mid-2011, and within seven years (six, if one includes Lyft) overtook the existing taxi service in terms of rides per day (Fig. 3). The fact that this growth in market share is not limited to New York can be seen in Fig. 4, which depicts the share of ground transportation by business travelers that is reimbursed by their employers across the US. Three facts are striking about this figure: first, the speed at which Uber and other ride-hailing apps such as Lyft overtook both taxi service and car rentals. Second, the total market for ground transportation in NYC increased dramatically during this period of growth of Uber and Lyft, from 520,000 rides per month in January 2015 to about 947,000 in June of 2019. Third, this rapid technological substitution is not only happening in the personal ride-sharing business, but in the business segment as well. This is important, as it starkly contrasts with Airbnb, as will be explained shortly.

Competing producers, **aka taxis**, are suffering the full brunt. Observe Table 2 that depicts the decline in revenues per vehicle, and consequently the price of a taxi permit ("medallion") in New York City in a five-year period, from Q1 of 2014 to Q1 of 2019. Similar scenarios are unfolding in other major cities such as Boston, San Francisco, and Chicago (Channick, 2018; Graham, 2018; Said, 2018), constituting a full-blown crisis at the taxi driver level that has led to numerous foreclosures and even several suicides (Fitzsimmons, 2018). In addition, as Fig. 4 shows, this is happening in the personal as well as the business sectors, and thus the decline is fast and across the board.

The striking difference between the percent decline in average monthly fare per cab (28%) and medallion price (82%) requires some explanation. After all, the medallion price should be correlated with future earnings of the cab bearing the medallion (discounted properly). The difference might be due to cost structure, in that if the fixed costs of running a cab are high enough, then this drop in revenues might be enough to decrease profits to such an extent so as to justify such a drop in the value of this asset. There might be two other reasons: first, medallion prices might have been artificially high at its peak around 2014. This is partly supported by an in-depth *New York Times* analysis on the predatory lending that was prevalent in this industry in New York in the last decade that might have led to inflated prices similar to the housing bubble that led to the 2008 crash (Payabarah, 2019; Rosenthal, 2019). Second, given Uber's continued losses (about $3b a year in the last three years – see Uber S1 SEC filing), the market is not at a sustained equilibrium and fares could go up, so that Uber (and Lyft) can at least break even. The drivers who are currently selling their medallions either are not taking this into account, or more likely, do not have pockets deep enough

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[6] As many users subscribe to more than one mobile line, the percent of mobile subscriptions in many developed countries is larger than 100%. For example in the US, there are 120 mobile subscribers per hundred population. Another statistic is penetration, that is, the percentage of the population that has at least one mobile subscription, which currently at around 82% in the US (Statista, 2019c). Both measures remain stable in the past few years.
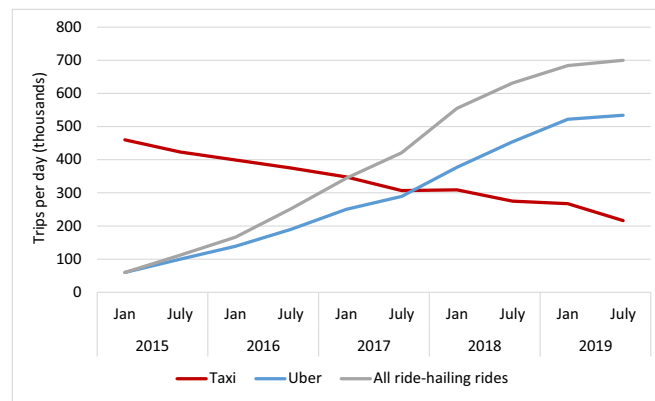
Fig. 3. Taxi and ride-hailing trips, New York City (thousand trips per day).
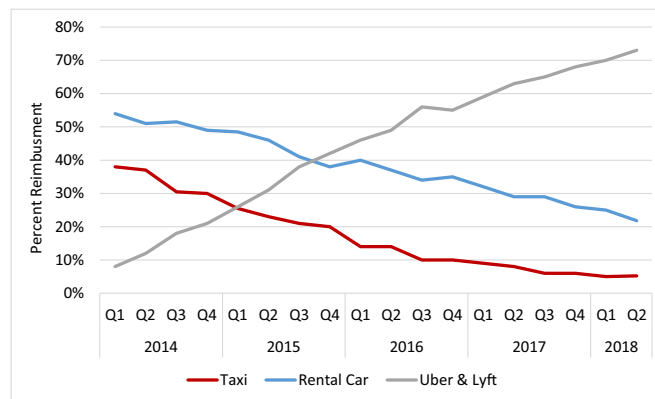Sources: NYC Taxi and Limousine Commission (2019); Schneider (2019).

