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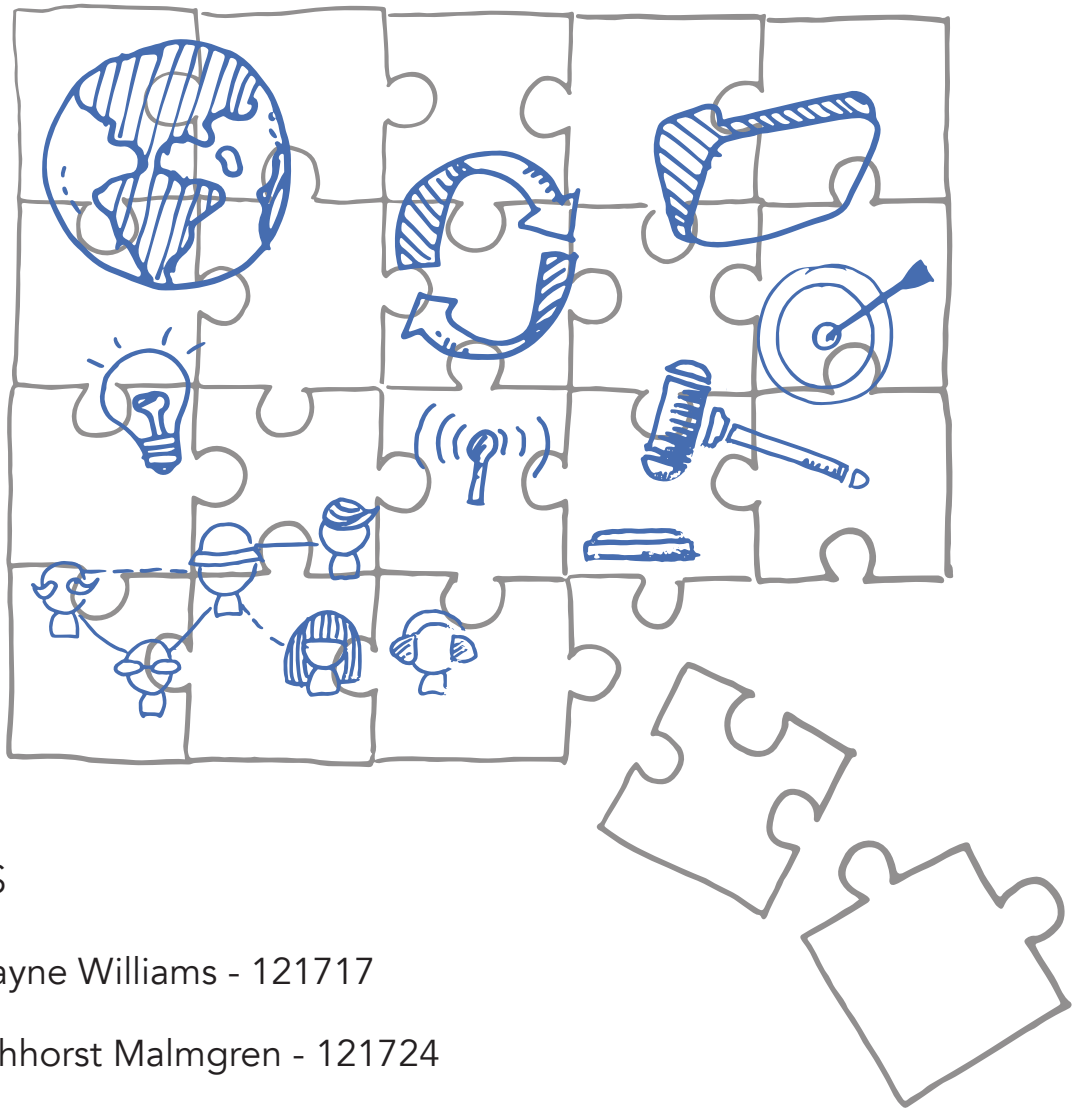
THE PLATFORM POLICY PUZZLE

Forms of Regulating Multi-Sided Platforms in Nine European Cities

MASTER THESIS

MSc in E-Buisness



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Abstract

It is no surprise that many believe platforms are a 21st-century tech innovation given the hype around emerging platform businesses in this day and age. Driven by rapid technological advancements, Multi-Sided Platforms have disrupted a vast majority of established industries in the past two decades. However, incumbent firms are raising concerns regarding unfair competition, labourers about the lack of social benefits, tax authorities about the loss of income, citizens about increasing housing prices, the list goes on. The common denominator is that, due to their technological infrastructure, platforms have often been able to circumvent existing legislation. Although qualitative research has been done regarding forms of regulating MSPs, little quantitative research has been done. In order to bridge this gap, a mixed method approach is adopted analysing effective forms of regulation MSPs. In order to contextualise the study nine cities within Europe has been chosen, namely: Amsterdam, Barcelona, Berlin, Brussels, Copenhagen, Lisbon, London, Paris, and Vienna. By grouping the cities based on their regulatory motivation, the effect of the various forms of regulation have been analysed in order to answer the research question at hand. The study found that the motives behind a city's regulatory intervention play a crucial role in what forms of regulation is implemented. Furthermore, cities can introduce the same regulatory mechanism to address certain policy issues although having different underlying motives. The effect of regulatory intervention varies across the cities with the level of enforcement playing an essential role. A transparent relationship between MSP and legislators with the sharing of both data and knowledge to make informed decisions is necessary. By adopting a co-regulatory approach and involving outside intermediary parties, legislation can be more flexible and unfragmented. The existing regulatory environment does not suit the rapidly evolving digital age we are living in.

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List of Abbreviations

AG	Advocate General
API	Application Programming Interface
CBS	Copenhagen Business School
CEO	Chief Executive Officer
EC	European Commission
ECJ	European Union Court of Justice
EH	Entire Home
EU	European Union
GDPR	General Data Protection Regulation
IFRS	International Financial Reporting Standards
IPO	Initial Public Offering
ISP	Information Service Provider
MSP	Multi-Sided Platform
PPP	Purchase Power Parity
RQ	Research Question
SH	Shared Home
STR	Short-term Rental
UK	United Kingdom
US	United States

1. Introduction

It is no surprise that many believe platforms are a '21st-century tech innovation' given the hype around emerging platform businesses in this day and age (Fisman & Sullivan, 2016). Driven by rapid technological advancements, Multi-Sided Platforms (MSPs) have disrupted a vast majority of established industries in the past two decades (Evans & Schmalensee, 2016). MSPs create value primarily by enabling direct interactions between two or more distinct groups (Hagiu, 2014). Platforms offering innovative alternatives operate within sectors such as accommodation, transportation, retailing, labour, and social networking. Prominent examples include Airbnb, Uber, Amazon, Upwork, and Facebook (Morozov, 2015). Out of the six most valuable companies worldwide, five of them are platform businesses (Yoffie, Gawer, & Cusumano, 2019). However, platforms are not a new phenomenon per se (Evans, 2009; Fisman & Sullivan, 2016). To illustrate, dating back to the 12th century, Champagne Fairs were hosted in the county of Champagne, France, connecting merchants and financiers from all around Europe (Fisman & Sullivan, 2016).

In 2016, there were over 170 platforms valued at least one billion dollars (Pey, 2018). At first glance, it comes as no surprise. As a consumer, what is not to love? Airbnb offers more personal and cheaper accommodation than the hotel industry while Uber provides a more convenient and cheaper transportation service than the taxi industry. From this perspective, it almost appears to be a win-win situation. However, every light has its shadow. Incumbent firms are raising concerns regarding unfair competition, labourers about the lack of social benefits, tax authorities about the loss of income, citizens about increasing housing prices, the list goes on. The common denominator is that, due to their technological infrastructure, platforms have often been able to circumvent existing legislation (McKee et al., 2018). While advancements in technology occur at a rapid pace, regulatory changes is expensive and slow. It requires time and knowledge to investigate and adapt to new situations. As a result, laws are outdated and ill-suited for the digital age we are living in.

Furthermore, legislators face pressure from various stakeholders regarding this concern. Critics of regulating MSPs argue that laws could stifle innovation and hinder the economic and social benefits thereof. On the other hand, supporters emphasize the importance of a level playing field as well as safeguarding public interests. As for consumers, they want cheap prices and innovative solutions. Governments worldwide are struggling with these topics and as has become evident, it is no easy task. Especially since the platform revolution has disrupted various industries, the legal landscape of each MSP differs immensely. A regulation that applies to the taxi industry may not be relevant in a different industry. Finding a well-functioning regulatory framework, which takes all involved stakeholders interest into consideration is a task that puzzles policymakers around the world.

Several academics have conducted research regarding the policy issues of platforms. Thelen (2018) investigate the comparative politics of the platform economy by using Uber as a case study. She explored three countries where the reception and subsequent regulatory responses differed: the United States (US), Germany, and Sweden. The findings were that in the US, policymakers had gone towards a deregulation of the existing taxi industry to suit Uber, Germany had taken a defensive approach, and Sweden had adapted legislation to include transportation platforms without jeopardizing its operation. Thelen emphasize on the importance of recognising and addressing the different political attitudes to certain issues in different countries. She concludes that a shared trigger may mobilise different actors and lead to different regulatory approaches depending on local political landscapes. Nieuwland and van Melik (2018) assess key challenges 11 European and American cities face when regulating short-term rental (STR) platforms as well as their reasoning behind specific regulatory approaches. They find that although the cities' rationale for regulation are similar, the approaches and consequences vary per city. Furthermore, Nieuwland and van Melik (2018) questions the effectiveness of regulations of STRs since the enforcement remains extremely difficult. They conclude that there is no-size-fits-all solution to regulating STR platforms. Guttentag (2017) performs a similar study although specialising on Airbnb and cities across the world. In line with Nieuwland and van Melik (2018), he concur that there is not one single way of regulating Airbnb and that regulators must address specific problems in their communities when forming legislation.

Surprisingly, very few quantitative studies regarding platforms in general have been conducted. Furthermore, the ones that exist are more specialised focusing on for instance Airbnb's impact on housing prices (Barron, Kung & Prosperio, 2017; Zervas, Proserpio & Byers, 2017). In other words, the relationship between a platform's operation and a certain issue within a city. While existing qualitative literature examines how cities around the world have regulated platforms and their underlying motive, there is to our knowledge, no quantitative study investigating the effect thereof. Possible reasons may include difficulties in retrieving data to assess causal relationships since not all platforms provide enough information by using scraping methods. Additionally, many regulatory interventions have been implemented quite recently, hence quantitative studies may simply not have been published yet. Furthermore, existing literature within the field often focus on the North American region where many platforms originate.

In order to bridge the gap in the existing literature, we combining qualitative and quantitative data with the hope to uncover interesting findings that would have been less feasible by simply using one approach. That is, a sequential mixed methods approach has been conducted. However, only descriptive and exploratory quantitative analysis have been performed, meaning without statistical test. Subsequently, the quantitative findings are not used to determine cause and effect relationships. Nevertheless, by using a mixed methods approach, the underlying motives behind regulatory

intervention, the chosen forms of regulation, and the subsequent evaluation of how well these forms of regulation worked in achieving the regulatory objectives, can be investigated. In other words, this paper not only aims to bridge the gap, but also to close the circle. With that being said, this paper aims to answer the following research question (RQ): *What are effective forms of regulating multi-sided platforms?* In order to contextualise the study and further bridge the gap, nine cities within Europe has been chosen, namely: Amsterdam, Barcelona, Berlin, Brussels, Copenhagen, Lisbon, London, Paris, and Vienna. Furthermore, the STR platform Airbnb have been chosen as it is a much disputed topic. The cities are all capitals that have different motives and objectives by regulating the platform as well as have implemented various forms of regulation. By grouping the cities based on their regulatory motivation, the effect of the various forms of regulation have been analysed in order to answer the research question at hand.

The study found that the motives behind a city's regulatory intervention play a crucial role in what forms of regulation is implemented. Furthermore, cities can introduce the same regulatory mechanism to address certain policy issues although having different underlying motives. The effect of regulatory intervention varies across the cities with the level of enforcement playing an essential role. A transparent relationship between MSP and legislators with the of sharing both data and knowledge to make informed decisions is necessary. By adopting a co-regulatory approach and involving outside intermediary parties, legislation can be more flexible and unfragmented. The existing regulatory environment does not suit the rapidly evolving digital age we are living in.

The remainder of this thesis is structured as follows: First, a review of the literature will be presented followed by the contextual setting this study is based on. Chapter 4 describes the methodology including the research philosophy, -approach, and -design. Next, the data analysis and findings will be provided, which is split into two parts. The first part addresses the qualitative section of the analysis. The second part addresses the quantitative section of the analysis including the data processing of which it is based upon. Subsequently, the findings will be discussed in light of the analysis and theory. Lastly, a conclusion of this thesis will be provided.

2. Literature Review

This chapter will review relevant topics relating to the problem statement. To provide a general understanding, both MSPs and the sharing economy will be reviewed in order to provide the reader with a basic understanding of the phenomenon. Thereafter, the topic will be approached from a regulatory point-of-view. Concluding this chapter, related literature will be explored.

2.1. Multi-Sided Platforms

Pioneering models of MSPs originate from Rochet and Tirole (2003), who used the term first, but models had been studied before by Parker and Van Alstyne (2000) and Caillaud and Jullien (2003). In 2014, Hagiu defines MSPs as 'technologies, products or services that create value primarily by enabling direct interactions between two or more customer or participant groups'. Later, Hagiu and Wright (2015) emphasize that MSPs have two essential components above any other prerequisite, which can be seen in Figure 1. The first feature is that they 'enable direct interactions between two or more distinct sides'. This implies that the distinct sides of the platforms are in charge of the main conditions of the interaction and that the intermediary does not take charge of these conditions. The second feature states that 'each side is affiliated with the platform' (p. 163), indicating that users on each side make platform-specific investments that are required for them to be capable of directly interacting with one another (Hagiu & Wright, 2015).

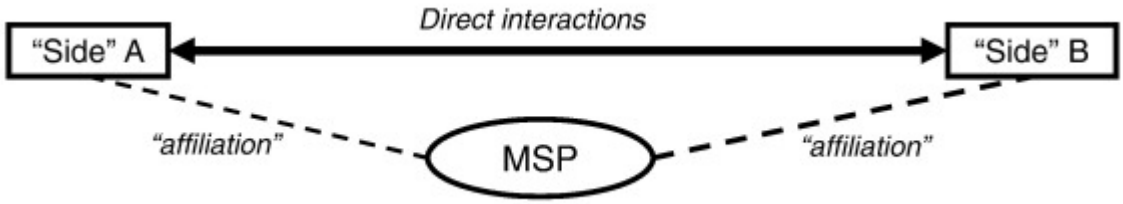

Figure 1. MSPs (Hagiu & Wright, 2015)

It is important to note that due to the purpose of this paper the focus will be on digital MSPs. Therefore, the terms MSPs, digital platforms, and platforms will be used interchangeably throughout the paper. Platforms serve as intermediaries that facilitate economic transactions. Their elemental function is to reduce transaction costs and enable distinct groups to find each other and interact. Specifically, they decrease transaction costs by facilitating searching, negotiating, and enforcing transactions. For instance, Airbnb connects hosts and guests, Uber connects drivers and riders, Amazon connects buyers and sellers, and Google's Android Operating System connects application developers, users and handset manufacturers (Hagiu, 2014). Different types of platforms differ in the extent to which they are involved in these activities (Evans & Schmalensee, 2011). Nevertheless, one of the key challenges of all these platform businesses is actually getting the sides to join.

Network effects are defined as the effect that the number of platform participants has on the value created for each participant. The effect can be both cross-side or same-side, and positive or negative (Van Alstyne, Parker & Choudary, 2016). One of MSPs' key characteristics is the existence of cross-side network effects, also known as indirect network effects (Evans, 2009; Evans & Schmalensee, 2011). They refer to the fact that the value to participants on one side of the platform increases with the number of participants on the other side of the platform (Hagiu, 2014; Parker et al., 2016). Van Alstyne et al. (2016) refer to the effect as the 'driving force behind every successful platform'. Furthermore, as Metcalfe's law suggests, the value of the network increases with the number of users who join it. For instance, in the case of the STR platform Airbnb, the value to guests increases, when the number of hosts on the platform increases as they have more listings to choose from. The value to hosts increases, when the number of guests on the platform increases as there is a higher probability that their listing will be booked. However, too many host listings on the platform can cause negative cross-side network effects as the search costs for guests increase once again. This is also known as information overload (Parker et al., 2016). Same-side network effects are commonly referred to as direct network effects (Evans & Schmalensee, 2010). In other words, the term refers to the impact users from one side of the platform have on users on the same side of the platform (Parker et al., 2016). In the case of the ride-sharing platform Uber, a negative same-side network effect is the existence of too many drivers. As a result, the competition to get customers increases between them. To that end, network effects play a crucial role in the process of getting both sides of the platform onboard (Rochet & Tirole, 2003).

Due to the aforementioned cross-side network effects, MSPs are faced with the so-called chicken-and-egg problem. This refers to the fact that neither side of the platform will join without the other side joining first (Caillaud & Jullien, 2003; Rochet & Tirole, 2003; Evans, 2009). Furthermore, it is crucial for a platform to reach critical mass, meaning that both sides of the platform need to have enough users to generate sufficient value. By reaching a critical mass, platforms can attract additional users to each side in order to ignite organic growth (Evans, 2009). Simply not being able to overcome the chicken-and-egg problem, as well as not reaching critical mass is a reason why many MSPs fail (Parker et al., 2016). If a platform does not achieve critical mass, users who have joined are inclined to stop engaging because the platform does not offer sufficient value and new members have no incentive to join (Evans, 2013). Having said that, problems may arise if one side of the network grows unproportionally large in comparison to the other side/s. Airbnb for instance, addresses this issue by recruiting hosts from their installed base of guests. This is referred to as side switching. In general, platforms often enable users to be both on the supply and demand side simultaneously. This method further stimulates the growth and scaling of platforms. Thus, platforms can work towards a long-term equilibrium (Parker et al., 2016).

A further strategy to growing the platform is through its pricing structure (Evans & Schmalensee, 2011; Parker et al., 2016). Earlier works on MSPs put a focus on the uncommon pricing scheme, which

differed from markets without network effects (Caillaud & Jullien, 2003; Rochet & Tirole, 2003; Armstrong, 2006). In contrast to traditional pipeline businesses, platforms hardly ever charge all users. Determining what side to charge can be a challenging decision when considering the different aspects of each user group, including their economic situation, motivations, and the amount of value they get from the platform (Parker et al., 2016; Yoffie et al., 2019). With this in mind, there are several pricing structures that attempt to get one side of the platform on board, encouraging the adoption of the other side (Armstrong, 2006; Parker et al., 2016). Examples include subsidizing, versioning, and facilitating (Bhargava & Choudry, 2001; Evans, 2008; Parker et al., 2016).

Subsidizing refers to discounting access for one side of the platform at the expense of the other side (Parker & Van Alstyne, 2005; Evans 2008). The reason is that one side of the platform is of significant importance to the other side, but not vice versa. For example, Facebook does not charge users to sign up, however, advertising companies are charged to advertise on their platform (Parker et al., 2016). Versioning is defined as offering numerous versions of a product or service that differ in the level of quality and in price (Bhargava & Choudry, 2001). The music streaming platform, Spotify, provides its users with both a freemium version and a premium version they can choose from. As the naming convention indicates, the freemium version is free of charge and the premium version is based on a subscription fee (Spotify, n.d.). Lastly, facilitating refers to the fact that specific platforms facilitate transactions amongst distinct groups of individuals. Since users only pay a transaction fee when a transaction takes place, they are not discouraged from joining. For instance, on Ebay, buyers and sellers are charged a transaction fee only once a transaction takes place. Hence, just by signing up, sellers can upload their content and buyers can browse the platform content without being charged (Parker et al., 2016). However, this results in low switching costs for users and leads to them often engaging in so-called multihoming (Caillaud & Jullien, 2003). The term refers to users utilizing more than one platform for similar purposes. Examples include a rider or driver using Uber and Lyft and a host or guest using both Airbnb and Homeaway (Parker et al., 2016).