Fig. 4. Ground transportation business reimbursement, USA (percent).
Source: Richter (2018).

to wait for this to happen. Indeed, about 85% of the sales of medallions in NYC in the first quarter of 2019 were from foreclosures. As one industry observer put it: "The key is liquidity" (Birch, 2018), and cab drivers just don't have it.

Producers in related industries: **car manufacturers and rental car companies**. Sales of new cars and light trucks in the US have been flat in the last four years at around 17.3 million units per year and have actually declined a bit to 17.2 million units in 2018. Moreover, gross profit margins at the dealer level have been eroding during this period from about 3.4% in 2015 to slightly over 2% in 2018 (National Automobile Dealers Association, 2019). While causality is unclear, there are indications of a shift in behavior, especially among millennials, who are buying fewer cars because of economic conditions as well as preferences for public transportation and ride-hailing services (Klein & Smart, 2017; Nerad, 2019; Ofek, Muller, & Libai, 2019). Rental car companies should be feeling some of the effects, as shown in Fig. 4, where reimbursement for ground transportation by businesses has declined from 50% to 20%, having been overtaken by ride-hailing services. This has not yet had any effect on the financial performance of the major car rental companies in the US, which appear to be able to consistently grow revenues, profits, and vehicle utilization.[7]

5.3. Airbnb

Airbnb is the quintessential Silicon Valley story of two former classmates who found an unfulfilled need in the market, launched a service out of a loft apartment in San Francisco (a garage is so 20th century), and within five years of launch, in mid-2013, had 9 million customers.[8] Now, showing that an innovation is not a disruption is more difficult, yet the argument will be that though it caused changes in the behavior of the major stakeholders in this industry, the changes are not significant enough to be labeled a disruption. Airbnb is simply too small in comparison to its rivals (hotels and rental market), and its growth is stagnating.

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[7] Avis-Budget Group 2018 Annual Report; Hertz Global Holding 2018 Annual Report.
[8] Urban legend has it that the loft became so crowded with employees, that the founders left and rented an Airbnb apartment nearby.

Table 2

Average monthly fares and medallion prices in NYC.Sources: NYC Taxi and Limousine Commission (2019); Schneider (2019).

Quarter	Average monthly fare per medallion	Average medallion price
2014, Q1	$13,832	$1,053,410
2019, Q1	$9914	$188,642
Decline (%)	28%	82%

Consumers have been changing their behavior and have been using the service instead of booking a room at a hotel in their destination. This change, however, is relatively minor as compared with the service it replaces – hotels – and its growth appears to be coming to a halt. Note that though much of the analysis is done on New York City, the largest and an early entrant of Airbnb in the US, the pattern found here is evident in other cities across the US and Europe, as discussed later. Also note that in contrast to Uber, while Airbnb seems to have somewhat changed the behavior of the leisure/personal segment of travelers, it has had far less impact on business travel.

When analyzing a two-sided market such as Airbnb, one might wish to consider both sides of this platform: homeowners who rent their residences (or parts thereof), and consumers who stay in these homes, reflected in **listings** and **occupancy** respectively.

Fig. 5 shows the trend in Airbnb listings in New York, which peaked toward the end of 2017/beginning of 2018. In terms of occupancy, Fig. 6 depicts actual nights booked in Airbnb in New York, and it demonstrates an even clearer picture. Booking nearly stopped growing toward the end of 2017 and has since remained the same (controlling for seasonality).

Fig. 7 depicts the growth of Airbnb in revenues in Manhattan and Brooklyn, the two main boroughs of New York City in terms of hotels and Airbnb rentals. In terms of revenues, Airbnb is still growing, but at a decreasing rate.