2.2. The Sharing Economy

The concept of sharing resources is not a new occurrence. In 1948, car sharing was first introduced in Zurich, Switzerland and was particularly popular in Northern Europe in the 1980s (Shaheen et al., 1999; Bardhi & Eckhardt, 2012; Codagnone & Martens, 2016). It was managed by numerous small and community-based cooperatives, whose motivations were not profit-oriented. However, information costs were high which prevented initiatives of this type from scaling up. In recent years, information costs have fallen considerably and coordination costs for sharing activities have decreased correspondingly due to significant advances in digital technology (Matzler et al., 2015; Codagnone &

Martens, 2016). Especially the emergence of MSPs facilitated the major growth that the sharing economy has experienced (Botsman & Rogers, 2010).

Defining the sharing economy is not easy since the literature on this topic is quite fragmented (Frenken & Schor, 2017). As the pioneer of the sharing economy, Botsman (2013) criticizes, terms such as sharing economy, collaborative consumption and peer-to-peer are used interchangeably even though they have different meanings. Keeping the purpose of this paper in mind, the focus will be on the definition of the sharing economy. Botsman (2015) defines the sharing economy as 'an economic system based on sharing underused assets or services, for free or for a fee, directly from individuals'. Furthermore, Schor (2014) categorizes sharing economy activities into four groups: The recirculation of goods, the increased usage of durable assets, the exchange of services, and the sharing of productive assets. An example of the first category is Ebay, which facilitates the redistribution of unwanted commodities. The second group enables a more intense usage of durable goods and other assets. Examples include Airbnb and Lyft. The third category matches freelancers with local demand such as TaskRabbit. The last practice involves sharing space or resources in order to allow production rather than consumption, such as co-working spaces.

Given the diversity of sharing activities, it is no surprise that motives for participating in the sharing economy differ. Incentives include social, economic and environmental factors (Schor, 2014; Frenken & Schor, 2017). From a social perspective, participants wish to expand their social network. Sharing economy platforms often advertise this characteristic. Airbnb, for example, puts an emphasis on meeting locals and being part of the Airbnb community when campaigning (Airbnb, 2018a; Airbnb, 2018b; Airbnb, 2018c). In general, platforms like to market themselves as being part of the sharing economy due to the positive symbolic value the word sharing brings with it (Frenken & Schor, 2017). From an environmental perspective, the sharing economy is said to have a positive impact. The reason for this is that the more people share, the less resources will be consumed, establishing a more efficient and sustainable manner of consumption. However, research suggests that the expansion of the sharing economy is mainly due to economic self-interest amongst the consumers rather than sharing. Consumers prefer lower costs, which firms in the sharing economy tend to offer in comparison to alternatives in the market (Schor, 2014; Maltzer et al., 2015). Supporters of the sharing economy state that it brings many advantages, such as improved resource allocation and usage, additional income from the users of those services, empowerment of regular people, as well as new economic activities for cities (Schor, 2014; Quattrone et al., 2016). In contrast, opponents argue that the negative externalities arising from the sharing economy by far outweigh the advantages (Schor, 2014).

Sharing is defined as 'a form of social exchange that takes place among people known to each other, without any profit' (Eckhardt & Bardhi, 2015). However, Belk (2014) argues that Internet technologies

have enhanced a new generation in sharing, which he defines as 'pseudo-sharing - a wolf-in-sheep's-clothing phenomenon whereby commodity exchange and potential exploitation of consumer co-creators present themselves in the guise of sharing'. Similarly, Eckhardt & Bahrdi (2015) state that the sharing economy is much rather an economic trade in which consumers pay to use another individual's goods or services for a limited time period. Consumers are not interested in the social connection but above all, their incentive is economically driven. In order to differentiate between sharing and pseudo-sharing, the characteristics of the latter can be considered. These include money, self-centered motives, expectations of reciprocity and lack of a sense of community. When comparing Couchsurfing and Airbnb, the previously mentioned characteristics become evident (Belk, 2017). Couchsurfing hosts offer guests a place to stay free of charge. It is even forbidden to charge guests for staying at one's home. Social relationships are often formed and are the main motive for individuals to sign up (Couchsurfing, n.d.). In contrast, Airbnb guests are charged money by hosts for staying at their homes (Airbnb, n.d.a). Often, the communication is solely handled through the platform meaning that most commonly, guests and hosts never meet. An individual's motivation to sign up is profit-oriented rather than for making social connections (Belk, 2017). To summarize, the term sharing economy has become an umbrella term for a variety of 'nonownership forms of consumption activities' (Habibi, Davidson, & Laroche, 2017) that include bartering, renting, exchanging, sharing and swapping.

2.3. Regulating Multi-Sided Platforms

For as long as disruptive technologies have changed the way people live and operate in society, governments have struggled with the balance between regulation and innovation. For instance, the development of the automobile industry was hindered by decades due to strict laws that, among other, limited the speed to eight km/h in order to protect pedestrians (Loomis, 2015; Eggers, Turley & Kishnani, 2018). These laws were not designed for automobiles per se, but rather for horse carriages and cattle. At the other extreme, children's toys containing radioactive materials were sold for over 15 years after the dangerous side-effects were discovered, due to the slow response of legislators (Crezo, 2012). These historical examples illustrate the dangers of both over- and under regulation as well as the consequences that may arise when interpreting emerging technologies in outdated legislation.

Today, policymakers are facing the same discussion and issues. Following the rapid expansion of digital platforms, discussions on if and how they should be subjected to regulatory frameworks has been widely debated. As much of the existing legislation around the world is based on post-industrial revolution technologies, platforms' technological infrastructure has often, at least initially, led them to be able to circumvent existing legislation (Finck, 2017; McKee, Makela & Scassa, 2018). For instance, Uber has famously claimed that they are not a taxi company nor an employer, but a technology company simply

allowing two independent parties to interact (McKee et al., 2018). As a result, heated disputes have emerged regarding topics such as consumer protection, unfair competition, tax, and labour rights, as well as platforms' impact on other sectors and society in general (Parker et al., 2016). Some nations and cities have gone as far as completely banning certain platforms, while others are adapting a more laissez-faire approach (McKee, Makela & Scassa, 2018). After all, the popularity amongst consumers experiencing numerous benefits have allowed platforms to thrive, making them subjective to regulatory disputes in the first place.

However, there is no reason to believe that policymakers will let platforms operate without any regulation or supervision (Parker et al., 2016). Even opponents of platform regulation argue that the idea that a complete free market functioning effectively is highly unlikely (Finck, 2017). The question is rather, what kind of regulatory framework will safeguard public interests, while at the same time allowing for innovation and economic development? Furthermore, as platforms are often transnational in nature, but have local impacts, on what level should they be regulated? These questions of if, how, and who should regulate platforms are puzzling policymakers and have resulted in divergent opinions. In contrast to the previous industrial revolution, a new regulatory concern is the rapid pace of technological advancements, which adds complexity (Finck, 2017). One thing is for certain, the platform economy is here to stay and a huge amount of uncertainty regarding the regulatory dimension of this paradigm shift prevails.

2.3.1 Reasons to Regulate

Those in favour of strict regulations often refer to the negative externalities that platforms may impose on society. Negative externalities concern when a non-user is affected by a platform's activity (Edelman & Geradin, 2016). Non-customers do not have a contractual relationship with the platforms, which they could use to shape the platform's behaviour, nor can they simply avoid interaction with the platform to escape its effect. For instance, a pedestrian who is concerned about the quality of an Uber driver's driving or whether they are insured or not, cannot walk elsewhere. Increasing housing prices affect all residents of a neighbourhood, regardless if one uses Airbnb or not. Amazon may drive small local stores out of business, even though one never shops there.

As described under section 2.2. it has become clear that sharing economy MSPs are not only used to share idle capacity or underutilised assets. New resources are brought to the market by private individuals in profit maximisation purpose (McKee et al., 2018). As previously mentioned, lack of proper insurance coverage has been one of the most debated negative externalities regarding sharing economy platforms in particular (Parker et al., 2016). Insurance companies have started to implement clauses in their products, where they disclaim responsibility for 'commercial activity'. Although it

might be difficult to enforce and monitor such clauses, the problem remains. If goods, ranging from tools to vehicles, are to a growing extent being utilised more, they will be worn out faster. Existing guarantees might need to be shortened and everyone's insurance premiums will have to rise to cover the costs for it (Parker et al., 2016; Munkøe, 2017). It is a recurring economic problem, that bystanders carry the costs of negative externalities and not the companies by whom they are created (Parker et al., 2016).

Despite contributing with tremendous value to society, both monetary and otherwise, platforms are still mostly private companies with the primary goal of generating revenue (Edelman & Geradin, 2016). In this regard, they differ from actors within the public sector, who might have the requirement to provide a universal service, i.e. serving all customers without discrimination. Taxi companies generally have the requirement to have wheel-chair adapted vehicles in their fleet and the same principle applies to the hotel industry. Since specially designed vehicles and hotel rooms are more expensive than their 'regular' equivalent, companies usually distribute the costs across all their products. As a result, non-wheel-chair adapted taxis or hotel rooms are exposed to a surcharge to compensate for the cost increase. The question whether platforms should be liable to provide a similar universal service as incumbent firms within their respective industry, causes an ongoing discussion, which is closely related to unfair competition and practises, which will be reviewed in the following section.

When reviewing the governmental purpose of ensuring equal accessibility to goods and services in further detail, platforms have in addition been criticized for not taking the appropriate actions against discrimination. A study by Edelman, Luca, & Svirsky (2016), conducted in the US, found that African-American individuals are 16% less likely to be accepted as an Airbnb guests compared to identical white individuals. Furthermore, they show that the racial discrimination produces negative economic impacts for hosts, and in extension, the platforms, as they are only able to find a replacement in 35 % of the cases.

Traditional industries that have faced serious competition from their platform counterparts, argue that they should be regulated in a similar manner. Sectors, such as transportation, hospitality, and finance, are subjected to industry specific laws that platforms generally have been able to avoid (McKee et al., 2018). The main argument is that in reality, the good or service manifests itself in the same manner as provided by traditional actors, and thus it should be considered unfair competition (Danish interview). For instance, both the taxi- and hotel industry are in many cases subjected to licensing regimes. According to McKee (2018), a license 'constitutes the conditional permission to engage in an activity that would otherwise be prohibited'. Furthermore, these licenses often come with requirements that firms must fulfil and comply with. At times, it has led to violent protest calling for government intervention, for instance, when French taxi drivers protested against Uber (The Guardian, 2016).

As previously mentioned, platforms have different pricing structures (see section 2.1). Subsidizing, for example, is when one side is charged less on the expense of the other side. Under European Commission (EC) law, it can be considered an abuse of dominance to price too low, so-called predatory pricing, in order to push out competitors (Evans, 2008). Furthermore, as positive network effects have allowed for platforms to rapidly grow and in some cases dominate entire markets, numerous legal cases have illustrated the importance of equal platform access and competition law (Parker et al., 2016). For instance, in 2017 Google received a fine of 4.34 billion Euros from the EC for favouring their own services and operating systems while simultaneously blocking out their competitors (EC, 2018). Similarly, Amazon was criticized for removing pre-order buttons and allegedly delaying orders for books provided by a French publisher following a dispute (Parker et al., 2016). Such abuse of market power may legitimate government intervention in order to ensure consumer welfare. Furthermore, innovation and technological improvements risks being stifled if platforms are allowed to act protectionist rather than in a dynamic competitive market. The power of network effects that may slow down or even prevent the adoption of new, perhaps better, technologies is referred to as excess inertia (Parker et al., 2016). In 1997, the developer of the Java programming language, Sun, sued Microsoft for making their operating system incompatible with the language (Graham, 1999).

Closely connected to unfair competition, is the question of taxation. Platforms that compete with incumbents might not be subjected to the same taxation schemas. Amazon has been heavily criticized for avoiding taxation e.g. through re-investments in their business even though having made billions of dollars in profit (Davis, 2019). The same applies for transportation and accommodation providers, such as Uber and Airbnb, that may avoid taxation through simply not being defined as a taxi or hotel business (Thelen, 2018). In this regard, the policymakers are more aligned. Governments must raise revenue to ensure public functions to operate and if the market upon which it is collected changes, then so must the tax collection system (Edelman & Geradin, 2016). Otherwise, local tax collections may be severely reduced if traditional players are losing market share and platforms that are not physically present within a city or country can escape taxation although operating within its borders (Parker et al., 2016).

As previously mentioned, the main regulatory goal is to protect consumers and ensure welfare. Yet again, platforms have been operating in a grey zone in terms of definition regarding the supply side. In many countries employees are entitled to certain benefits, e.g. pension, paid sick days, and the possibility to negotiate collectively through labour unions (Parker et al., 2016; McKee et al., 2018). Furthermore, in nations such as the US, health insurance is usually provided by the employer (Parker et al., 2016). Individuals who offer their service for a living, for instance through transportation or labour platforms, are often not subjected to these rights. If platforms were to be subjected to provide

the same protections as traditional employees, the possibility of multihoming, i.e. people using several competing platforms, adds additional complexity.

'Data is the new oil' - a term coined by the British mathematician and developer of Tesco's loyalty program, Clive Humby, that dates back to 2006 (Marr, 2018). Although opinions differ regarding the legitimacy of the quote, it illustrates the importance of the topic and the potential for harm. Uber made massive headlines when a top manager allegedly retrieved information about a journalist he was scheduled to meet with (Kennedy, 2015). Although controversial, it may not be illegal. Platforms are in this regard protected by legal regimes concerning copyright and intellectual property (Scassa, 2018). It is considered to be proprietary to them. Although, usually advocating for a relaxed regulatory framework, platforms want to mobilise and protect their data as they consider it to be a strategic business asset (McKee et al., 2018). The lack of supervision and information risks impeding the public interest (Scassa, 2018). In contrast, platforms claim that they have a positive impact on the economy and consumer welfare, which can be proven by the data (Finck, 2017). However, critics argue that since only platforms themselves have access to the data, and the data they choose to share are subsets controlled and owned by them, it is difficult to evaluate their proper impact (Finck, 2017; Scassa, 2018; Zimmer Christensen, 2019). As Edelman and Geradin (2016) suggest, platforms' direct access to information regarding user activity indicates that they are all the more susceptible to regulations, not less.

2.3.2 The Dangers of Over-Regulation

The main argument for people opposing regulation of platforms is that existing legislation is both outdated and protectionist in nature (Edelman & Geradin, 2016). As previously mentioned, existing laws are often based on technology originating from after the industrial revolution and ill-suited for the platform economy (Finck, 2017). Furthermore, opponents emphasize the risk of regulatory failure as especially relevant in the case of evolving technology and that market failures are often best addressed by the market mechanisms themselves (Parker et al., 2016). Nobel Prize laureate, George Stigler (1971) states that market participants will influence regulation in favour of their own interests rather than the public welfare, which in turn will worsen the market problem. He refers to this as 'regulatory capture'. Parker et al. (2016) exemplify this as policymakers and government agencies often must turn to business leaders and other organisations for advice on how to form legislation, which could end up benefiting incumbents rather than the general public. In addition, politicians often combine their political career with projects within the private sector either before, during, or after their term in office (Edelman & Geradin, 2016). As a result, politicians may end up offering advice to companies on how to best evade current legislation in order to maximise their profit.

Such protectionist regulation and regulatory capture risk benefitting the incumbents on the expense of new entrants and society at large (Edelman & Geradin, 2016). Traditional industries can subsequently use regulation to block out competition and the competitive market that platforms entail (Parker et al., 2016). For instance, a study by Allen and Berg (2014), show that Uber matches supply and demand more efficiently than the regular taxi industry. This could be an effect of their dynamic pricing mechanisms, which attracts more drivers during peak hours and subsequently can offer rides to more passengers. Incumbent taxi operators naturally benefit from a fixed license quantity since they can benefit from both charging a higher price and by selling the license itself on the secondary market. In 2011, before the launch of transportation providers such as Uber and Lyft, a taxi medallion, i.e. a license, in New York City was worth more than one million dollars (Perry, 2014). Although the price has dropped significantly in the last few years and today worth a little over 100.000 dollars, it illustrates the arbitrage opportunities that exist and why many consider it to be regulatory-driven market failure (the price in May 2019 insert footnote with current price). Naturally, the license holders want to protect their investment, but worth noting is that the number of medallions have not changed since 1937 (Parker et al., 2016). Nevertheless, an increased supply when the demand is high benefits consumers and increases the customer experience. The latter seems to confirm the possibility of regulatory capture (Edelman & Geradin, 2016). The same principle applies to other industries as well, e.g. accommodation, and product marketing. Platforms have often illustrated the need for relaxed regulation of existing industries by proving how efficiently markets can perform (Kennedy, 2015), especially in terms of increased efficiency and customer experience.

Another purpose of regulatory intervention is to establish trust in markets and protect consumers from being fooled (Finck, 2017). For instance, governments ensured that hotels had proper safety standards through legislation and different interest organisations created hotel stars systems to inform consumers about the hotel's quality standard (Parker et al., 2016). Today, many platforms enforce their own trust mechanisms often in the form of reviews and rating systems. The information asymmetry has decreased significantly with the Internet and platforms may now simply implement what governments have previously done more efficiently in terms of trust enforcement.

Although there are numerous legitimate arguments of why the platform economy has undermined consumer protection and labour contracts, critics argue that platforms simply shed light on faulty systems in society and that regulating platforms is not a technical problem, but a political one (McKee et al., 2018). In a better world, health insurance and pension should not be dependent on ones' employer. Those benefits are ultimately paid for by the employee anyway and should be equally accessible for all working individuals (Kennedy, 2015). It would decrease the reliance on one's employer, which is becoming increasingly relevant as individuals appreciate the flexibility and independence it entails. Furthermore, externalising labour by classing workers as contractors rather than employees is not a new

phenomenon although the extent of it has increased with the platform economy (McKee et al., 2018). The same argument, that the existing system is the problem, not platforms, applies to the industries subjected to licensing regimes. In line with the example of the New York City taxi medallion systems in the previous section, the original thought was not to create a secluded and protectionist market. The system was established during the Great Depression in order to prevent competition to drive prices down to unreasonably low levels (Edelman & Geradin, 2016). In other words, it was implemented to protect the drivers. Additionally, licensing has been an effective method of collecting tax revenue and has in numerous cases simply been used as an indirect tax (McKee, 2018). To summarize, licensing has been, a powerful regulatory tool for governments to protect consumers and ensure public welfare. However, as time has passed and brought unintended consequences, perhaps there are other more effective ways for governments to ensure that the same objectives are met.

As previously mentioned, platforms have grown rapidly due to the fact that they create value to a large group of individuals. Regulatory intervention may stifle growth and innovation that improve consumers access to goods and services (Parker et al., 2016; Finck, 2017). In extension, this is a restriction against market forces that increases the amount of goods and services that the common individual is able to own, control, and profit from (Boudreaux, 2015). Simply put, the platform economy is a win-win-situation for both consumers and companies alike. As a motive by government policymakers is to ensure consumer welfare, they must take this into consideration.

2.3.3 Regulatory Setting

As discussed in the previous two sections, there are legitimate arguments in favour of both regulating and not regulating the platform economy. Policymakers are facing a complex dilemma of promoting innovation and economic growth, while at the same time safeguarding public interests and ensuring consumer welfare. However, as Lobal (2016) suggests, legal disruption is not a side-effect or product of the platform economy, it is a core feature. Digital platforms challenge the law, showing the need for updated regulations. Some even build their business model around it, with changing the law as goal, which Pollman and Berry (2016) refer to as ‘Regulatory Entrepreneurship’. Important to bear in mind is that technological disruption is not a new phenomenon, nor is the political reaction towards it (Kennedy, 2015). In the United Kingdom, high-skilled textile workers protested against the introduction of machines, which low-skilled employees could operate. Similarly, travel agents have had to adapt to the fact that travellers can now book flight tickets themselves. Nevertheless, there is significant tension between those in favour of strict legislation versus those promoting a relaxed laissez-faire approach regarding regulating platforms (Parker et al., 2016).

In its Communication on Online Platforms and the Digital Single Market, the EC discussed three different approaches of legislation: top-down legislation, self-regulation, and co-regulation (European Commission, 2016). Since this paper focuses on cities within the EU, it will subsequently be the focus. However, as both the motives and regulatory approaches of the cities are seen elsewhere in the world, it is still relevant for cities outside of the EU.