The analysis is done on New York City, the largest city in the USA, yet the pattern found in Fig. 5 of sustained growth in 2016 and slowed growth in 2017, and then saturation and even slight decline in 2018 and 2019, is mirrored in the other large cities in the US and Europe, for example, Los Angeles (with about 25k active listings); San Diego (13k); and Austin, TX (11k). Interestingly the other three large cities in Texas – Houston, Dallas, and San Antonio – are still increasing, yet by a low rate (of about 6k on average). In Europe, the city in which Airbnb is larger than New York is London, with a similar pattern (about 80k active listings); Paris, at around 50k, is declining since 2017, and Rome is still slightly growing at around 38k active listings (source: AirDNA).

Note that it is possible for Airbnb to revitalize its growth, as we might be witnessing a saddle phenomenon where the service appeals to the early market, yet the main market is yet to be convinced of the merit of this new service (see Goldenberg, Libai, & Muller, 2002).

In terms of the size of Airbnb vs hotels, Tables 3 and 4 summarize Airbnb's share out of total hotel bookings and revenues in 2018. While the share is impressive for such a new service, it is small. Airbnb is less than 9% of the market in monetary terms and 14% in bookings. Given the stagnation in growth, it is likely to remain small.

Competing producers, **aka hotels**, are reducing their prices as a result of Airbnb entry and growth, the price decrease is not substantial when taking into account the control variables that should be taken into account, such as population, hotel room capacity, and airport passenger count. Thus, for example, in a study done in Texas, each additional 1% increase in the size of the Airbnb listings resulted in a 0.039% decrease in hotel room revenues (Zervas, Proserpio, & Byers, 2017). Moreover, these effects are distributed unequally between business and leisure travelers. Independent hotels and budget hotels – which do not usually cater to business travelers – are more heavily affected by Airbnb. In Texas, these effects are pronounced in Austin, where Airbnb inventory has grown extremely rapidly over the past few years, resulting in an estimated revenue impact of 8%–10% for the most vulnerable hotels in Austin. Given also the relative stagnation in Airbnb's growth in Austin, these effects have already occurred, and little further effect is expected (notwithstanding the saddle phenomenon mentioned earlier).

Several other studies, however, did not find any significant effect of Airbnb on hotel revenues, for example in Los Angeles, San Francisco, Miami, and other major US markets (Blal, Singal, & Templin, 2018; Haywood, Mayock, Freitag, Owoo, & Fiorilla, 2017). It is possible that the significant results of Zervas et al. might be idiosyncratic to Austin due to its volatility, especially during the high-demand period of the South by Southwest Festival (SXSW) attended by 160,000 people in a city with about 40,000 hotel rooms.

This points to a characteristic of Airbnb that can be highly beneficial to consumers, namely its flexibility in supplying accommodations in high-demand periods, allowing potential hosts not to rent throughout the year, then list their properties for the peak season for the high prices they can charge. This surge in supply weakens the effect of seasonal pricing by hotels (Li & Srinivasan, 2019). The flexible supply of Airbnb in a high volatility city, with potential hosts that have rented independently in the past, yet are considering listing on Airbnb, is a prime example of a **contestable market** where the competitors that have an effect on the prices in an industry are not only those who are **currently** in the market, but rather **outsiders**, waiting to enter if the price is right (see Spence, 1983 for a review paper on the subject).

This raises the seemingly technical research issue of what measure of the stock of Airbnb listings to use: cumulative or current. The cumulative (total) stock includes all the homes or rooms that were ever listed in the city, while current stock constitutes active listings.[9] The difference can be large: for example in 2014, Austin had about 8000 cumulative Airbnb listings, while active