Closely related to the question of how platforms should be regulated, is on what level it should take place. Platforms today are subjected to both local, national, and supranational frameworks. Since they often have a global reach, experts and platform representatives alike argue that being constrained by national, and in particular local, laws is not a suitable solution (Parker et al., 2016). However, governments have often referred to their right as sovereign nations to decide for themselves what laws should apply within their borders. The EC (2016) emphasized that 'creating the right framework conditions and the right environment is essential to retain, grow and foster the emergence of new online platforms in Europe. In the following sections, the three regulatory approaches will be discussed, as well as the different levels.

Top-down legislation, also known as command-and-control legislation, dates back to 3000 BC where Egyptian and Sumerian law is considered the world's oldest legal system (Mark, 2017). The EU has certainly empowered the top-down approach across numerous areas and so have its member states (Finck, 2017). As these regulations often pre-date digital platforms, the discussion regarding their applicability, as well as whether existing legislation should be modified, has been a much discussed topic. Furthermore, creating new regulatory frameworks has been up for debate. The EC (2016), takes a critical standing point towards both top-down national and local legislation. It creates uncertainty and fragmentation for both platforms and users, as well as hinders innovation and economic development of reaching their full potential (EC, 2016; Finck, 2017). This view is shared between multiple academics within the field, such as McKee et al. (2018), Parker et al. (2016), and Strowel and Vergote (2016). In addition, creating a future-proof legislation based on current technology might risk only repeating the regulatory issues in the future as innovation is ongoing and bound to change (Edelman & Geradin, 2015).

Although their opinion towards top-down legislation is negative, the EC does express the need for some form of regulatory framework to protect consumers (EC, 2016). According to Edelman and Geradin (2015), the prospect of market failure and negative externalities affecting consumers is the strongest argument for regulatory intervention. Currently, there are numerous laws fulfilling that purpose, e.g. the General Data Protection Regulation (GDPR) and other legislation concerning competition and consumer protection. In addition, supranational legislation allows for tighter control and enforcement (Parker et al., 2016). For instance, harmonised competition law states that companies may be fined up

to ten percent of their total global turnover if non-compliance takes place (EC, 2011). However, the EC (2016) emphasize the fact that 'there cannot be 28 different sets of rules for online platforms in a single market' and calls for harmonised legislation in such cases. Although chronic problems may be best addressed by top-down legislation, there are other approaches that are more suitable for platforms due to their global reach and rapid development (Finck, 2017).

Self-regulation is on an EU level, according to the Interinstitutional Agreement on Better Law-Making (2003), defined as 'the possibility for economic operators, the social partners, non-governmental organisations or associations to adopt amongst themselves and for themselves common guidelines at European level (particularly codes of practice or sectoral agreements)'. The strongest argument in favour of self-regulation is the fact that top-down legislation is often costly, slow, and inflexible (Allen & Berg, 2014). Self-regulation has the benefit that platforms can easily change what behaviour is allowed and not by simply changing the code behind the platform. For instance, the freelance platform Upwork, set their minimum wage to three dollars per hour (Upwork, n.d.). Although it may seem very low, it illustrates the power of self-regulation. Lawrence Lessig (1999) famously argues that code is the law of the Internet since it regulates what one can and cannot do.

Historical examples show that self-regulation could be a viable option. Complex fields such as the finance and nuclear industries are both based on self-regulatory pillars (Finck, 2017). For instance, the International Financial Reporting Standards (IFRS), controlled by a non-profit private accounting organisation, replaced most countries national regulations (Parker et al., 2016). If private companies can provide uniform, flexible, and effective legislation, governments should consider adopting self-regulation. As Parker et al. (2016) suggest, de-regulation and by allowing change to flourish, often leads to positive outcomes. In the 1980's, movie studios fought to make it illegal for private persons to use the newly developed video recording technology. The Supreme Court of the US ruled that it was not illegal to do so. To the movie studios surprise, an entirely new profitable market emerged: movie rentals that turned out to benefit both the studios and consumers.

As previously mentioned, platforms are already self-regulating by determining acceptable behaviour both on and off the platform, usually manifested in requiring users to comply with their terms and conditions (as with the example of Upwork). The set rules are at times stricter than traditional top-down legislation would be (Finck, 2017). For instance, Uber forbids all physical contact, even if the passengers have fallen asleep and the intention of the driver is to wake them up (Uber, n.d.). As a result, platforms' self-regulation may protect consumers to a higher extent in order to have a good reputation. Many platforms are conducting discussions amongst each other regarding topics such as safety, trust, and security, and how to implement such standards (Finck, 2017).

Although there are numerous examples of the benefits of self-regulation, there are also arguments against it. Firstly, it is difficult to name even one market that has been completely unregulated. As with any innovation, technological or otherwise, there is potential for harm. In particular, platforms are proficient at regulating market failure on the platform, but less able and willing to do so off the platform (Parker et al., 2016). However, one cannot forget that platforms are private companies operating in a profit maximisation purpose. As Finck (2017) suggests, fearing criticism from the public, platforms may choose to protect their image rather than being truthful. In 2017, Uber was accused by the London police of 'choosing what crimes to report' (Gilligan, 2017). Allegedly, they were not reporting crimes such as sexual assaults that risked damaging their reputation.

Moreover, studies have shown that platforms' trust enforcing mechanisms have their downsides. Although decreasing the information asymmetry for consumers, the question of how well the rating and review systems actually work remains. In the case of Airbnb, Zervas, Proserpio, and Byers (2015) found that over 95% of the listings have over 4.5 out of 5 stars, as their average rating. In addition, psychological aspects may have an impact, as people may feel bad for giving a negative review or rating, as they recognise the tough requirements of the platform providers (Ferguson, 2014). Users may also not have the knowledge, nor rationality needed to make informed judgements (Edelman & Geradin, 2016). While staying at an apartment rented through Airbnb during the summer, guests are not exposed to a faulty heating system, which can inflict an unpleasant experience for guests that rent the same apartment in the winter. As a further example, guests might consider aspects such as neighbourhood security, but neglect fire safety standards when selecting accommodation. In cases like these, in which users and service providers may not be able to properly evaluate the risk and subsequently not take suitable precautions, some form of regulatory intervention may be necessary after all. As Finck (2017) states, if self-regulation is the favourable option, there must be mechanisms in place to ensure that public interests and consumer welfare is ensured. Otherwise, platforms risk turning into oligopolies, acting solely in their own interest without any external checks or controls that ensure transparency. The idea of freedom with responsibility is the basis of the co-regulation approach, which will be reviewed in the following section.

The Interinstitutional Agreement on Better Law-Making (2003) defined co-regulation as 'a mechanism whereby a community legislative act entrusts the attainment of the objectives defined by the legislative authority to parties which are recognised in the field (such as economic operators, the social partners, non-governmental organisations, or associations)'. Finck (2017) simply describes it as regulated self-regulation and highlights the interaction between the regulators and the regulated party (Finck, 2017). According to Flew (2019), the approach can be favourable in cases when there is both a public interest in regulation and need for authorities to have some distance to the procedure. The latter can be due to

information asymmetry, costs, or flexibility. In light of the EU, it would allow them to become a regulatory facilitator, rather than having the exclusive right as a governing organ (Finck, 2017).

Information asymmetry is a strong argument in favour of co-regulation. Usually, no single actor has the knowledge and overview needed to solve complex and dynamic regulatory issues, and find an effective solution (Finck, 2017). For instance, platforms have data, while local governments have knowledge about the development in e.g. the housing market. According to Evans (2008), policymakers are likely to make mistakes in identifying problems in multi-sided markets and even less likely to find a solution, that would increase welfare. Since platforms are exposed to indirect network effects, legislation that does not let platforms grow to their full potential, risk decreasing welfare. Furthermore, by involving different stakeholders with different motives, it creates a nuanced point-of-view. In addition to governments, platforms and industry groups should have a say, that may benefit communities. This type of polycentric decision-making enables concentration of knowledge of which is spread out across the society (Finck, 2017).

As previously mentioned, platforms' data is considered proprietary to them. That data contains a vast amount of information about their users and their activities. As Edelman and Geradin (2016) suggest, it makes platforms more suitable to regulation, not less. Similarly, Grossman (2015) argues that data is the key for a new type of regulatory framework in the information age. He argues that the so called Regulation 1.0 which exists today is bureaucratic, creates friction, and is based on governmental permission. Furthermore, he suggests to adopt Regulation 2.0, which in contrast relies on accountability, transparency and open innovation. Since the information asymmetry between customers and firms have decreased, the governmental goal of ensuring consumer safety and welfare, can be better and more efficiently achieved by Regulation 2.0. By introducing public auditing systems through open Application Programming Interfaces (APIs), the platforms would be free to operate in exchange for access to their data.

Perhaps the most convincing argument in favour of co-regulation is how efficiently platforms can enforce certain regulations by their involvement. As previously discussed, platforms can for instance implement changes in their software code and start collecting tax on behalf of the government. Tax collection is often a burdensome and expensive tasks. In the platform economy, it can be difficult to enforce and oversee, and tends to have limited success (Fink, 2017; Leenders, 2019). This type of co-regulation already exists. For instance, Airbnb has partnered with numerous cities e.g. Copenhagen and Paris in order to collect tax (Ramme Nielsen, 2019; Airbnb, n.d.). Furthermore, legislative processes are long and expensive. In a constantly changing technological environment, the regulations may have already become partly outdated when enforced and it might drain government resources to try to keep up. Co-regulation is a cheaper and quicker alternative that allows for flexibility. The benefit of

flexibility is two-folded and does not only apply to the rapid technological development. As previously mentioned, although global in nature, platforms may have local impacts on e.g. housing markets (Finck, 2017). Such local externalities cannot be regulated in a homogenous manner. Though co-regulation, standards can be regulated on an EU level, while it allows for variations on national or subnational levels in collaboration with the platforms. Furthermore, the flexibility allows regulation to be constantly assessed and, if needed, quickly updated.

To conclude, co-regulation can focus on outcomes rather than processes. The EC (2016), has expressed their positive opinion towards the regulatory approach. They emphasize on the use of industry tools for the implementation of legal requirements, as well as proper monitoring mechanisms. As they suggest 'it can strike the right balance between predictability, flexibility, efficiency, and the need to develop future-proof solutions' (EC, 2016).

2.4. Related Studies

Thelen (2018) investigates the comparative politics of the platform economy by using Uber as a case. She explored three countries where the reception and subsequent regulatory responses differed: the US, Germany, and Sweden. For each country, Thelen conducted a thorough article review and interviews in which she identified the regulatory attitude towards Uber, as well as what legislative mechanisms were discussed and to what extent. In the study, she emphasizes the possible consequences of that existing literature of the topic often revolves around a shared trigger, e.g. Uber, and that researchers then 'attribute the variation in outcomes to differences in the relative power of the affected groups in the countries under examination'. Furthermore, Thelen explains that the approach makes two assumptions that may not always be the case. Firstly, the actors across the countries share the same interest. However, while the arrival of Uber led to high resistance from incumbents in the US, the Chief Executive Officer (CEO) of Sweden's oldest taxi company said it was good for the market to be pushed into trying new techniques and business models. Secondly, the shared trigger translates into virtually the same problem across the countries. Yet, the main discussion regarding Uber in the US has revolved around labour rights, which has not been the case in Sweden. There, social benefits, e.g. health insurance, is not as reliant on ones' employer, but instead is provided by the government to all citizens. Subsequently, taxation has dominated the debate. Thelen argues that the case of Uber demonstrates the importance of recognising and addressing the different political attitudes to certain issues in different countries. This is of utmost importance since the trigger, i.e. Uber, sheds light on different areas of regulation depending on the country (such as labour rights or taxation), which mobilises different actors with their own agenda. In turn, they influence the policymakers. In the US, the response towards Uber has been towards a deregulation of the taxi industry and that governments adapt their regulations to suit Uber. In contrast, Germany has taken a defensive standing point of existing legislation. Sweden has

responded with adaptation by making sure the company is in compliance with current legislation on licensing and taxation without jeopardizing their operation by adjusting some elements of it. She concludes that a shared trigger may mobilise different actors and lead to different regulatory approaches depending on local political landscapes.

Nieuwland and van Melik (2018) qualitatively assess key challenges 11 European and American cities face when regulating STRs as well as their reasoning behind specific regulatory approaches. Their findings include that most cities are quite lenient towards STRs with little to no prohibition. In comparison, European cities are more tolerant than American cities. Regulatory approaches include a day cap, a maximum number of guests, a limit to the number of times a property can be rented, the requirement of specific safety precautions and information provision, or primary residency. Furthermore, they discover that although the cities' rationale for regulation are similar, namely limiting the number of tourists and prohibiting the commercial STRs, the approaches and consequences vary per city. They conclude that there is no one-size-fits-all solution to regulating STRs and cities are still struggling to deal with the negative externalities. Additionally, it is questioned how realistic the regulation of STR platforms really is since no matter what kind of regulation a city implements, the enforcement remains of those regulations remains extremely difficult. The authors emphasize that insights into the outcome of different regulatory approaches would be interesting.

Similarly, Guttentag (2017) qualitatively examines the different regulatory approaches cities worldwide are taking towards regulating Airbnb in response to both positive and negative externalities. These issues mostly concern taxes, tourism, consumer safety and locals. Primary forms of regulation in response to these externalities include renting limitations, licensing requirements, taxes and enforcement. However, he emphasizes that different cities have different needs. While one city might welcome the increasing number of tourists, other cities overrun by tourists will not want the number to increase. Therefore, no one-size-fit-all solution exists that cities can simply implement. Instead, regulators need to analyse the specific problems in their communities and consequently formulate the most suitable action.

3. Cities and Airbnb

As previously mentioned, the purpose of this paper is to investigate effective forms of regulating MSPs. Thus, nine European cities have been chosen along with the STR platform, Airbnb, in order to contextualize the study. The European cities to be analysed in this report are: Amsterdam, Barcelona, Berlin, Brussels, Copenhagen, London, Lisbon, Paris, and Vienna. The selection of these cities is based on a number of aspects. What they have in common is that they are all European capitals and different stakeholders have expressed concerns about the emergence of digital platforms, especially Airbnb. Furthermore, the cities differ in existing regulatory approaches towards regulating MSPs. In terms of Airbnb, the emerging negative externalities include housing shortage, tax evasion, overtourism, nuisances, and unfair competition. This section will be structured as follows: first, a brief introduction to Airbnb will be provided. Second, the motivation behind the cities' legal intervention will be discussed, followed by an overview of what regulatory mechanisms Airbnb has been subjected to. Thirdly, Airbnb's attitude towards regulating STR platforms will be covered. Lastly, the legal frameworks of the cities will be addressed.

3.1. A Brief History of Airbnb

In late 2007, the two roommates Brian Chesky and Joe Gebbia, realized that hotels across San Francisco were fully booked due to a forthcoming convention. They decided to place an air mattress in their living room and turn it into a bed and breakfast in order to earn some extra money for rent. When the convention was over, they had hosted three guests, made a thousand dollars, and the idea of airbedandbreakfast.com was born (Parker et al., 2016). In February 2008, Chesky's former roommate, Nathan Blecharczyk joined as their first Chief Technology Officer and in August of the same year, their website was launched (Helm, 2014). In March 2009, they decided to shorten the name and simply call it Airbnb, as well as expand to include apartments, houses, and vacation rentals (Airbnb, n.d.b). The core idea of Airbnb was to 'offer more than a place to stay', including networking opportunities and to 'live like a local' (Benner, 2016; Parker et al., 2016.). These concepts have remained to be key components of their user experience and company vision throughout the years. Today, Airbnb has over seven million listings worldwide, more than the five largest hotel chains combined, that accommodate two million people every night (Airbnb, n.d.b, Hartmann, 2017). As the company is preparing for an Initial Public Offering (IPO) in 2020, the market value is estimated to be around 31 billion dollars (Griffith, 2019).

3.2. Regulatory Motives of European Cities

Europe is Airbnb's largest market and is projected to have over 24 million users in 2020 (Bustamante, 2019; Henley, 2019). In a joint letter by ten European cities, they addressed housing shortage, increasing rental prices, commercial subletting (i.e. purchasing property in the sole purpose of short-term subletting), nuisances, and over-tourism as consequences of not regulating STR platforms (City of Amsterdam, 2019). Of the cities relevant to this paper, the following were behind the letter: Amsterdam, Barcelona, Berlin, Brussels, Paris, and Vienna. It read, 'European cities believe that homes should be used first and foremost for living in' and that 'cities are best placed to understand their residents' needs'. Furthermore, they address Airbnbs' unwillingness to share information with cities as a significant problem, as it is difficult to ensure that regulations are being followed. Measures of enforcement place excessive burden on public funds. For instance, over 40% of hosts in Amsterdam exceed the 60 day limit of subletting through Airbnb (Dutch News, 2019b). According to Leenders (2019), Amsterdam is currently 'knocking on doors' to identify misconduct as a result of Airbnb and the city failing to reach an agreement regarding enforcement. Barcelona's Sectoral Manager of Tourism, Commerce and Markets, states that they had conducted a similar approach (Pons, 2018). Furthermore, he confirms that the city's motives for regulatory intervention include housing concerns and overtourism. Lisbon also refers to housing shortage, increasing rental prices, over-tourism, nuisances, and unfair competition as drivers for regulatory intervention (Wisniewska, 2019). Long-term rental availability has seen a 70% decrease in the past five years and the prices have risen significantly. The city of Lisbon says Airbnb is to blame.

Although also signing the letter, Berlin and Brussels put more emphasis on housing shortages, increasing rental prices, and commercial subletting as their main motivation (Beck, 2018; O'Sullivan, 2018; Johansson, 2019). Likewise, the mayor of London has stated that they need to 'to help protect the capital's housing for long-term residents', hence London's motivation for regulatory intervention is also focused on housing shortage (City of London, 2019).

In addition, concerns have been raised regarding both the loss of tax revenue, as well as the possible consequences of such a large market operating without any control or oversight. Taxation is a widely discussed topic across all cities and has been the focus of regulatory discussions for Copenhagen and Vienna also with respect to unfair competition (Guldemund, 2019; Remme Nielsen, 2019; Zimmer Christensen; 2019; Bauer, 2019; Die Presse, 2019). Especially Copenhagen promotes tourism and, above all, wants to redeem control and ensure a level playing field (Goldemund, 2019; Ramme Nielsen, 2019). Amsterdam, Barcelona, Lisbon, and Paris have also expressed, and in the meantime regulated, that STR accommodations should be subjected to taxation similar to the hotel industry, as it is a valuable

source of revenue for the cities that finances tourism related expenses (Dw, 2015; Airbnb, 2018; Portugal News, 2018b; Hardingham-Gill, 2019; Guldemund, 2019).

3.3. Regulatory Actions Towards Airbnb

As a result of the tense situation, Airbnb has been subjected to legal restraints by cities. The most frequently used regulatory mechanisms are day caps and licensing requirements. The day cap prohibits hosts to sublet their property for more than a fixed number of days each year. The main motivation behind the day cap is to prevent commercial subletting, housing shortage, and increasing housing prices. The licensing requirement is an obligation for hosts, meaning they have to register their personal and listing details with the authorities. This can be in the form of a simple registration process or an authorisation process, i.e. it is not provided that a host will definitely get a license.

For a number of cities that have implemented a licensing requirement, the main motivation is either to prevent commercial subletting and protect the housing market as described above, collect taxes, redeem control of the unsupervised market, or a combination thereof. Regarding tax collection, numerous cities around the world collect a specific tourist tax on short-term accommodation. As Airbnb has become a popular alternative to hotels, various cities have chosen to expand the tourist tax to include STR accommodations as well. Many cities have implemented fines as a sanction, although they vary in terms of who is subjected to it, i.e. hosts, STRs, or both (see section 3.4). As previously mentioned, the lack of insights to Airbnb's data often makes it difficult to identify misconduct and subsequently dispense the fines.

The a joint letter by the ten European cities was published as a reaction to Advocate General (AG) Szpunar's opinion of the European Union Court of Justice (ECJ), in which he argues that Airbnb should be regarded as an Information Service Provider (ISP) under the E-Commerce Directive (Boffey, 2019). The AG's opinion relates to a French case that concerns a tourism association's demand that Airbnb should be subjected to the same regulations as traditional real estate providers (Connely, 2019). As an ISP, Airbnb would be free to operate within the EU with no such obligations. Furthermore, they would not be held accountable for their users' actions, nor would they have to ensure that local policy objectives are met by, for instance, sharing data, or implement automated restrictions in the platform (Boffey, 2019). In 80% of the cases, the ECJ has followed the AG's decision, although the final ruling remains to be seen.