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[9] There are multiple ways to measure active listings of Airbnb: AirDNA, whose data are used in this paper, considers a property to be active if it was available or had at least one booking in the reporting period. Some use other methods to find out if a listing is active such as reviews posted during the period (Zervas et al., 2017).
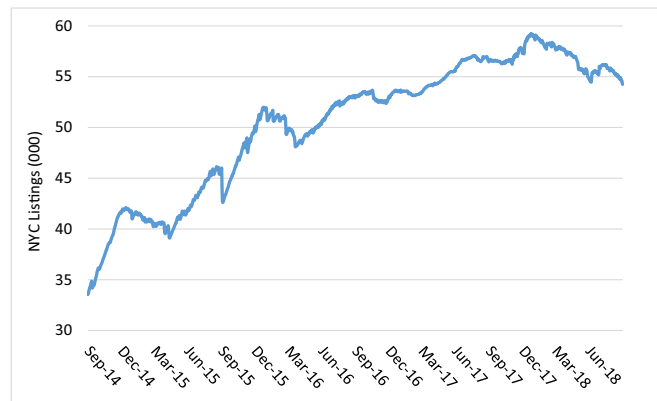
Fig. 5. Airbnb listings in New York (000).
Source: Wachsmuth (2019). Data include all listings on Airbnb's site.

listings were about 2000, rising to 3000 during SXSW festival. At first glance, it appears as if the active listings are the ones to consider when trying to elicit the effect of Airbnb on hotel prices, as this is the stock of housing units that hotels are observing at the moment. Yet this underestimates the stock of relevant listings, as this is a contestable market where homeowners who have listed their properties in the past have the potential to enter the market or refrain from doing so depending on demand and prices.

Note that while the number of active listings underestimate the stock that has an effect on hoteliers' decisions, cumulative number of listings is an overestimation, as it invariably contains some homeowners who exited the business for good, for a number of reasons, such bad experiences. Thus for small and volatile markets such as Austin, cumulative measure might be a reasonable estimation, while for large and relatively stable markets such as London or New York, using active listings is a sound working assumption. Also note that the more Airbnb listings are done by real estate agents, the less flexible the supply, and the benefit to consumer decreases.

Producers in related industries: **long-term rental** is affected by Airbnb, though to a relatively minor degree. Airbnb is small compared to the rental market. Wachsmuth, Chaney, Kerrigan, Shillolo, and Basalaev-Binder (2018) and Wachsmuth, Combs, and Kerrigan (2019) estimated that Airbnb has removed between 7000 and 13,500 housing units from New York City's long-term rental market. The larger estimate of 13,500 units is 0.4% of the 3,275,412 housing units in New York City. Even if we assume that this number of units was removed from Manhattan and Brooklyn only, then this number is 0.7% of the 1,030,674 units of these two boroughs. The issue arises when comparing Airbnb to vacant apartment stock, where the vacancy rate might be between 2.5% and 5% of the total renter-occupied units, and thus a substitution between these two services is likely to happen (source: CoreData.NYC). Indeed Barron, Kung, and Proserpio (2019), who assessed the impact of home-sharing on residential and rental housing prices in the US, found that a 1% increase in Airbnb (active) listings leads to a 0.018% increase in rents in the affected zip codes, pointing to a low substitution elasticity. Moreover, given that the growth of Airbnb is slowing, its future effects on rental prices should be negligible.
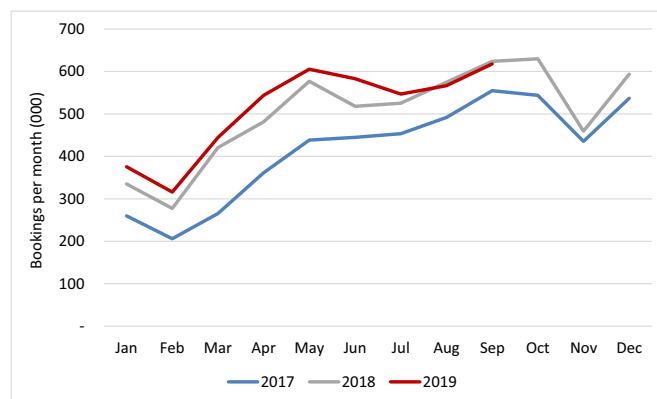