3.4. Legal Framework of Chosen Cities

As has become evident, the legal landscape of the nine European cities (Amsterdam, Barcelona, Berlin, Brussels, Copenhagen, Lisbon, London, Paris, Vienna) differ from one another. In summary, four main regulatory approaches have been identified: Day Cap, Fines, Licensing Requirement, and Taxes which can be seen in Table 1. In the following section, the nine European cities will be analyzed in terms of which of the aforementioned regulatory approaches have been implemented and insights will be given to the development and background of the regulatory interventions. The exact implementation dates will be stated behind the respective regulation in parentheses.

Amsterdam, Berlin, Brussels, Copenhagen, London and Paris have implemented day caps. However, they vary in the number of authorized nights. In Amsterdam, hosts are allowed to sublet their property for 30 nights a year, which came into effect on 01 January 2019 (Leenders, 2019). Two years earlier, a day cap of 60 days was implemented but the city of Amsterdam felt it was necessary to take further actions in order to keep the city liveable for locals (Rodriguez, 2018; Dutch News, 2019a). In contrast, the day cap implemented on 24 April 2016 in Brussels is 90 nights a year (L'ordonnance du 8 mai 2014 relative à l'hébergement touristique), while in Copenhagen the day cap of 70 nights a year was implemented on 1 May 2019 (Nielsen, 2018). On 01 January 2017, a 90 day cap was implemented (§44 Deregulation Act; City of London, 2019; Airbnb, n.d.d), and on 01 December 2017 Paris followed with a 120 day cap (LOI n° 2018-1021). It is worth noting that the day cap in Paris was first implemented on 01 January 2018, but at that point only targeted central districts. Berlin has a day cap targeting only secondary residences, limiting the number of nights to 90 a year (01.08.2018) (Busch, 2019).

All cities except for Copenhagen have fines for not complying with STR regulations. While Barcelona (Hosts: 30.000€-600.000€; Platforms: up to 600.000€) (Nadal, 2019), Lisbon (Hosts: 4.000€; Platform: 40.000€) (Turismo de Portugal, 2016; de Beer, 2018), Paris (Host: 5.000€-10.000€; Platform: 12.500€-50.000€) (LOI n° 2018-1021), and Vienna (Hosts: 2.100€; Platform 2.100€) (§20 Wiener Tourismusförderungsgesetz) have fines targeting both home-sharing platforms, and hosts, in Amsterdam (6.000€ for first offense, up to 20.000€ for repeated offenses) (Leender, 2019), Berlin (up to 500.000€) (§7 (4) ZwVbG; Busch, 2019), Brussels (250-25.000€) (L'ordonnance du 8 mai 2014 relative à l'hébergement touristique), and London (20.000£) (Coldwell, 2015; City of London, 2019) fines only apply to hosts.

In Amsterdam, Barcelona, Berlin, Brussels, Lisbon, and Paris hosts are required to have a license in order to sublet their residence. However, these licenses differ in character. Firstly, while obtaining a license in one city is a registration process, i.e. hosts only have to declare that they are renting out their residence, in other cities it is an authorisation process. That meaning, hosts have to apply for a license

and it is not given that they will definitely attain one. Secondly, cities approaches differ in defining what type of residency needs a license. They often distinguish between EHs and SHs, and primary- and secondary homes. Thirdly, in some cases the license number needs to be visibly shown in advertisements, in others it does not.

In Amsterdam, a license is required when renting out an entire home and the activity must be reported to authorities each time. If a shared home exceeds 40% of the entire residence, a license is required. Besides, hosts are only allowed to rent out property that they own and to not more than four guests at a time (Leender, 2019).

In Barcelona, a license is required when a property is rented out for less than 31 consecutive days. Authorities have stopped permitting licenses in specific areas due to overtourism. Precisely, in so-called zone 1 no licenses are issued anymore, in zone 2, a license can only be issued if one in that same zone is ceased, and zone 3 and 4 will allow growth with limits in Barcelona's outskirts. Furthermore, hosts with property in the city centre are only permitted to obtain a maximum of two licenses, i.e. they can only sublet two properties (01.02.2017). Additionally, the license number needs to be visible when advertising the property (Nadal, 2019; Government of Catalonia, n.d.a). The city of Barcelona is known for its strict enforcement regarding these requirements. Way back in 2013, authorities started an intense operation of detecting illegal properties online. It went so far that in 2014 they completely banned the issuing of STR licenses. Announcing properties for tourist use without a proper license was classified as a serious offense. In 2016, a team of 'viewers' was established whose job it was to detect illegal subletters. They did this by going from door-to-door and carrying out interviews with neighbours and tourists trying to uncover possible residences being sublet illegally. From July 2016 to July 2017, 6.197 cases were opened, 3.473 sanctions were imposed and 2.332 listings were deleted (Pons, 2018). Platforms such as Airbnb and HomeAway were fined for lack of cooperation because at first they refused to delete the detected listings. In July 2017, Airbnb finally agreed to delete the listings detected by Barcelona's city council after heated discussions. As for the most recent development, on 01 June 2018 Airbnb implemented a tool to help hosts 'follow local tourism rules in Barcelona and Catalonia and make it easier for City Hall to identify bad actors, promoting responsible home sharing that makes communities stronger.' (Airbnb, 2018b). That meaning, hosts have to give consent to their personal details including their listing details being shared with Barcelona's authorities.

Hosts in Berlin need a license when renting out an entire home or secondary residences. Furthermore, if more than 50% of a primary residence is rented out, hosts need to apply for a license at their local district office, in other words, it is an authorisation process (§ 1 (2) ZwVbG; §5 (6) ZwVbG; Berliner Mieterverein, 2018; Busch, 2019). If less than 50% of the property is rented out, it is a registration process (§ 1 (2) ZwVbG; §5 (6) ZwVbG; Berliner Mieterverein, 2018; Berlin.de, n.d.a). It is prohibited

to have licenses for both a primary and secondary residence and the registration number, regardless of what type of property is being rented out, needs to be displayed on any advertisement (Berliner Mieterverein, 2018; Busch, 2019). It is worth noting that these regulations present a relaxation of the previous law. When the so-called Zweckentfremdungsverbot-Gesetz (ZwVbG) which can be translated to the 'Act on the Prohibition of illegal Repurposing of Housing' initially came into effect on 01 May 2014, it became illegal to commercially sublet apartments without a rarely issued permit (Krex, 2016). After a two-year transition period, on 01 May 2016 the law came into full effect (§1 ZwVbG; Berliner Mieterverein, 2014).

In Brussels, it is required to obtain a license for both an entire and a shared residence. The license number needs to be displayed in all advertisements of the property (L'ordonnance du 8 mai 2014 relative à l'hébergement touristique). Furthermore, only primary residences are allowed to be rented out and hosts are not allowed to have more than one listing, i.e. sublet more than one property at a time. The application is a very bureaucratic and burdensome process, in which for instance, a criminal record and a fire safety certificate have to be provided. Specific requirements such as where the trash can needs to be placed is stipulated by law (l'ordonnance du 8 mai 2014 relative à l'hébergement touristique). The EU has warned Brussels about their strict and disproportionate home sharing rules and has asked for a relaxation of the law (Chee, 2019).

Hosts in Lisbon need to apply for a license (01.07.2017) when renting out SHs and EHs (Airbnb, n.d.e). Existing properties have two years to comply with the new requirements. Councils have 30 days to review the application and are permitted to inspect the residence and ensure conformity with existing requirements. Yet, in so-called containment zones, there is a maximum limit of licenses permitted by authorities and a single owner is not permitted to obtain more than seven licenses (de Beer, 2018; Portugal News, 2018a). The registration number needs to be displayed in advertisements of the dwelling (Airbnb, n.d.e). While Barcelona had already initiated the fight against Airbnb in 2014, Lisbon was still embracing the perks of the sharing economy. The previously bureaucratic process of applying for a STR license was greatly simplified and could even be done online. However, a few years later it became apparent that STRs needed regulatory intervention after all.

EH- and SH listings, as well as primary- and secondary residences are required to have a license in Paris. STRs are classified as subletting a residence for less than three consecutive months. However, hosts only need to register their property in contrast to getting authorisation (l'ordonnance du 8 mai 2014 relative à l'hébergement touristique). If a host has more than one property, each property needs a license. In addition, Parisian authorities specify what can be classified as a primary residence and a secondary residence. A residence must be occupied by the owner for a minimum of 8 months to be

classified as a primary residence and for a maximum of four months to be classified as a secondary residence (l'ordonnance du 8 mai 2014 relative à l'hébergement touristique).

Notably, the city of Vienna requires by law that STR online platforms pass on host details (17.08.2017). In a way, this avoids the need for a license because cities have direct access to the information needed for regulatory actions. However, Airbnb refuses to do this since they argue that it would be against personal data protection laws. This is an ongoing process and the further development remains interesting.

Due to the purpose of this paper and the complexity of taxes, only tourist tax and personal income tax will be considered. This is due to the fact that Airbnb is involved in both the collection of tourist tax and/or passes on details of hosts' rental activities to authorities. In that way, authorities can ensure that individuals are paying enough tax. For instance, in Barcelona, Airbnb shares host information with the tax authorities to ensure that hosts are paying the correct amount of tax (Nadal, 2019; Skatteministeriet, 2019). As previously mentioned, the sharing of data does not only facilitate tax concerns but also the process of detecting illegal sublettings. Starting from January 2021, Airbnb will do the same in Copenhagen (Airbnb, n.d.j). In terms of tourist/occupancy tax, Barcelona (Airbnb, n.d.f; Government of Catalonia, n.d.b), Berlin (Berlin.de, n.d.b), Brussels (l'ordonnance du 8 mai 2014 relative à l'hébergement touristique), and Vienna (§11 Wiener Tourismusförderungsgesetz; Wien 1x1, 2017) have tourist tax by law which differ per city in the exact amount. Amsterdam (01.02.2015) (Airbnb, 2014), Lisbon (01.05.2016) (City of Lisbon, 2018; Airbnb, n.d.g), and Paris (01.07.2018) (Paris Property Group, n.d.) also have tourist tax, what differs is though, is that it is directly collected through Airbnb and passed on to the respective cities.

City/Metric	Day Cap	Fines	Licensing Requirement	Taxes
Amsterdam	✓	✓	✓	✓
Barcelona	x	✓	✓	✓
Berlin	✓	✓	✓	✓
Brussels	✓	✓	✓	✓
Copenhagen	✓	x	x	x
Lisbon	x	✓	✓	✓
London	✓	✓	x	x
Paris	✓	✓	✓	✓
Venice	x	✓	✓	✓
Vienna	x	✓	✓	✓

Table 1. Forms of Regulation

3.5. Airbnb's Perspective

In order to ensure safety and trust amongst their users, as well as to improve the consumer experience, numerous additional features and policy objectives have been added to Airbnb's core product. Today, Airbnb have the Host Protection Insurance, which covers up to one million dollar worth of damages for injury or on property related to an Airbnb stay (Airbnb, n.d.i). In 2016, they released the Neighbours function, which allows neighbours of Airbnb hosts to file complaints (Kim, 2016). Two years later, the accessibility filters were implemented enabling people with physical disabilities to easier find suitable accommodation (Airbnb, 2018b). The three above mentioned examples are just a few features that Airbnb has added to their service in order to meet the needs of their users.

However, it is no secret that Airbnb and local authorities have not always been on the same terms. The company has defended the right of individuals to share their home and emphasized that Airbnb was founded by ordinary people who needed some extra money to cover their rent (Airbnb, n.d.a.). In their Community Compact, Airbnb states that they will collaborate in order to make sure local policy objectives are met, as long as the cities respect the right for people to share their home (Airbnb, 2015; Guldemund, 2019). For instance, on behalf of over 275 jurisdictions across the world, Airbnb now automatically deducts tourist tax from host income (Guldemund, 2019; Airbnb, n.d.c.). However, Pieter Guldemund (2019), Head of Policy for the Netherlands and Nordics, implies that the regulatory mechanisms cities have or want to implement do not solve the intended problem. For instance, Airbnb accounted for only 8% of the total booked nights in Amsterdam in 2018, while the rest attributes to hotels and other accommodation types (Airbnb, 2018g). Guldemund (2019) claims that the figures prove that Airbnb is not responsible for over-tourism. Furthermore, while hotels are often located within city centres, Airbnb listings are more dispersed across the cities, which in fact would relieve pressure on city centres and decrease over-tourism. Guldemund (2019) also stresses that it is in both interest of Airbnb and communities to tackle the nuisances caused by tourists. The company suggested that Amsterdam should hand over the complaints that they received regarding Airbnb listings so the company can take action. However, the city never did this and negotiations were abandoned in July 2019.

Airbnb states that the company 'embraces cooperation as long as it is lawful, evidence-based, and proportional' (Guldemund, 2019). Danish authorities have partnered with Airbnb to simplify the taxation process for hosts by implementing automatic tax deduction in the platform which will begin in January 2021. This cooperation has been seen as a great success from Airbnb's side. Apart from collaborating with national authorities, Airbnb has cooperated with the EC in order to ensure compliance with standards under EU consumer law (EC, 2019). The collaboration concerned improved clarity regarding the price of their listings. The displayed price now represents the total price, including

all sub-fees. Airbnb wishes to see a supra-national legal framework across the EU to eliminate uncertainty and city specific legal processes in addition to cooperating with local authorities to ensure local policy objectives are met (Guldemund, 2019).

4. Methodology

In this chapter, we describe the methodology of the thesis. Following the approach of Saunders, Lewis, and Thornhill (2016), we begin with an overview of existing research philosophies, followed by the adopted research approach. Next, we define the research design including the research method, research strategy and time horizon. Concluding this chapter, we will discuss the credibility of the research process in terms of reliability and validity.

4.1. Research Philosophy

Research philosophy refers to the forming of knowledge and the resulting character of that knowledge. It holds essential assumptions about one's view of the world and greatly influences the selection of the research strategy, the methods of that strategy, and the interpretation of findings. Hence, the research philosophy influences the entire research project. Saunders et al. (2016) propose five primary research philosophies: positivism, critical realism, interpretivism, postmodernism, and pragmatism. These research philosophies vary in their concept of ontology, epistemology, and axiology.

Ontology relates to the theory of being and highlights the nature of reality. It reflects the assumptions researchers have in terms of what forms a fact, i.e. the way the world operates. Two essential aspects of ontology are subjectivism and objectivism. From an objectivist perspective, reality is a set of entities that exist independent of social actors. In contrast, subjectivism views reality as the result of perceptions and following actions of the social actors. Epistemology refers to the evaluation of what can be considered acceptable knowledge within the respective research philosophy. It is also known as theory building. Lastly, axiology is the theory of beliefs and assesses the role of ethics within the research. Hence, a researcher's values greatly influence the research process and are therefore of utmost importance (Saunders et al., 2016).

However, pragmatism is an approach that argues that the most important determinant of the adopted epistemology, ontology and axiology is the RQ itself (Tashakkori & Teddlie, 1998; Feilzer, 2010; Saunders et al., 2016). That meaning, one approach may be more applicable when answering one specific question than the other one. For the purpose of this thesis, a pragmatic approach is taken. Rather than being forced to choose between different worldviews, which is considered unrealistic in practice, pragmatists prefer to choose a method and paradigm that fits their research question. A practical approach is taken in order to help collect and interpret the data enabling different perspectives to be included and instead of being a 'prisoner of a particular research method or technique' (Robson, 1993) solving practical problems in reality (Feilzer, 2010; Saunders et al., 2016). Tshakkori and Teddlie (1998) argue that the adopted philosophy should be seen as a continuum rather than an opposite position.

That meaning, while at certain times of the research process 'the knower and the known must be interactive', at other times it might be more appropriate to stand apart from what is being researched.

4.2. Research Approach

The research approach relates to the procedure of theory development and can be divided into three types: deductive, inductive and abductive. A deductive approach derives logical conclusions from a set of premises by collecting and analysing data, typically of quantitative nature. Emphasis is put on describing causal relationships between data and drawing general conclusions (Reichertz, 2007; Saunders et. al., 2016). In simpler terms, it can be considered as shifting from theory to data in the form of testing theory. In contrast, an inductive approach can be described as building theory. Data, typically of qualitative nature, is collected in order to investigate a phenomena by detecting patterns and hence, formulating explanations for those patterns (Saunders et al., 2016). Unlike deductive approaches, the emphasis is put on developing new theory and frameworks (Dubois & Gadde, 2002). However, both the aforementioned approaches have weaknesses. In terms of deduction, weaknesses include that the approach rigorously relies on theory testing. Inductive approaches on the other hand have the issue of no amount of empirical data alone being adequate to build an in-depth theory (Bell, 2014).

However, an abductive approach is a consolidation and further development of the deductive and inductive approach and allows for the offsetting of the respective weaknesses (Dubois & Gadde, 2002; Saunders et al., 2016). In general, an abductive approach starts with the collection of data to modify existing theory and frameworks or to produce new ones. Such theory is then verified by additional data collection (Saunders et al., 2016). The researcher shifts between literature and empirical data (Morgan, 2007; Bell, Bryman, & Harley, 2018). For the purpose of this research an abductive approach is adopted. From a pragmatic point of view, abduction departs from an inconclusive observation. As previously mentioned, effective forms of regulating MSPs is the puzzling observation in our case. A framework of existing forms of regulation is first established. On top of that, the motivations behind these forms of regulation are identified. Subsequently, the framework is tested by additional data collection. However, the additional data collection should also help describe the relationship found in the framework (Saunders et al., 2016; Bell et al., 2018).

4.3. Research Design

The research design refers to the way the researcher plans to answer the research question. In the following section, the research purpose and the choice of research method, -strategy and time horizon will be described.

In general, research can be designed with either an exploratory, explanatory, or descriptive purpose. The purpose of the research study at hand is exploratory. This type of purpose is appropriate for clarifying and understanding phenomena with only little theoretical background. The phenomena of interest can be assessed in terms of current happenings which can result in new insights (Saunders et al., 2016). MSPs are not a new phenomenon per se, however through rapid technological advancements new issues concerning their regulation have emerged. Existing laws are inadequate in addressing the problems and current legislators worldwide are struggling with this. Furthermore, the precise nature of the problem varies to an extent since they can be very different from platform to platform.

While quantitative and qualitative research methods have been termed the first and second paradigm of research methods respectively, mixed methods research is a more recent emergence. Therefore, it is referred to as the third paradigm (Venkatesh, Brown, & Bala, 2013). The purpose of quantitative research methods is to measure and examine causal relationships between variables within a value-free framework. In order to ensure that samples are representative, the sample sizes are much bigger than in qualitative research. In qualitative methods, the emphasis is put on process and meanings (Sale, Lohfeld, & Brazil, 2002). Applied techniques include interviews and participant observations. In contrast to quantitative methods, samples are not meant to represent large populations. Instead, small, purposive samples are used in order to provide important information rather than because they are representative of a large group (Saunders et al., 2016).

In some cases, a combination of the previously mentioned methods seems like the more appropriate approach, also referred to as a mixed methods approach. This approach blends qualitative and quantitative research methods and can lead to an increased understanding of the phenomena of interest that a mono method cannot provide on its own. In addition, mixed methods approaches have the potential to offset the weaknesses inherent in the two previously mentioned methods. For the purpose of this research, a mixed methods approach is adopted since one research method is not considered sufficient to fully understand the phenomena of interest (Venkatesh et al., 2013). With the rapid technological advancements in society, existing theories are often inadequate to explain the topic of interest. This is exactly the case with the rise of digital platform based businesses to which existing regulations only apply to an extent, or in some cases, not at all. More precisely, a sequential mixed method approach is adopted. The qualitative phase is followed by a quantitative phase in order to enable an improved understanding of the phenomena of interest. In that way, it is possible to expand on initial findings from the qualitative approach in the quantitative approach which allows for further development (Creswell et al., 2003; Tashakkori & Teddlie, 2003). As acknowledged by Venkatesh et al. (2013), it is common for mixed methods research to have a predominant approach. This is also the case in the research study at hand, as the quantitative approach is considered the predominant one.

The qualitative phase consisted started with a systematic literature review of relevant policy and legal documents of the nine European cities. Secondary data in the form of journals, newspapers, books, and government publications was collected. In addition, primary data in the form of interviews was provided to us by the Digital Department of Copenhagen Business School (CBS) and one complementary interview was conducted by us. While the systematic literature review enabled us to set up framework of forms of existing regulatory approaches, the interviews provided us with deeper insights into the motivations behind the identified approaches. In the quantitative stage, data obtained from the Department of Digitalization at CBS was analysed enabling further development of the previously established framework. Using descriptive and inferential statistics, specific metrics were analysed in order to help identify effective forms of regulatory approaches. It is important to note that no conclusion in regard to the causal relationship can be drawn since no statistical tests were conducted. The quantitative data processing will be described in detail in section 5.2.1.

Venkatesh et al. (2013) emphasize the importance of meta inferences in mixed method approaches and argue that they have been largely neglected in existing literature. Meta inferences are defined as 'theoretical statements, narratives, or a story inferred from an integration of findings from quantitative and qualitative strands of mixed method research'. When framing meta inferences the main objective is to pass the results from each study and develop an in depth understanding that a single study cannot offer. In order to identify effective forms of regulation, it was necessary to firstly identify the motive and reason for the respective regulation which was done in the qualitative part. Resulting from this, we were able to group cities by motive and implemented regulatory approach. In the next step, we needed to find out what regulation actually was effective in terms of the predefined motive. In summary, we could not have gotten our findings without combining the results from each part.

Research strategy is defined as the plan of action through which the research question is answered (Saunders et al., 2016). For the purpose of the paper, a case study strategy was adopted incorporating multiple cases since one case was not deemed sufficient to generalise findings. In order to address the research question it was necessary to identify forms of regulating MSPs in Europe and group them based on their motivations. Since existing literature is lacking a unified definition, multiple cases were looked into. To be specific, the legal landscape of nine European cities, Amsterdam, Barcelona, Berlin, Brussels, Copenhagen, Lisbon, London, Paris, and Vienna was looked in order to be able to generalize findings concerning European cities.

An integral part in the research design process is the establishment of a time horizon. While longitudinal studies relate to studies that are repeated over an extended period of time, cross-sectional studies are limited to a specific time frame. As we look at a time frame of 12 months in each city, this study can be

considered a cross-sectional study (Saunders et al., 2016). Besides, the time allocated for this thesis does not allow for a longitudinal study.

4.4. Data Collection

As previously mentioned, an additional interview was conducted apart from the four interviews obtained from the Department of Digitalization at CBS. Research interviews are classified as primary data collection and can be categorized based on the level of structure, standardization and the degree of direction given by the interviewer in regard to the subject matter discussed (Saunders et al., 2016). As the goal of our interview was to gain further insights into the phenomena of interest, i.e. the motivation behind regulatory approaches from a city's perspective, a semi-structured interview was conducted. Before the interview, an outline of questions and topics to discuss was framed. All questions were drafted with the aim of avoiding sources of observer bias. The interview took place in person at the workplace of the interviewees, in an effort to make the participants feel at ease in a more familiar environment. The interview was held at Horesta's office headquarters in Copenhagen. Horesta is trade association and employers organization for the restaurant, hotel and tourism industry in Denmark. The interviewees were Jens Zimmer Christensen, Chairman of Horesta and Sebastian Skougaard Markfoged, a student assistant at Horesta. The interview lasted 43 minutes. To ensure transparency, the transcribed interview in its original language, i.e. English, and can be found in appendix C.

4.5. Credibility

In order to ensure credibility, researchers are advised to continuously review the validity and reliability during their research (Venkatesh et al., 2013). These two concepts will be discussed in the following section.

The reliability of a research design refers to the degree to which the analysis technique will yield consistent findings. Furthermore, it can be classified as internal and external reliability. The former relates to the degree to which consistency is maintained throughout the research, while the latter is defined as a measure of quality of the procedures of data collection, measurement, and analysis. Saunders et al. (2016) suggest that having more than one researcher involved in the process of conducting interviews as well as in the analysis process is beneficial. Therefore, the internal reliability is considered high since both researchers were involved in every aspect of the thesis at hand. In terms of the external reliability, since our quantitative data is in numerical form, yielding consistent results is rather straightforward. However, since the analysis is based on a specific regulation date that varies for each city, the same results will not necessarily be held on other occasions. To ensure transparency, the data processing and analysis is documented in detail in section 5.2.1. and the code is attached in the appendix M making it easy for others to retrace the steps that were taken to make sense of the raw data

(Saunders et al., 2016). To conclude, we consider the reliability of this thesis to be high due to the well-grounded derivation and contemplation of measures and techniques. It should be noted that reliability and validity are related to an extent because unreliable research are invalid and will affect the results and their subsequent interpretation.

Validity relates to the truthfulness of findings, i.e how well the results represent the truth in the objective world. Therefore, it can be established by the rightful implementation of data collection and analysis methods. The validity of a research design can be assessed internally and externally (Saunders et al., 2016; Dudovskiy, 2018). Internal validity is established when research correctly represents the causal relationship between variables. Due to the thoughtful implementation of statistical methods, we consider the internal validity to be high. However, it must be considered that there are more advanced statistical methods that could be used for a more powerful identification of the causal relationship of the variables. Furthermore, external validity relates to the generalization of the study to other applicable settings outside the research. It examines the extent to which the study conclusions can be generalized to the context and settings in which the phenomenon is generally observed. (Venkatesh et al., 2013; Saunders et al., 2016, Malhotra et al., 2017). Nine cases are looked into, i.e an empirical investigation is conducted. General conclusions are drawn based upon the findings and we therefore believe that our conclusions can indeed be generalised.

5. Analysis and Findings

In the following chapter, both the analysis process and findings will be presented. First, the qualitative analysis will be described which provides a framework for the quantitative analysis that follows.

5.1. Qualitative Analysis

Based on the study by Thelen (2018) described under section 2.4., we acknowledge the importance of addressing the motives of each city due to two main reasons. Firstly, the actors across the cities do not share the same interests. As previously discussed, Barcelona and Copenhagen have very different attitudes towards Airbnb. While Copenhagen has encouraged the platform economy and the value it provides to the city, Barcelona has taken, at least initially, a very defensive approach. Secondly, the shared trigger, i.e. Airbnb, does not translate into the same issues across the cities. While Barcelona struggles with e.g. overtourism, Copenhagen does not. This illustrates the importance of addressing the motives of each city in order to investigate what forms of regulation they have implemented to combat the perceived issues of platforms. Furthermore, since different actors are mobilised depending on the externalities, they may pressure and influence the policymakers as one can assume that policymakers are acting in the interests of the cities. These actors may include for instance hotel organisations, disturbed residents, and tax authorities, as well as satisfied users of the platform. This further accentuates a thorough mapping of the motives behind the cities regulatory interventions.

As duly noted, cities have taken different approaches towards regulating Airbnb. Some have included Airbnb in the process, while others have had no dialogue nor cooperation with the platform. Since cities have expressed the difficulty of ensuring that hosts comply with the law, it is important to distinguish between what regulatory mechanisms apply and what is actually enforced on the platform. Although stipulated in law, hosts may choose to disregard the rules if they know that authorities have no means of controlling whether or not they are being followed. Subsequently, it might lead to meaningless regulations. In order to properly address what effective forms of regulation are, we introduce a qualitative metric called *Enforcement*. This metric defines whether or not the regulation made by the cities is enforced on the Airbnb platform. Based on cities motivations, we divide them into three groups: Group A, Group B, and Group C. In that way, it should later facilitate the identification of effective forms based on the motivation. It should be noted that the grouping is based on a city's primary motive/s. Hence, it does not mean that a city in Group B does not have any of the problems that cities in Group A have.

5.1.1. Group A

Housing shortage, touristification, taxes evasion, nuisances, and unfair competition are the primary motives for regulatory intervention from Amsterdams', Barcelonas', Lisbons', and Paris' perspective and are therefore, in Group A. As mentioned in section 3.4., these cities are struggling to find a common ground with Airbnb in terms of regulatory approaches. The four cities are overrun by tourists, who do not always behave. Amsterdam and Barcelona have gone as far as employing individuals to go door knocking to identify illegal Airbnb listings. However, although their motivations may be similar, the legal landscape of the cities differ in terms of STRs. As can be seen in Figure 2, the y-axis displays the number of existing forms of regulation and the x-axis shows the number of forms of regulations actually enforced on the platform. Forms of regulation in Amsterdam and Paris include a day cap, a licensing requirement, and the collection of tourist taxes. Of these three forms of regulation, two are enforced on the platform, namely the day cap and the automatic collection of tourist tax. In contrast, Barcelona and Lisbon have a licensing requirement and the collection of tourist tax as forms of regulation. While both of Lisbon's regulatory approaches are enforced on the platform, only the licensing requirement is enforced in Barcelona.

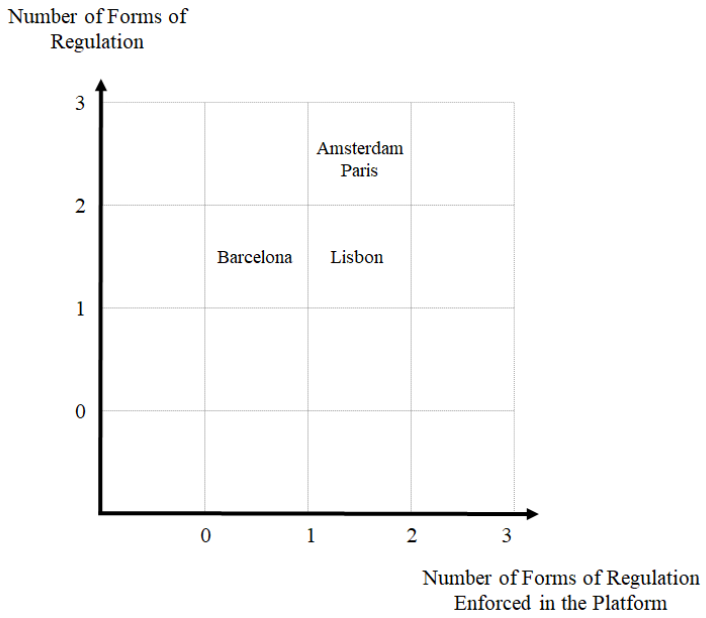

Figure 2. Forms of Regulation in Group A

5.1.2. Group B

Group B consists of Berlin, Brussels, and London. The existence of housing shortage in the respective cities illustrate their main problem, as well as motivation for regulatory intervention in terms of Airbnb. In terms of STR regulations, these three cities have taken different approaches. As demonstrated in Figure 3, the y-axis displays the number of existing forms of regulation and the x-axis shows the number of forms of regulations actually enforced on the platform. Berlin has a day cap, a licensing requirement,

and collects tourist taxes. Hence, the number of forms of regulation is three. Yet, when looking at the enforcement of these forms of regulations in Airbnb's platform, the number is zero. Likewise, Brussels has three forms of regulation, namely a day cap, a licensing requirement and collects tourist taxes. Again, none of these forms of regulation have actually been implemented on the platform. In contrast, London only has a day cap which is enforced on the platform.

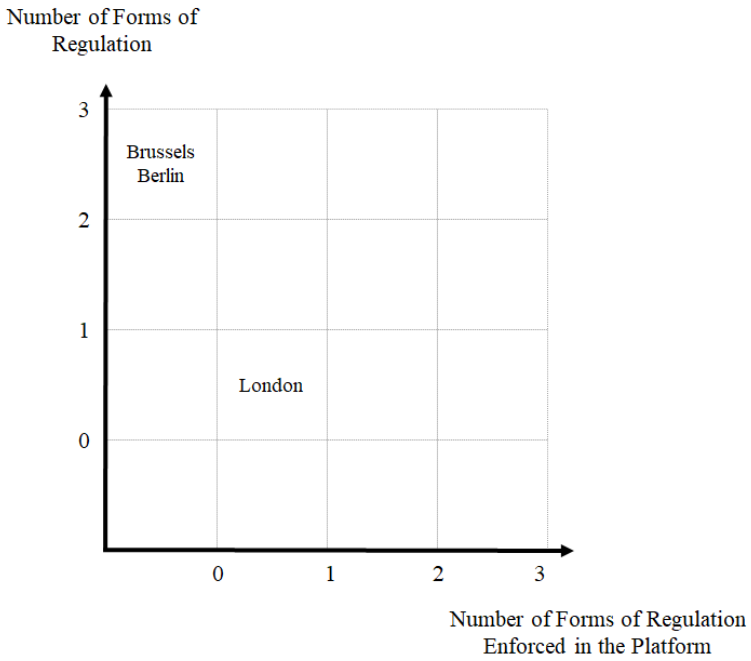

Figure 3. Forms of Regulation in Group B

5.1.3. Group C

Group C consists of Copenhagen and Vienna. Their main motivation behind regulatory intervention is to prevent tax evasion and to ensure fair competition. While Vienna has regulations targeting tourist taxes and obliging online accommodation platforms to pass on host details to municipalities, Copenhagen has a day cap.

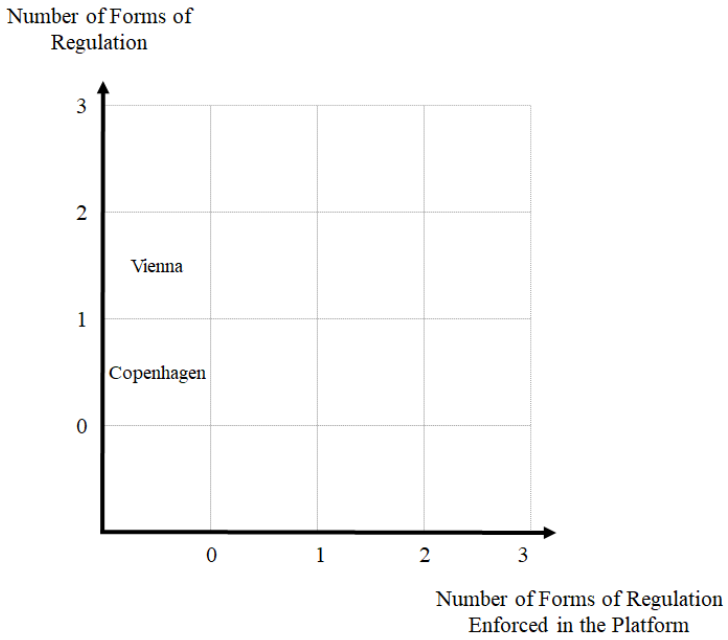

Figure 4. Forms of Regulation in Group C

5.2. Quantitative Analysis

The qualitative analysis allowed us to investigate the motives behind the cities regulatory intervention. Furthermore, we identified that the level of enforcement varies. Theses insights enabled us to frame and contextualise the quantitative analysis in order to answer the research question at hand. The section will be structured as follows: First, the data processing will be outlined along with related limitations throughout the section, Second, the findings of the data analysis will be presented split by the groups obtained from the qualitative analysis.

5.2.1. Data Processing

The quantitative data was provided by the Department of Digitalisation at Copenhagen Business School. A custom build script was used to scrape the data directly from Airbnb's website. Six months of data before and after the enforcement date of the regulation was retrieved in order to analyse direct impacts of the regulations for each city. For Amsterdam and Barcelona, two time periods, and subsequently two datasets, were analysed. The cities had two significant regulations enforced at different times, unlike the other cities, where major regulations were enforced on one occasion.

5.2.1.1 Overview of the Datasets

When reviewing the datasets, the first step was to delete irrelevant variables for this paper. Of 106 variables, 97 variables were deleted, hence 9 variables remained (see Appendix A). We noticed that some values contained NA values, NULL, or blanks. For consistency purposes and simplification, we

converted them all to NA values, which represents missing values in R. For all remaining variables, we reviewed the share of missing variables in order to assess how complete the datasets were. In general, very little data was missing as can be seen in Table 2. With the exception of the variable [license], most datasets had 100% NA values and for [last_review], it ranged between 11% and 31% of the observations.

Variable/Dataset	AMS 17/18	AMS 18/19	BCN 16/17	BCN 17/18	BER 18/19	BRU 15/16
Number of observations	(166.554)	(217.694)	(198.244)	(222.809)	(295.321)	(48.648)
id	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
last_scraped	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
host_id	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
host_location	0.35%	0.20%	0.38%	0.32%	0.59%	0.32%
room_type	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
price	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
last_review	14.07%	11.53%	18.32%	18.92%	18.74%	25.79%
requires_license	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
license	100.00%	99.98%	80.51%	65.43%	96.79%	100.00%
Variable/Dataset	**CPH 18/19**	**LIS 17/18**	**LDN 16/17**	**PRI 17/18**	**VIE 17/18**	
Number of observations	(241.664)	(113.365)	(627.212)	(755.488)	(106.049)	
id	0.00%	0.00%	0.00%	0.00%	0.00%	
last_scraped	0.00%	0.00%	0.00%	0.00%	0.00%	
host_id	0.00%	0.00%	0.00%	0.00%	0.00%	
host_location	0.50%	0.49%	0.44%	0.61%	0.57%	
room_type	0.00%	0.00%	0.00%	0.00%	0.00%	
price	0.00%	0.00%	0.00%	0.00%	0.00%	
last_review	16.67%	18.56%	30.74%	23.90%	20.07%	
requires_license	0.00%	0.00%	0.00%	0.00%	0.00%	
license	100.00%	67.91%	100.00%	92.31%	99.95%	

Table 2. Overview of the Datasets

5.2.1.2. Preparation of Data

Once the available data had been reviewed, the variables were transformed into the correct format, e.g. date, numeric, or character. Due to the vast amount of data, the scraping process took place across multiple days for many datasets. Therefore, [last_scraped] was set to the first of each month in order for further analysis to be accurately attributed to each month and minimise the customisation process for each script.

5.2.1.2.1. Removal of Inactive Listings

Some listings on Airbnb's website may be inactive and therefore do not represent the actual available supply of listings. For instance, a host could have uploaded a listing and then simply stopped or paused subletting their property without removing it from the platform. These inactive listings may skew the results and affect the analysis. Therefore, some adjustments were made in order to identify and subsequently delete the inactive listings.

Of the available data, we identified [last_review] as the most promising indicator of when a listing had a completed booking. By calculating the difference between [last_scraped] and [last_review], we acquired the number of days between the month in question and last confirmed completed booking. The new variable was named [date_diff]. Since one can assume that the majority of hosts sublet their property on an occasional basis, we set the [date_diff] limit to six months (182 days) in order to capture seasonality in supply. If the value was higher than that, we considered the listing to be inactive and therefore deleted it from the dataset. Worth noting is that we calculated [date_diff] before the [last_scrape] date was set to the first of each month (as described in the previous section) in order for the limit to be exactly 182 days for all listings. The decision of setting the limit to six months was based on other studies that analyse Airbnb data. For instance, Lane & Woodworth (2016) consider an inactive listings if it had not been rented out during the last month. What 'rented out' is defined as does not say. Zervas, Proserpio and Byers (2017), use three and six months since the last review. Coyle and Yeung (2016) classify an inactive listings not having a transaction within the last 12 months, although they do not specify what a 'transaction' is based on. To conclude, the idea behind the calculation is similar although the time frame varies. Using six months as a separator seemed legitimate. However, a limitation to this approach is inevitably that active listings were deleted. Since the limit is six months and is calculated on a rolling basis, as well as the datasets containing a vast amount of observations, we do not think that this will affect the results.

Furthermore, some observations had NA values in [last_review]. When reviewing the NA values for the variable (see Table 2), we learned that they accounted for between 11-31% of the total observations for each dataset. As we had no other way of determining the last confirmed booking and the datasets were quite large, we decided to delete all observations containing NA values for [last_reviewed] as it will not have a significant impact on the accuracy of the analysis. Important to note is that it is not 11-31 % of the listings, but the observations. In theory, a unique listing may be represented by 12 rows if it was present on the website during the entire time period.

5.2.1.2.2. Defining New Variables

In order to properly assess what effective forms of regulation are in the context of Airbnb, the motivations of the cities had to be evaluated and an approach to measure them in quantitative manner

developed. Therefore, new variables were defined based on the available data. Airbnb categorise their listings as either 'Entire apartment/house', 'Private room', or 'Shared room', under the variable [room_type]. As the majority of the listings are 'Entire apartment/house' and numerous regulations across the cities target that listing type in particular in terms of their regulatory interventions, the listing types 'Private room' and 'Shared room' were merged. The new variable [room_type_NV] holds either 'Entire home' for listings categorised as 'Entire apartment/house' or 'Shared home' for 'Private room' and 'Shared room'. As can be seen in Table 2, no NA values were present. Due to the merge of 'Private room' and 'Shared room', the [price] variable will be slightly affected since one can assume that 'Shared rooms' are less expensive than 'Private rooms'. However, they represent a very small share of the number of listings. Furthermore, due to the research focus of this paper, the price development is not the main focus.