Fig. 6. Airbnb nights booked per month in New York (000).
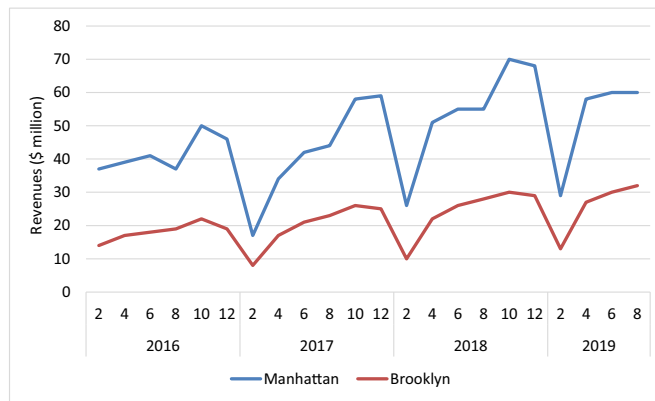Source: AirDNA (including 8% listings of HomeAway from June 2017).

Fig. 7. Airbnb revenues in Manhattan and Brooklyn (in millions of $).
Source: AirDNA (including 12% and 4% listings of HomeAway in Manhattan and Brooklyn, from June 2017).

6. Implications and future directions

In stark contrast to disruption theory, where the claims are that iPhone and Uber are not disruptive, while Airbnb is (Christensen et al., 2015; McGregor, 2007; Trabucchi, Talenti, & Buganza, 2019), a new definition of disruption is presented in this paper, that relies on the behavior of consumers. Its corollary is that iPhone and Uber are disruptive innovations, as they significantly changed the behavior of most stakeholders in their respective industry, while Airbnb has not.

There are several avenues for future research that present themselves at this point:

- **Scale development**: It might be possible to develop a scale that reflects the effects of the innovation on the various constituencies in the above definition and then decide on a threshold, above which the innovation constitutes a disruption. This requires a large and comprehensive dataset on technology generations, such as that in Sood and Tellis (2011).
- **Market expansion**: One of the inputs to this scale might be the increase in the size of the market. As shown earlier in this paper, the total market for ground transportation in New York City dramatically increased during the period of fast growth of Uber, from 520,000 rides per month in January of 2015 to about 947,000 in June of 2019.
- **Price elasticity**: One of the measurement that are likely to be used in such scale is the cross elasticity of demand. What will be the price change of the incumbent's as a result of a percent change in the quantity demanded of the disruptive innovation? This is the thrust of the papers by Zervas et al. (2017) and Li and Srinivasan (2019) on the response of the pricing of hotels as a result of the growth of Airbnb.
- **Ranking of disruptions**: Once a scale is developed, ranking of disruptions might be possible. For example, if we compare iPhone to Uber, the former seems to generate a larger response from consumers in all segments as well as related industries, while the latter, despite having disrupted an industry, this has not yet spilled over to related industries such as car manufacturers or rental car companies.
- **Market share**: One may ask if supplanting the incumbent is really necessary for an innovation to be labeled disruptive? Thus for example it is possible that Amazon is disruptive for some industries such as apparel, without reaching 50% market share? On the other hand, reaching 50% market share on its own does not guarantee a disruption as the transition from LCD to OLED in smartphones demonstrates.
- **Segment level analysis**: It is possible that one category or segment of consumers would be more affected than others, as shown in case of Airbnb on tourists vs business customers. Should the definition of disruption then be applied per segment if the change in behavior is large enough?
- **Ethical issues**: In economic terms, there are some indirect benefits to piracy, in that pirates may begin as a reaction to inefficiencies caused by either (state run) monopolies, or (state or city) regulations, compelling the latter to change their policies as the newcomer grows into a legitimate business – see Durand and Vergne's (2012) intriguing book on piracy. In this sense, both Uber and Airbnb can be thought of as modern-day pirates, as they have sustained a continued struggle, often illegal at first, against inefficient regulators while gradually succeeding in changing the industries and regulations in which they operate.

Table 3
Airbnb and hotels in New York City in 2018.Source: AirDNA; Miller (2019).

	No. of rooms/active listings	Average occupancy	Rooms occupied daily
Hotels	121,965	87.3%	106,475
Airbnb	52,254	32.0%	16,703

A listing is "active" if it was available or had at least one booking in the reporting quarter.

Table 4
Airbnb and hotels share in New York City in 2018.Source: AirDNA; Miller (2019).

	Rooms occupied daily	Share of rooms occupied daily	Monthly revenues ($ millions)	Share of monthly revenues
Hotels	106,475	86.4%	$915	91.5%
Airbnb	16,703	13.6%	$85	8.5%

The ethical question we should be concerned with is whether Airbnb and Uber could have succeeded as they did without breaking the law?

What's the difference between Uber and Airbnb? After all, they're both part of the new sharing/gig economy. Well, there are several differences, the major one being that while Uber is part of the sharing economy, as the drivers own the car that they share with the rider, it's not at all clear that Airbnb is. For example in New York City, many Airbnb listings are posted by licensed realtors who simply added another line to their business portfolio (Ferré-Sadurní, 2019). These multi-unit or full-time hosts make up about between a quarter and 60% of Airbnb revenues in cities such as New York, Miami, Los Angeles, and San Francisco (O'Neil & Ouyang, 2016).

Second, while both have affected the respective markets that they entered, the difference lies in the sheer size of the effect. While with the advent of Uber, taxi drivers in major cities such as San Francisco and New York lost anywhere from 75% to 90% of their investment in taxi licenses ("medallions"), and many lost their livelihood as they entered insolvency (Harnett, 2018), this has not happened in the case of Airbnb. In Texas, where Airbnb's penetration is substantial, there has been no effect on either building of new hotels or closures of hotels, and the decline in room prices has been relatively small (Zervas et al., 2017).

Moreover in Austin, where Airbnb is substantial (the largest Airbnb market in Texas despite Austin being the fourth largest city), there's a boom in hotel being built. About 5300 rooms under construction as of December 2018, quite a sizable addition to the current 40,000 rooms currently available in the city (Hoisington, 2019). Similarly, in New York, in 2017, there were about 270 hotels with 40,000 rooms in the supply pipeline across the city: quite a sizable pipeline to be added to the 120,000 current rooms available (NYC Department of City Planning, 2017). In addition, as mentioned earlier, Airbnb's and Uber's respective market shares differ so widely that their effects on their respective markets differ by an order of magnitude.

One observation that might be made with respect to Airbnb in NYC and other major cities is that its growth is stagnant because the city is limiting its growth by imposing further regulations. This comment, however, ignores the piracy mode of Airbnb's operation. As mentioned earlier, Airbnb as well as Uber are modern-day pirates. They enter markets in blatant violation of local ordinances hoping to be able to change these regulations down the road. This mode of operation is inherent to their business model. For example, about two thirds of Airbnb's revenues in NYC come from rental that is illegal under current city and state law (Wachsmuth et al., 2018). Airbnb knows this full well, but refuses to cooperate with the city in order to curb these illegal activities, as doing so would erode its revenues and profits. As this is their mode of operation, it is within the usual course of business that cities and states push back.

This is another point of difference between Airbnb and Uber. The regulations with respect to taxi drivers and specifically the medallion system were originally designed to protect drivers against unruly competition, rather than consumers, who were benefitting from the low costs of the service. Thus when Uber entered a city, public sentiment was in most cases favorable, and the regulations were amended so as to accommodate the new service (Hoyt & Callander, 2012). In contrast, hotel regulation, especially with respect to zoning, is designed to balance visitors' needs against local needs and to protect neighborhoods and communities (Cook, 2010; Fontan, 2019). Local sentiment that might have been positive initially has turned against Airbnb, as these house rentals and "ghost hotels" (Wachsmuth et al., 2018) are blatantly ignoring zoning.

On disruption hype: Marketing has not yet succumbed to the hype and hard sell that surround disruption such as the notion of "Big-Bang Disruption" with its images of collapsing buildings and dire warnings that your business will be "destroyed overnight" (Downes & Nunes, 2013). But given the growth in the number of MBA students choosing strategy and consulting, and the trickle down of Trump-like rhetoric, perhaps we should reconsider. After all, frightening people about an eminent collapse surely gains more attention than does cool-headed discussions about confusion matrices and the advantages of adaptive conjoint.

Disruption theory has taken a wrong turn in the last decade, and marketing academics have the tools to take up the challenge of investigating the important issue of disruption as a marketing subject that is imbedded in innovation diffusion and new product growth.

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