Furthermore, two dummy variables were added. The first one, [regulation], refers to if the observation, i.e. listing, attributes to the time period before or after the regulation. The second one named [host_local] address whether or not a host resides in the city in question. This variable was based on [host_location]. As the variable came in a character format, the definition of [host_local] was based on whether the variable contains the name of the city in question. For the cities where the name in English differed from the local language, both names were used in the categorization process. For instance, in Copenhagen, 'København' was also included. In the special case of Brussels, both the French, German, and Ducth names were used in addition to the English one. Even though Brussels is mainly French speaking, the two additional official languages of Belgium were included. In Table 3, a summary of all the variables in the datasets can be found along with a short description.

Moreover, three variables regarding the number of listings per host for the given month were added. To specify, for each host [host_id] we counted the number of listings [id] for each month [last_scraped]. The variable was named [count_of_listings]. In addition, we repeated the procedure by distinguishing between the [room_type_NV], i.e. Entire home and Shared home. The variables were called [count_of_listings_EH] and [count_of_listings_SH]. Lastly, three additional variables with categorical values were added. Based on [count_of_listings], the variable [count_of_listings_group] was created, which holds the value 1 if the hosts have one listing, 2 if the hosts have two listings, and 3 if the hosts have three or more listings. As with [count_of_listings], it disregards which listing type it is. The same procedure was conducted for entire and shared homes. The variables were subsequently named [count_of_listings_group_EH] and [count_of_listings_group_EH]. However, one additional group holding the value of 0 had to be added to account for the opposite listing type. To illustrate the relation between the variables, two examples will be provided. Firstly, consider a host having two entire home listings. The variables would hold the following values: [count_of_listings_group] = 2, [count_of_listings_group_EH] = 2, [count_of_listings_group_SH] = 0. Secondly, consider a host who

has three listings of which two are EH and one is SH. The variables would hold the following values: [count_of_listings_group] = 3, [count_of_listings_group_EH] = 2, [count_of_listings_group_SH] = 1. However, worth to note is that the variables regarding SH listings are not used for anything other than double checking that the calculations were correct. This is due to the fact that EH listings are the primary focus of regulatory interventions and to the scope of this project.

Variables	Description
Existing variables	
id	Unique ID for a listing
last_scraped	Date when the data for each month was scraped
host_id	Unique ID for a host
host_location	Location of where the host resides
room_type	Listing type by Airbnb's classification - Entire home/apt, Private room, Shared room
price	Listing price per night
last_review	Date of when the last review for the listing made
requires_license	True or False value depending on if a license is required for the listing type
license	True or False value depending on if the host has entered a license number
Additional variables	
date_diff	Difference in days between last_scraped and last_reviewed
room_type_NV	Listing type by our classification. Entire home for 'Entire home/apt', Shared home for 'Private room' or 'Shared room' based on [room_type]
room_type_NV_numerical	room_type_NV in numerical form for statistical tests. 0 for Entire home, 1 for Shared home.
regulation	Categorical dummy based on [last_scraped]. 0 if before the regulation, 1 if after.
host_local	Categorical dummy based on [host_location]. 0 if [host_location] is not the same as the city in question, 1 if it is.
count_of_listings	Number of listings per host for the given month
count_of_listings_EH	Number of Entire home listings per host for the given month
count_of_listings_SH	Number of Shared home listings per host for the given month
count_of_listings_group	Categorical variable based on count_of_listings. 1 if count_of_listings = 1, 2 if count_of_listings = 2, 3 if count_of_listings >= 3.
count_of_listings_group_EH	Categorical variable based on count_of_listings_EH. 0 if count_of_listings_EH = 0, 1 if count_of_listings_EH = 1, 2 if count_of_listings_EH = 2, 3 if count_of_listings_EH >= 3.
count_of_listings_group_SH	Categorical variable based on count_of_listings_SH. 0 if count_of_listings_SH = 0, 1 if count_of_listings_SH = 1, 2 if count_of_listings_SH = 2, 3 if count_of_listings_SH >= 3.

Table 3. Variables

5.2.1.3. Statistical Test

The quantitative findings begins with descriptive visual representations of the data. In order to check whether our findings can be statistically proven, inferential statistical tests were conducted. To specify, Wilcoxon rank-sum tests (also called a two-sampled Mann-Whitney U test) were used. It is a non-parametric statistical hypothesis tests that tests whether the mean of the sample differs between groups. Since the test computes on the means, aggregated values for each month is used. Hence, the number of observations will be 12 or lower. The Wilcoxon rank-sum tests is therefore appropriate since the data is unbalanced, i.e. contain unequal observations in the groups, and as it is suitable for small samples. The test can be performed either two-sided or one-sided. The first tests if the mean of the sample between the groups are not equal as opposed to specifying directionality in the one-sided test.

5.2.2. Findings

In this section, the findings from the quantitative analysis will be presented. The structure will be in line with the groups of cities obtained from the qualitative analysis. By conducting the quantitative analysis by group, it allows us to investigate the development of the metrics for cities with the same regulatory motives. Furthermore, it provides an indication of the consequences of different regulatory approaches. As previously mentioned, the time period consists of 12 months, six months before and after the implementation date of the regulation. This specific time frame has been chosen to have sufficient data to identify trends and developments possibly attributed to the regulatory interventions. It should be noted that two implementation dates of regulatory approaches are considered in Amsterdam and Barcelona since both were considered relevant.

Since the regulatory approaches commonly distinguish between entire homes, and shared and private rooms, we categorize the listings into two types: EH and SH (i.e. shared rooms and private rooms) as described in section 5.2.1.2.2. Due to insufficient data for some cities, the related time periods are reduced, which will be stated throughout the analysis in the affected cases. For each group, the following metrics will be analysed: *Number of Listings*, *Listings per Host*, *Host Local*, *and Price*.

Number of Listings provides an overview of Airbnb's presence in the cities as well as the distribution of EH and SH listings. Furthermore, it provides an indication of how the supply of the listing types are affected by the regulatory intervention. Important to bear in mind is that the number of listings does not take availability into account. In theory, a listing that has reached e.g. the day cap limit, is most likely still on the platform but has a blocked calendar, assuming that the host complies with the rules. However, as discussed in the previous section, if a listing has not received a review (i.e. a confirmed completed booking) within the last six months, it has been filtered out and considered an inactive listing. See Appendix H for all the data.

As the name suggests, *Listings per Host* shows how many listings the host has on the platform. The metric was divided into three groups: hosts who have one listings, hosts who have two listings, and hosts who have three or more listings. The intention of the grouping, in particular the third group, is to gain an understanding of how many hosts are presumably subletting in a commercial purpose rather than simply earning some additional income. All cities are against such activity. *Listings per Host* was additionally focused on EH since it is the main concern and target of regulatory approaches for most cities. See Appendix I for all the data.

As previously described, we defined the variable [host_local] as whether or not a host resides in the city in which their listing is located. As with *Listings per Host*, the intention of the metric *Host Local* is to investigate what impact regulations have on commercial hosts. If a host does not live in the city, the listing is presumably not their primary home in which they usually reside. Unfortunately, it is not possible to determine if a listing is a host's secondary residence. For instance, one might have a holiday home which is sublet on a regular basis. We do not consider secondary residences as being of a commercial nature. As previously discussed, we define it as when people or companies purchase properties for the sole purpose of STR activities, so-called commercial landlords. Therefore, the holiday (secondary) homes where the hosts do not reside in the city might have an impact on the results. Nevertheless, it is still interesting to analyse as it is the best approach to investigate the number of non-local hosts. See Appendix J for all the data.

Lastly, the metric *Price* will be analysed. It refers to the average price per night for a listing and is split by EHs and SHs. Although all countries except for the United Kingdom and Denmark have Euro as a currency, they all have different purchase power and can therefore not be directly compared. One way to tackle this issue is to convert all prices to the Purchase Power Parity (PPP) index to eliminate the effect of price level differences. As our aim of this report is to investigate what effective forms of regulation are, when exploring *Price* the focus is on if regulation has had an impact, i.e. the movements of price. To conclude, investigating the price levels for the cities is not in scope and the decision to leave the currencies in their original state was taken. See Appendix K for all the data.

5.2.2.1. Group A

In the upcoming sections, Group A (Amsterdam, Barcelona, Lisbon, and Paris) will be analysed in terms of the development of the metrics *Number of Listings*, *Listings per Host*, *Host Location*, and *Price*. The time frame consists of six months before the enforcement date of the regulation and six months after for each city. The dotted lines in the graphs represents the regulation dates for the specific cities.

5.2.2.2.1. Number of Listings

Figure 5 shows the number of listings split by listing type in Amsterdam, during the period July 2016 to June 2017, i.e. 12 months. It is worth noting that data for October 2016 is missing, hence data from the previous month was used for visualisation purposes. The time frame, which is shown on the horizontal axis, was selected since a regulatory approach in the form of a day cap (60 days) was implemented in Airbnb's platform on 01 January 2017. This regulatory approach was a result of collaboration between the city of Amsterdam and Airbnb. The vertical axis presents the number of listings. When comparing EH- and SH listings, the number of EH listings is more than three times as high as the number of SH listings. Overall, an increase in the number of shared listings is observable. From December 2016 until June 2017, SH listings increase by 28.57%. In contrast, the number of EH drops by 12.45% in that specific time frame, after it increases up until November 2016.

In order to test if there is a significant difference between the *Number of Listings* before - and after the regulation, a two-sided Wilcoxon rank-sum test was conducted. The result shows that there is a significant difference in the number of EH listings ($W = 0$, $p = 0.004$) before- and after the regulation, as can be seen in Figure 5. Since the mean of EH listings appears to be higher before than after the regulation, we conduct another Wilcoxon rank-sum test to test this hypothesis. However, the alternative hypothesis is rejected meaning that there is no statistical proof of the mean of EH listings being higher before than after the regulation ($W = 30$, $p = 1$). Regarding SH listings, a two-sided Wilcoxon rank-sum test was conducted. The result shows that there is no significant difference in the number of SH listings before and after the regulation ($W = 24$, $p = 0.013$).

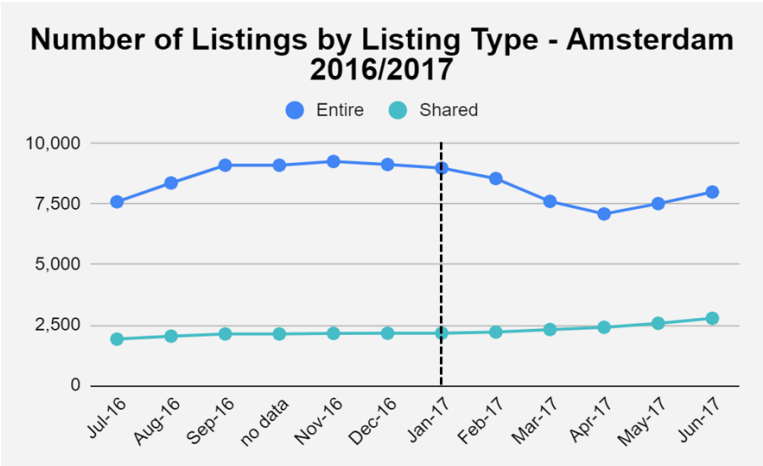

Figure 5. Number of Listings: Amsterdam (2016/2017)

Figure 6 illustrates the development of the number of listings split by listing type in Amsterdam from July 2018 to May 2019, which is presented on the horizontal axis. The vertical axis describes the number

of listings. A regulation in the form of a day cap (30 day limit), an occupancy limit of four people, and the need to register with the council when subletting was implemented on 01 January 2019. In contrast to the previously mentioned day cap in Amsterdam in 2017, it was not directly implemented in the platform since the city of Amsterdam and Airbnb could not reach an agreement. In Airbnbs' opinion, the low day cap lacked justification. In regard to SH, only minor changes can be seen in the number of listings. From December to May, i.e. after the implementation of the regulation, a total decrease of 4.62% in SH is observable. In that same period, the number of EH decreases by 21.70%. Precisely, the number of EH listings rises by 15.62% from July 2017 to October 2018 and subsequently, steadily declines by 27.95% in total until April 2019. Thereafter, a mild increase of 3.18% is perceivable.

In order to test if there is a significant difference between the *Number of Listings* before - and after the regulation, a two-sided Wilcoxon rank-sum test was conducted. The result shows that there is a significant difference in the number of EH listings ($W = 30$, $p = 0.004$) before- and after the regulation, as can be seen in Table 4. Since the mean of EH listings appears to be higher before than after the regulation, we conduct another Wilcoxon rank-sum test to test this hypothesis. The results were significant and therefore confirms that the mean of EH listings is higher before than after the regulation ($W = 30$, $p = 0.002$). Regarding SH listings, a two-sided Wilcoxon rank-sum test was also conducted. The results show that there is a significant difference in the number of SH listings ($W = 28$, $p = 0.017$) before- and after the regulation. Although no major change can be observed, we test for whether the number of SH listings is higher before than after the regulation. The result was significant meaning that mean of SH listings is higher before than after the regulation ($W = 28$, $p = 0.009$).

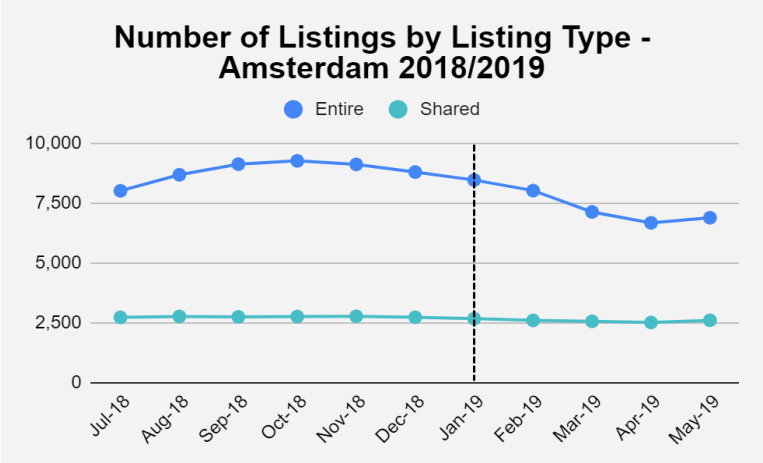

Figure 6. Number of Listings: Amsterdam (2018/2019)

In Figure 7, the number of EH- and SH listings in Barcelona is shown from August 2016 to July 2017. It should be noted that data for October 2016 was not available, hence data from the previous month was used for the visualization. The horizontal axis shows the aforementioned timeline and the vertical axis the number of listings. On 01 February 2017, Airbnb limited the number of listings per host to one

in the city centre. That meaning, hosts are limited to uploading one listing in the city centre on Airbnb's website. It is noticeable that the distribution of EH- and SH listings is quite similar. Over the entire time frame, a steep decrease of 19.03% in EH listings can be observed. From January until July, i.e. the time period after the regulation came into effect, a total decline of 8.48% is visible in the number of EH listings. Over the entire time period, the number of SH listings drop by 7.35%. After a slight increase up until September 2016, a steady decrease until April is observable. Thereafter, the number of shared listings rises sharply by 22.60%. After the regulation date, the number of SH listings increases by 8.78% from January 2017 until July.

In order to test if there is a significant difference between the *Number of Listings* before - and after the regulation, a two-sided Wilcoxon rank-sum test was conducted. For EH listings, the result is not significant and we cannot statistically proved that there is a difference before and after regulation ($W = 25$, $p = 0.082$). Regarding SH listings, the results is significant, i.e. a difference between the groups can be statistically proven ($W = 30$, $p = 0.002$). As the mean of SH listings appears to be higher before than after the regulation, another Wilcoxon rank-sum test was conducted to test for this hypothesis. The results were significant meaning and confirms our hypothesis ($W = 30$, $p = 0.002$).

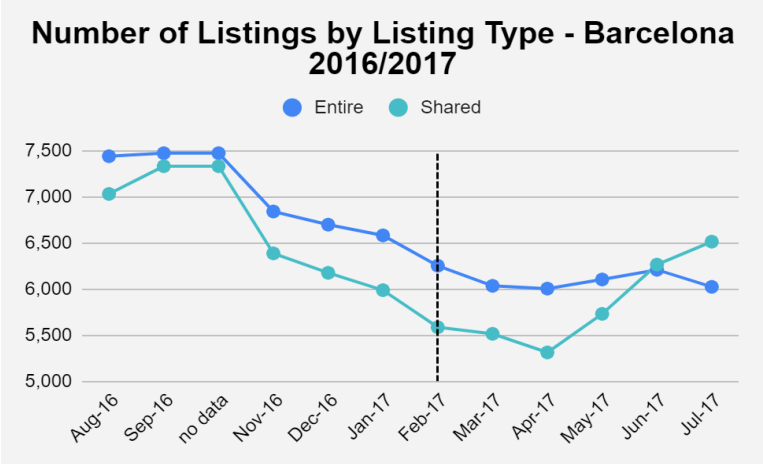

Figure 7. Number of Listings: Barcelona (2016/2017)

Figure 8 presents the development of the number of listings split by listing type in Barcelona over 12 months, specifically from December 2017 until November 2018. The time period is represented by the horizontal axis and the number of listings by the vertical axis. On 01 June 2018, Airbnb and the city of Barcelona introduced a new agreement that gives Barcelona authorities access to host- and listing data. Overall, the number of EH- and SH listings is in a similar range. The number of EH listings remains rather level up until May 2018. A sharp drop of 16.85% can be observed up to the enforcement of the new data sharing regulations. After that, it returns to becoming quite level again. From April until May, i.e. the period after the regulation date and one month beforehand, a total decrease in EH listings of

3.17% can be seen. In contrast, the number of SH listings increases by 4.7% in that time period. Moreover, the number of shared listings drops slightly starting from December 2017 until April 2018. Then, an increasing trend is recognizable until August 2018, after which it continuously decreases again.

In order to test if there is a significant difference between the *Number of Listings* before - and after the regulation, a two-sided Wilcoxon rank-sum test was conducted. The results were significant for EH listings ($W = 4$, $p = 0.026$) as well as for SH listings ($W = 32$, $p = 0.026$), which means that we can statistically prove that there is a difference before and after regulation for both listing types. As the mean of EH listings appears to be higher before than after the regulation, another Wilcoxon rank-sum test was conducted to test for this hypothesis. The results were not significant meaning that we cannot prove that the mean of EH listings is higher before than after the regulation ($W = 4$, $p = 0.992$). As the mean of SH listings appears to be higher before than after the regulation, another Wilcoxon rank-sum test was conducted to test for this hypothesis. The results were significant meaning and confirms our hypothesis ($W = 32$, $p = 0.013$).

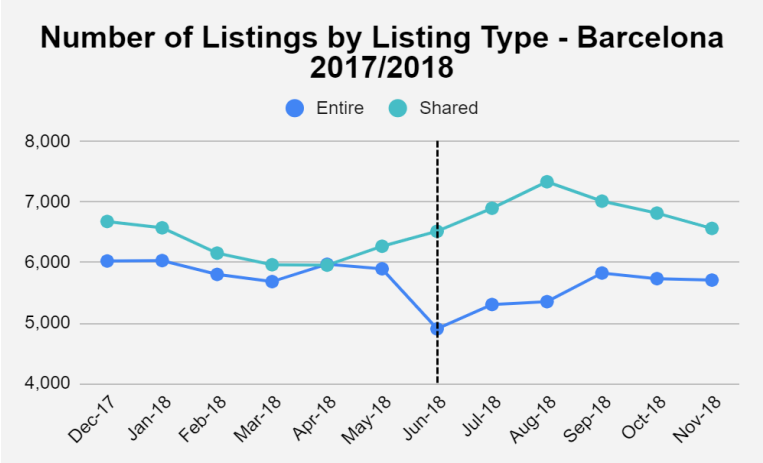

Figure 8. Number of Listings: Barcelona (2017/2018)

Figure 9 shows the development of the number of listings split by listing type in Lisbon from June 2017 until December 2017. A regulation in the form of a license requirement came into effect on 01 July 2017 and became a mandatory field for hosts on Airbnb's platform. Data for July could not be obtained, therefore data from the previous month was used as the datapoint for visualization purposes. It is worth noting that only six months of data could be obtained. From July 2017 until August 2017, a sharp increase by 22.11% is recognizable in the number of EH listings and 31.05% in the number of SH listings. For EH listings, the increase continues until October 2017, however not as steeply. In September 2017, EH listings rise by 3.39%, in October by 1.19%. After that, the numbers decrease slightly by 0.42% in November and 1.17% in December. SH listings increase by 3.16% in September, 3.26% in October, and 2.74% in November and thereafter decrease by 4.84% in December. As only one data point is available before the regulation, no statistical test could be conducted.

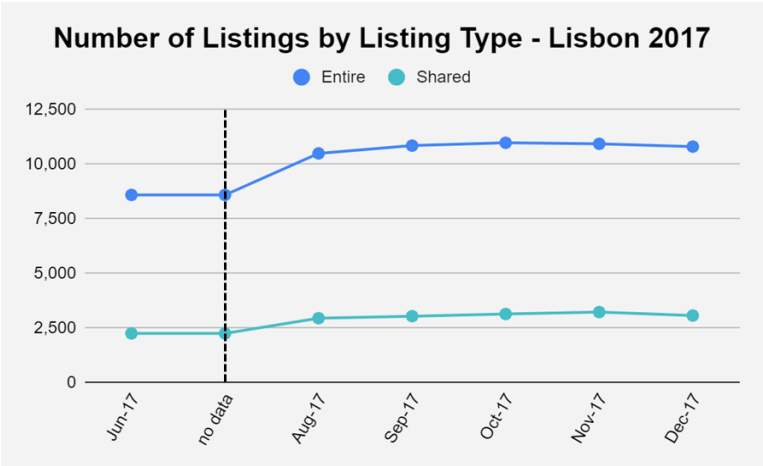

Figure 9. Number of Listings: Lisbon

In Paris, a regulation in the form of a license requirement was implemented on 01 December 2017. However, it was only enforced as an optional field for hosts on Airbnb's website. In Figure 10 and 11, the development of the number of EH- and SH listing can be seen. It should be noted, that in addition, an automated day cap was introduced to Airbnb's platform on 01 January 2018. Since the number of SH listings is much smaller than the number of EH listings, these metrics will be shown in separate graphs to properly capture the development. A steady increase of 20.01% is noticeable in the number of EH listings up until August 2017. Thereafter, a slow decrease can be seen. When looking at the time period November 2017 to May 2018, a total decrease of 17.21% can be observed in EH listings. Likewise, an overall decrease of 15.33% is noticeable in SH listings. Up until October 2017, a slight upwards trend can be seen. After that, an overall decrease is visible.

In order to test if there is a significant difference between the *Number of Listings* before - and after the regulation, a two-sided Wilcoxon rank-sum test was conducted. The result shows that there is a significant difference in the number of EH listings ($W = 34$, $p = 0.005$), as well as SH listings ($W = 33$, $p = 0.010$) before and after the regulation as can be seen in Table 4. Since the mean of EH listings appears to be higher before than after the regulation, we conduct another Wilcoxon rank-sum test to test this hypothesis. The result was significant and therefore confirms that the mean of EH listings is higher before than after the regulation ($W = 34$, $p = 0.003$). Regarding SH listings, the mean of SH listings also appears to be higher before than after the regulation and test our hypothesis with another test. The result was significant meaning that mean of SH listings is higher before than after the regulation ($W = 33$, $p = 0.005$).

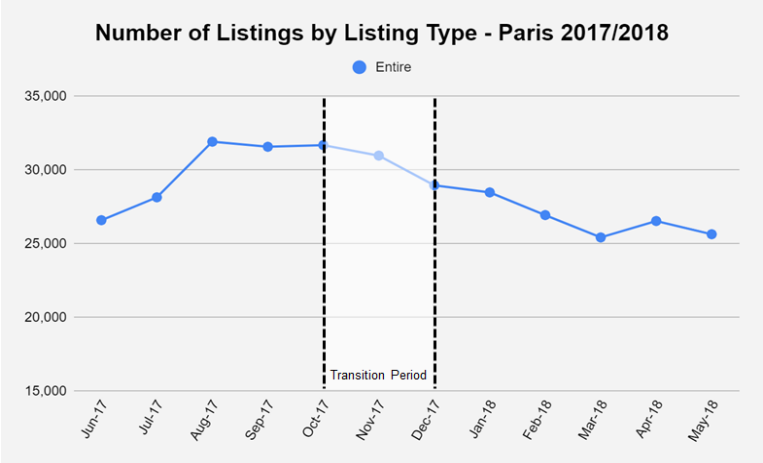

Figure 10. Number of Listings: Paris (EH)

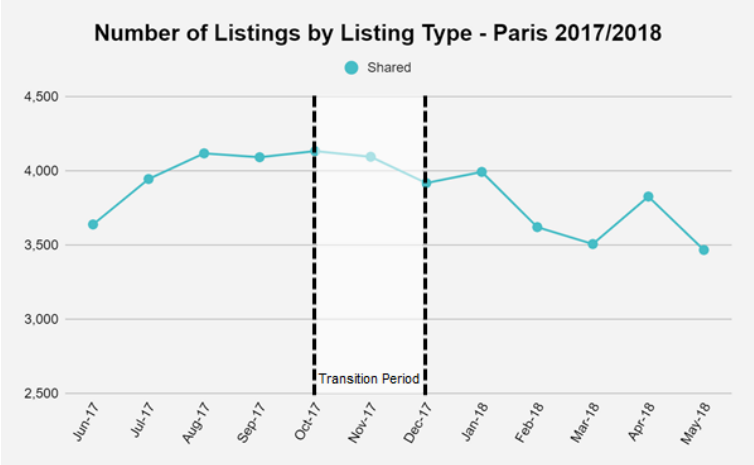

Figure 11. Number of Listings: Paris (SH)

Dataset / Test Statistics	Difference between groups?	W test statistic	p-value	Significance level
Amsterdam 16/17				
Entire	Yes	0	0.004329	**
Hypothesis	Greater	0	1	-
Shared	No	24	0.01255	*
Amsterdam 18/19				
Entire	Yes	30	0.004329	**
Hypothesis	Greater	30	0.002165	**
Shared	Yes	28	0.01732	*
Hypothesis	Greater	28	0.008658	**
Barcelona 16/17				
Entire	No	25	0.08225	-
Shared	Yes	30	0.004329	**
Hypothesis	Greater	30	0.002165	**
Barcelona 17/18				
Entire	Yes	4	0.02597	*
Hypothesis	Greater	4	0.9924	-
Shared	Yes	32	0.02597	*
Hypothesis	Greater	32	0.01299	*
Paris 17/18				
Entire	Yes	34	0.005051	**
Hypothesis	Greater	34	0.002525	**
Shared	Yes	33	0.0101	*
Hypothesis	Greater	33	0.005051	**

Table 4. Test Statistics for Group A

5.2.2.1.2. Listings per Host

In Figure 12, 13, and 14, *Listings per Host* is shown for EH in Amsterdam, Barcelona, Lisbon and Paris. In the graphs, the data is shown with a logarithmic scale, i.e. the percentage change of the data points is shown and not the equidistant position. The decision is based on the fact that the values of three groups for each city often range in value. Therefore, it is hard to observe the development with a linear scale. Subsequently, the vertical axis shows the number of hosts while the horizontal axis shows the timeline. Furthermore, the three different groups represent the number of hosts who have either one, two, or three or more active listings. For simplicity, the group containing hosts who have one listing will be called 'Group 1', the group containing hosts who have two listings will be called 'Group 2', and the group containing hosts who have three or more listings will be called 'Group 3'. The dotted line represents the implementation date of the regulation.

Figure 12 shows the number of EH listings per host in Amsterdam from July 2016 to June 2017. As previously mentioned, data for the month of October 2016 is missing. The day cap (60 day) was implemented on 01 January 2017 in Airbnb's platform on 01 January 2017. This regulatory approach was a result of collaboration between the city of Amsterdam and Airbnb. The number of hosts with one listing increases from July 2016 up until November 2016. Thereafter, a steady decrease up until April 2017 is noticeable. From February 2017 to April 2017 the drop is biggest and towards June 2017 the number increases again. In the overall time frame considered, i.e. July 2016 to June 2017, Group 1 rises by 10.63%. However, looking at the time period after the implementation of the day cap i.e. July 2016 to June 2017, a total decrease of 8.64% is identifiable. The number of hosts with two listings increases slightly from July 2016 up until November 2016. With the exception of January 2017, a slight but steady decrease can be seen up until April 2017. Again the biggest drop is between February 2017 and April 2017. Following that, the number of hosts with two EH listings slightly increases again. Over the entire time period, Group 2 increases by 0.60%. In the period after the implementation of the day cap, Group 2 decreases by 6.67%, i.e. 24 hosts. A clear decreasing trend can be seen in Group 3 after the implementation date. A decrease of 16.43% is visible over the entire time period. More specifically, in the period after the day cap implementation, i.e. December 2016 to June 2017 a decrease of 23.03% is identifiable.

In order to test if there is a significant difference between the *Number of Listings per Host (EH)* before - and after the regulation in Amsterdam (2016/2017), a two-sided Wilcoxon rank-sum test was conducted for hosts with 2 listings, and hosts with 3 or more listings. Since the motivation by investigating this metric is to see the development of the number of hosts who may be subletting commercially, the number of hosts with 1 listing was not further investigated. The result presents that there is no significant difference in the number of hosts with 2 listings ($W = 26$, $p = 0.055$) before- and after the regulation. However, a significant difference between the groups is noticeable in the number of hosts with 3 or more listings ($W = 29$, $p = 0.0135$). Since the mean of hosts with 3 or more listings appears to be higher before than after the regulation, we conduct another Wilcoxon rank-sum test specifying our hypothesis. The result was significant meaning that the mean of hosts with 3 or more listings is higher before than after the regulation ($W= 29$, $p = 0.004$) (Table 5).

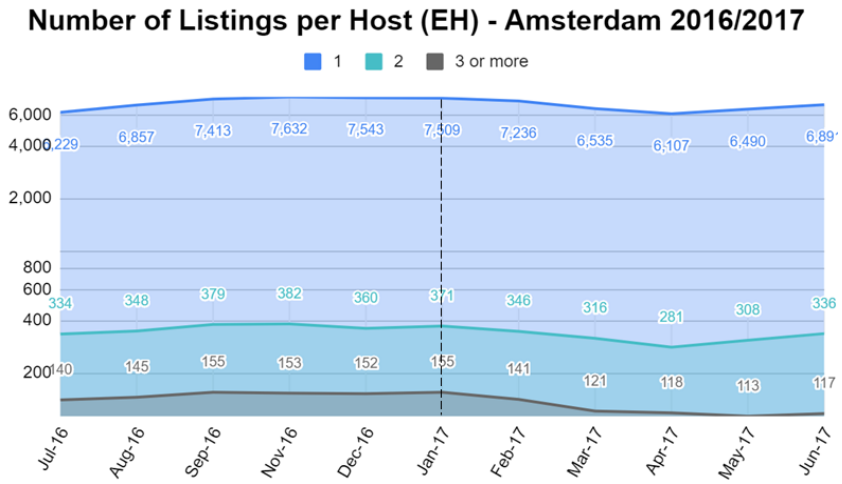

Figure 12. Listings per Hosts (EH) : Amsterdam (2016/2017)

Figure 13 shows the number of EH listings per host in Amsterdam from July 2018 to May 2019. It is worth noting that data for the month of October 2018 is missing. The new day cap (30 day limit) was implemented on 01 January 2019. The number of hosts with one EH listing minimally increases from July 2018 until September 2018. Subsequently, a marginal yet consistent decrease can be observed from September 2018 to April 2019. From February 2019 onwards, the decrease rises but stabilizes again. In the entire time frame, a 14.98% decrease in Group 1 can be seen. After the implementation of the day cap i.e. from December 2018 to May 2019, a 21.79% decrease is noticeable. The development of the number of hosts with two listings is similar. From July 2018 to August 2018 a marginal increase can be seen. Thereafter, a consistent drop is noticeable towards the end of the considered time frame. Specifically, after the day cap implementation i.e. December 2018 to May 2019, Group 2 drops by 25.68%. Over the entire time frame, the decrease is 20.47%. In terms of Group 3, a minimal increase up until November 2018 is observable. After that, a downwards trend is noticeable. The overall decrease is 2.59% and the decrease after the regulation is 5.83%.

In order to test if there is a significant difference between the *Number of Listings per Host (EH)* before - and after the regulation in Amsterdam (2018/2019), a two-sided Wilcoxon rank-sum test was conducted for hosts with 2 listings, and hosts with 3 or more listings. The result presents that there is no significant difference in the number of hosts with 3 or more listings ($W = 25$, $p = 0.082$) before- and after the regulation. However, a significant difference between the groups is noticeable in the number of hosts with 2 listings ($W = 29$, $p = 0.014$). Since the mean of hosts with 2 listings appears to be higher before than after the regulation, we conduct another Wilcoxon rank-sum test specifying our hypothesis. The result was significant meaning that the mean of hosts with 2 listings is higher before than after the regulation ($W= 29$, $p = 0.007$) (Table 5).

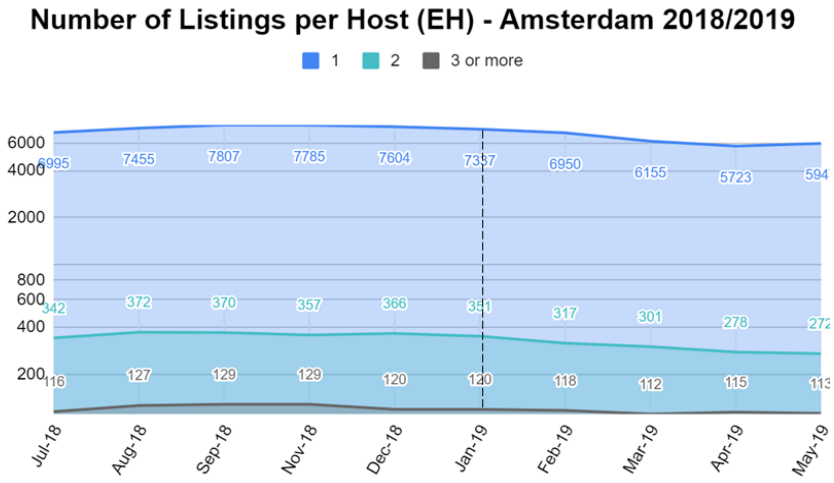

Figure 13. Listings per Hosts (EH) : Amsterdam (2018/2019)

Figure 14 shows the development of the number of EH listings per host in Barcelona from August 2016 to July 2017. On 01 February 2017, it became illegal to rent out more than two EHs in the city centre. An overall decrease can be observed in Group 1, Group 2, and Group 3. To be more specific, Group 1 decreases up until April 2017. Subsequently, the number starts increasing again towards June 2017, although dropping again in July 2017. Over the entire time frame, a 23.13% decrease in Group 1 can be seen. After the regulation, i.e. January 2017 to July 2017, a 9.51% decrease is noticeable. Regarding Group 2, the drop stabilizes from March 2017 onwards. When observing the change after the implementation date, a 8.64% increase can be seen. However, the overall decline represents 24.86%. As for group 3, the decrease stabilizes towards May 2017. An overall decrease of 25.15% can be seen and specifically, in the time period after the implementation date, a 12.01% decline.

In order to test if there is a significant difference between the *Number of Listings per Host (EH)* before- and after the regulation in Barcelona (2016/2017), a two-sided Wilcoxon rank-sum test was conducted for hosts with 2 listings, and hosts with 3 or more listings. The result shows that there is a significant difference in the number of hosts with 2 listings ($W = 30$, $p = 0.004$), as well as with 3 or more listings ($W = 30$, $p = 0.004$) before- and after the regulation. Since the mean of hosts with both 2 listings and 3 or more listings appears to be higher before than after the regulation, we conduct another round of Wilcoxon rank-sum tests specifying our hypotheses. The results were significant for both 2 listings ($W= 30$, $p = 0.002$) and 3 or more listings ($W = 30$, $p = 0.02$) meaning that the hosts with 2 listings and 3 or more listings are higher before than after the regulation (Table 5).

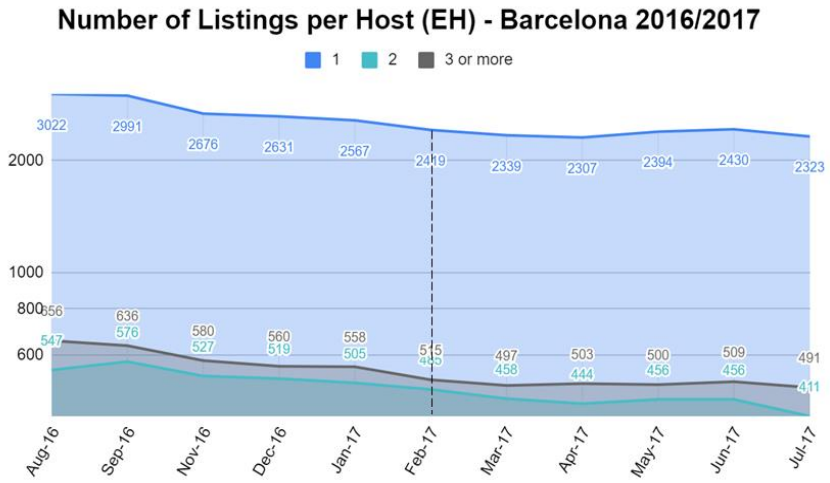

Figure 14. Listings per Hosts (EH) : (Barcelona 2016/2017)

Figure 15 shows the development of the number of EH listings per host in Barcelona from December 2017 to October 2018. On 01 June 2018, Airbnb implemented a new tool into their platform that passes on host information to the city of Barcelona. An overall decrease in the number of hosts with one listing, two listings, and three or more listings can be observed. Especially towards the aforementioned implementation date, namely between May 2018 and June 2018, a large decrease is noticeable. After that, the number of EH listings for all groups stabilizes again. Over the entire time frame, a 35.20% for Group 1, a 29.41% for Group 2, and a 10.70% for Group 3 decrease can be seen. When specifically looking at the time period after the regulatory approach date i.e. May 2018 to November 2018, a decrease of 30.48% in Group 1, 22.69% in Group 2, and 3.13% in Group 3 is noticeable.

In order to test if there is a significant difference between the *Number of Listings per Host (EH)* before- and after the regulation in Barcelona (2017/2018), a two-sided Wilcoxon rank-sum test was conducted for hosts with 2 listings, and hosts with 3 or more listings. The result shows that there is a significant difference in the number of hosts with 2 listings ($W = 36$, $p = 0.002$), as well as with 3 or more listings ($W = 4.5$, $p = 0.037$) before- and after the regulation. Since the mean of hosts with both 2 listings and 3 or more listings appears to be higher before than after the regulation, we conduct another round of Wilcoxon rank-sum tests specifying our hypotheses. The results were significant for 2 listings ($W= 36$, $p = 0.001$) meaning that the hosts with 2 listings is higher before than after the regulation. However, for hosts with 3 or more listings, the results were not significant ($W = 4.5$, $p = 0.988$) meaning that we cannot determine a difference between the groups (Table 5).

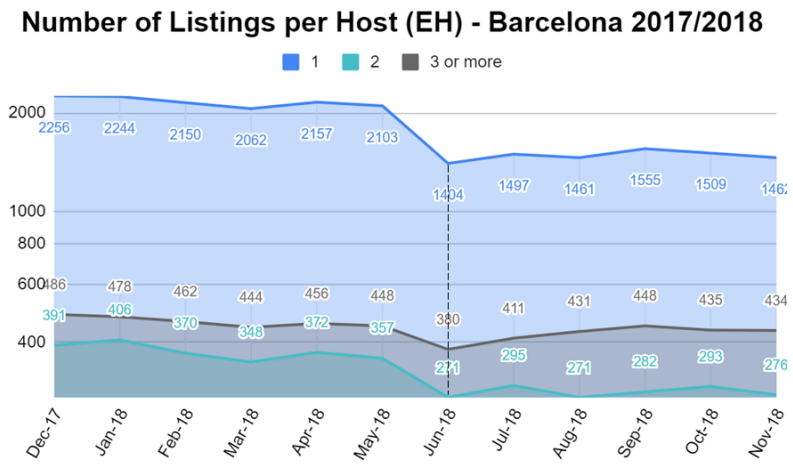

Figure 15. Listings per Hosts (EH) : (Barcelona 2016/2017)

Figure 16 shows the development of the number of EH listings per host in Lisbon from June 2017 to December 2017. On 01 July 2017, a regulatory approach in the form of a license requirement was introduced. In contrast to the previously considered figures, an overall upwards trend is identifiable. Specifically, the number of listings for Group 1, Group 2, and Group 3 increase from June 2017 to August 2017 and after that, stabilize towards November 2017. Over the entire time frame, Group 1 increases by 26.40%, Group 2 by 18.65%, and Group 3 by 24.49%. Due to only having one datapoint before the regulation was implemented, no statistical tests could be conducted.

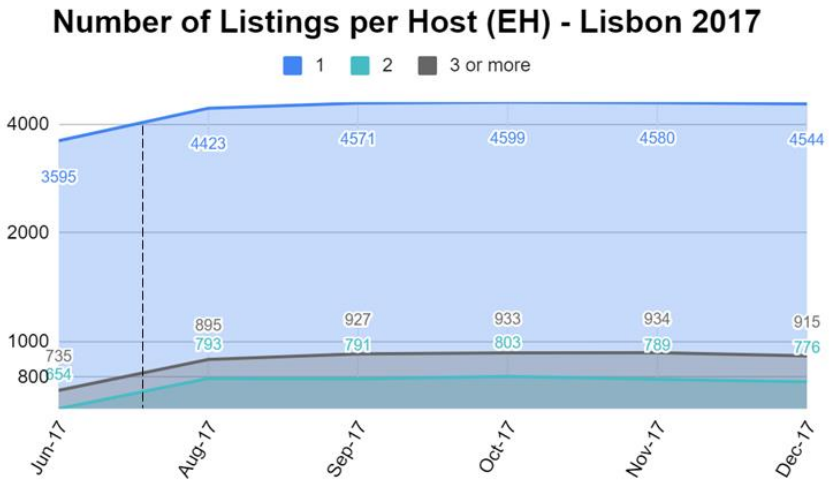

Figure 16. Listings per Hosts (EH) : Lisbon

Figure 17 shows the development of the number of EH listings per host in Paris from July 2016 to June 2017. On 01 December 2016, a license requirement was introduced. In addition, on 01 January 2017, a day cap was introduced. Group 1, Group 2, and Group 3 decrease over the timeframe by 1.99%, -8.41%, and -8.31% respectively. Regarding the time period after the regulation date, i.e. December 2016 to

June 2017, large decreases can be seen in Group 1, Group 2, Group 3, namely by 16.39%, 23.03%, and 14.26% respectively. In order to test if there is a significant difference between the *Number of Listings per Host (EH)* before- and after the regulation in Paris, a two-sided Wilcoxon rank-sum test was conducted for hosts with 2 listings, and hosts with 3 or more listings. The result shows that there is a significant difference in the number of hosts with 2 listings (W = 35, p = 0.003), as well as with 3 or more listings (W = 35, p = 0.003) before- and after the regulation. Since the mean of hosts with both 2 listings and 3 or more listings appears to be higher before than after the regulation, we conduct another round of Wilcoxon rank-sum tests specifying our hypotheses. The results were significant for both 2 listings (W= 35, p = 0.001) and 3 or more listings (W = 35, p = 0.001) meaning that the hosts with 2 listings and 3 or more listings are higher before than after the regulation (Table 5).

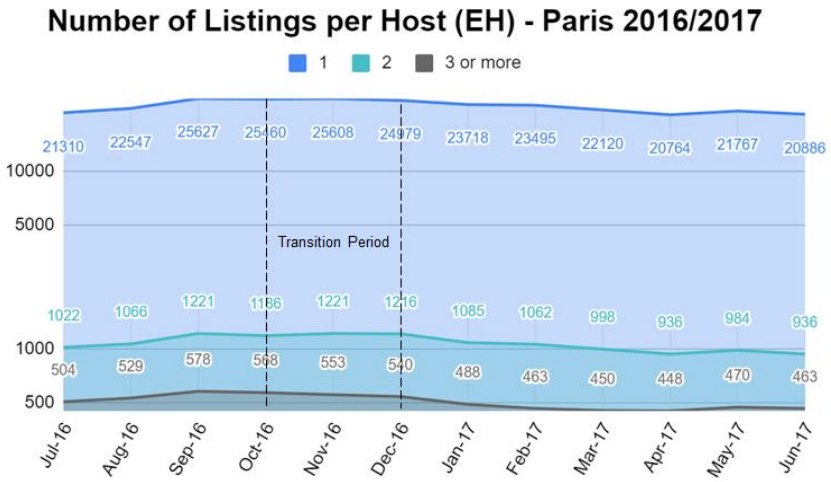

Figure 17. Listings per Hosts (EH): Paris

Dataset / Test Statistics	Difference between groups?	W test statistic	p-value	Significance level
Amsterdam 16/17				
2 listings	No	26	0.05468	-
3 or more listings	Yes	29	0.008658	**
Hypothesis	greater	29	0.004329	**
Amsterdam 18/19				
2 listings	Yes	29	0.0135	*
Hypothesis	Greater	29	0.006749	**
3 or more listings	No	25	0.08225	-
Barcelona 16/17				
2 listings	Yes	30	0.004329	**
Hypothesis	Greater	30	0.002165	**
3 or more listings	Yes	30	0.004329	**
Hypothesis	Greater	30	0.002165	**

Barcelona 17/18				
2 listings	Yes	36	0.002165	**
Hypothesis	Greater	36	0.001082	**
3 or more	Yes	4.5	0.03704	*
Hypothesis	Greater	4.5	0.9876	-
Paris 17/18				
2 listings	Yes	35	0.002525	**
Hypothesis	Greater	35	0.001263	**
3 or more listings	Yes	35	0.002525	**
Hypothesis	Greater	35	0.001263	**

Table 5. Test Statistic for Group A

5.2.2.1.3. Host Local

As previously mentioned, host local describes whether or not a host who is subletting a property in a specific city, actually lives in that city. The horizontal axis of Figures 18,19, and 20 show the distribution of local and non-local hosts in %. The vertical axis describes the time period in months. The dotted line represents the implementation of the regulation in each specific city.

In Figure 18, a slight but steady increase in the number of non-local hosts can be seen in Amsterdam from July 2016 until June 2017. Hence, a decrease in the number of local hosts is observable. The share of local hosts ranges between 87.26%-89.51% and the distribution of non-local hosts ranges between 10.49%-12.72%. In summary, the percentage of non-local hosts is higher after the implementation of the day cap (60 days) than before. In order to test if there is a significant difference in the number of non-local hosts before- and after the regulation in Amsterdam, a Wilcoxon rank-sum test was conducted. The result, which can be seen in Table 6, shows that there is no significant difference in the number of non-local hosts ($W = 11$, $p = 0.537$) before- and after the regulation. In order to test if there is a significant difference in the number of non-local hosts before- and after the regulation in Amsterdam, a Wilcoxon rank-sum test was conducted. The result, which can be seen in Table 6, shows that there is a significant difference in the number of non-local hosts ($W = 29$, $p = 0.008$) before- and after the regulation, which is presented in Table 6. Since it appears that the number of non-local hosts is higher before than after the regulation (see Appendix J), another Wilcoxon rank-sum test was conducted. It tests if the number of non-local hosts are greater before than after the regulation, which can be statistically proven ($W = 29$, $p = 0.004$).

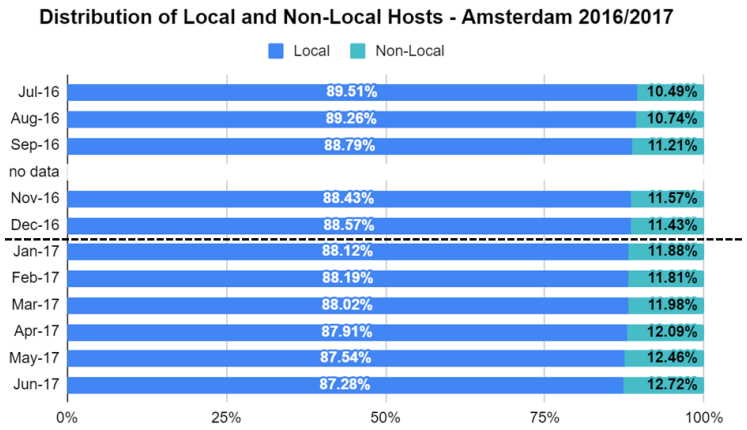

Figure 18. Host Local: AMS (2016/2017)

In Figure 19 the distribution of non-local hosts and hosts can be seen in Amsterdam from July 2018 until May 2019. As previously mentioned, a regulation in the form of a day cap was implemented on 01.01.2019. The percentage of local hosts ranges between 84.75%-85.58% and the number of non-local hosts between 14.42%-15.25%. An overall increase in the number of non-local hosts can be seen. Consequently, the number of local hosts drops. In comparison to Figure 18, the share of non-local host and local hosts has changed. While the percentage of non-local hosts in June was 12.72%, it rises to 15.07% in May 2018. In order to test if there is a significant difference in the number of non-local hosts before- and after the regulation, a Wilcoxon rank-sum test was conducted. The result, which can be seen in Figure X, shows that there is a significant difference in the number of non-local hosts ($W = 29$, $p = 0.009$) before- and after the regulation, which is presented in Table 6.

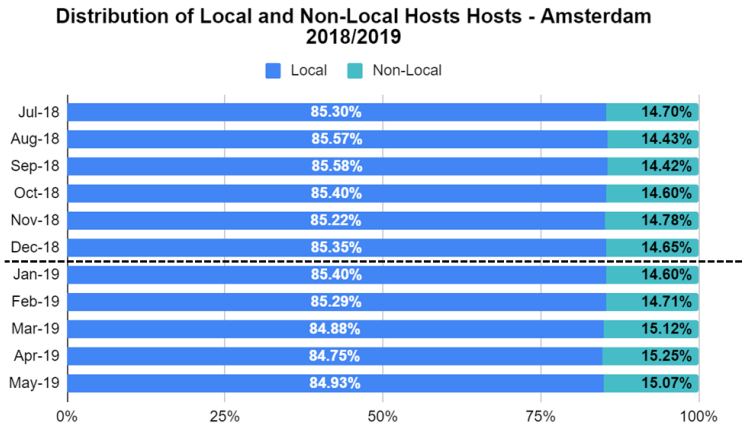

Figure 19. Host Local: AMS (2018/2019)

Figure 20 presents the distribution of non-local hosts, which can be seen on the horizontal axis, in Barcelona from August 2016 until July 2017, which is presented on the vertical axis. It is noteworthy that data for October 2016 could not be obtained. Furthermore, a limit to the number of rental licenses was implemented on 01 February 2017. Specifically, hosts in the city centre were no longer allowed to

have more than two listings. The share of non-local hosts ranges between 16.15%-18.35% and the distribution of non-local hosts ranges between 81.65%-83.85%. Overall, a drop in the number of local hosts is noticeable and therefore, an increase in the number of non-local hosts. The percentage of non-local hosts is higher after the regulation, i.e. February 2017 to July 2017, than before i.e. August 2016 to January 2017. In order to test if there is a significant difference in the number of non-local hosts before- and after the regulation in Barcelona, a Wilcoxon rank-sum test was conducted. The result, which can be seen in Figure X, shows that there is no significant difference in the number of non-local hosts ($W = 24$, $p = 0.1255$) before- and after the regulation, which is presented in Table 6.

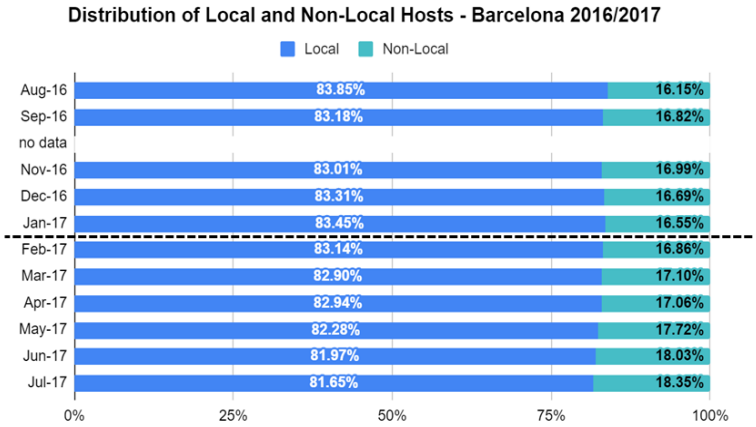

Figure 20. Host Local: Barcelona (2016/2017)

Figure 21 shows the distribution of local and non-local hosts in Barcelona, after the implementation of Airbnb's new tool, i.e. passing on host information to the city of Barcelona. From December 2017 until November 2018, an overall decrease in the number of local hosts can be seen in Barcelona, hence, an increase in non-local hosts. The percentage of local hosts ranges between 79.47%-81.24% and non-local hosts between 18.76%-20.53%. In comparison, the percentage of non-local hosts is higher after the regulation, i.e. June 2018 to November 2018, than before, i.e. December 2017 to May 2018. That meaning, the distribution of local hosts is lower after the regulation than before. In contrast to Figure 20, the distribution has changed. While the number of local host in July 2017 was 81.65%, in November 2018 it has decreased to 79.85%. Hence, the number of non-local hosts has increased from 18.35% to 20.15%. In order to test if there is a significant difference in the number of non-local hosts before- and after the regulation in Barcelona, a Wilcoxon rank-sum test was conducted. The result, which can be seen in Figure X, shows that there is no significant difference in the number of non-local hosts ($W = 7$, $p = 0.093$) before- and after the regulation, which is presented in Table 6.

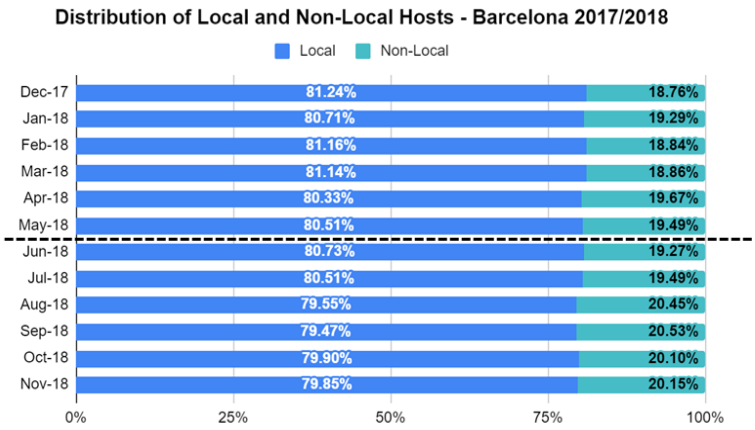

Figure 21. Host Local: Barcelona (2018/2019)

Figure 22 presents the distribution of non-local hosts, which can be seen on the horizontal axis, in Lisbon from June 2017 to December 2017, which is presented on the vertical axis. A license requirement was implemented on 01 July 2017. It is noteworthy that data is missing, hence, only one month before the regulation date can be observed and five months after it. Furthermore, data for the month of July is missing. In contrast to the aforementioned cities, the distribution of local and non-local hosts is slightly different. The percentage of non-local hosts is higher, namely between 22.34% - 25.45%, and accordingly, the percentage of local hosts ranges between 74.55%-77.66%. As there is only one datapoint before the regulation, no statistical test has been conducted.

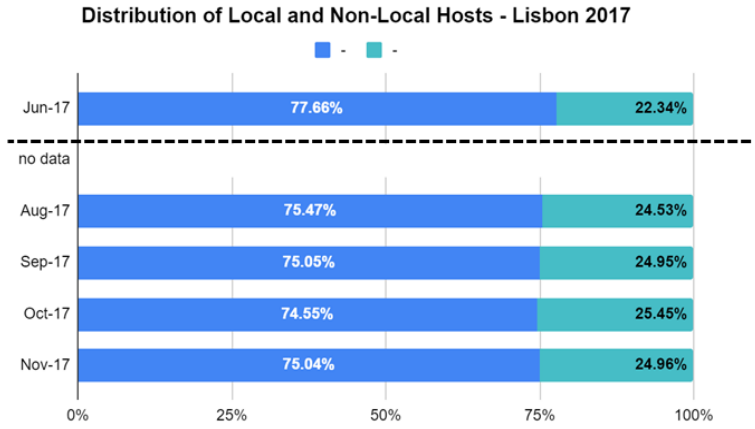

Figure 22. Host Local: Lisbon

Figure 23 presents the distribution of non-local hosts, which can be seen on the horizontal axis, in Paris from June 2017 to May 2018, which is presented on the vertical axis. On 01 December 2017 a license requirement was implemented. Hosts had a two-month transition period to register (from October). Similar to Lisbon, in Paris, the share of non-local hosts ranges between 20.71% and 25.60%, hence it is slightly higher than in the previously mentioned cities. Accordingly the number of local hosts ranges between 74.40%-79.29%. Overall, the percentage of non-local hosts is lower before the regulation date,

i.e. June 2017 to November 2017, than after it, i.e. December 2017 to May 2018. In order to test if there is a significant difference in the number of non-local hosts before- and after the regulation in Paris, a Wilcoxon rank-sum test was conducted. The result, which can be seen in Figure X, shows that there is no significant difference in the number of non-local hosts (W = 26.5, p = 0.167) before- and after the regulation, which is presented in Table 6.

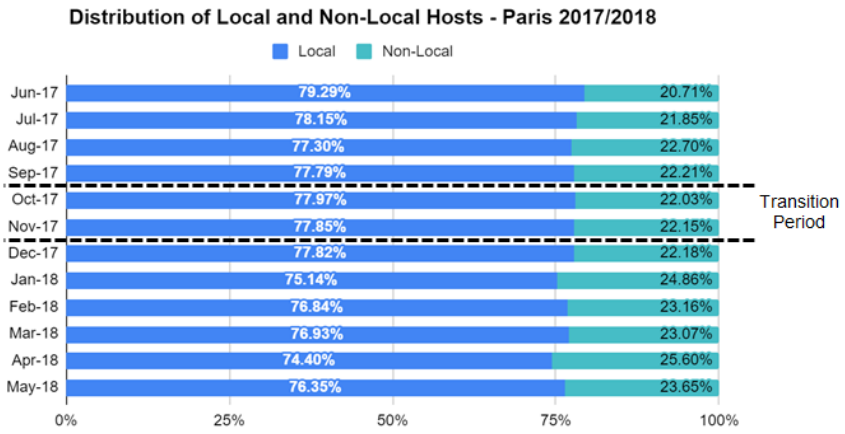

Figure 23. Host Local: Paris

Dataset / Test Statistics	Difference between groups?	W test statistic	p-value	Significance level
Amsterdam 16/17				
Non-local	No	11	0.5368	-
Amsterdam 18/19				
Non-local	Yes	29	0.008658	**
Hypothesis	Greater	29	0.004329	**
Barcelona 16/17				
Non-local	No	24	0.1255	-
Barcelona 17/18				
Non-local	No	7	0.09307	-
Paris 17/18				
Non-local	No	26.5	0.1667	-

Table 6. Test Statistic for Group A

5.2.2.1.4. Price

Figure 24, 25, and 26 show the average price per night for EHs and SHs for Group A (Amsterdam, Barcelona, Lisbon, and Paris).

In Figure 24, the average price development in Amsterdam can be seen from July 2016 to June 2017, and July 2018 to May 2019. It is worth noting that data for October 2016 and June 2019 is missing. A

regulation in the form of a day cap (60 days) was implemented on 01 January 2017. After the regulation date, an increase in both EH- and SH prices is noticeable. Before the regulation date, only marginal changes can be seen in the price of SHs and EHs, with 2.32% being the maximal change. A total increase of 7.30%, i.e. 10€, can be seen in EH prices from December 2016 to June 2017. On a month-to-month basis, increases between 0.24% and 3.08% are noticeable in that time period. In terms of SH prices, the increase is even higher. After the regulation date, the average price per night increases by 18€, representing a rise of 22.95%. On a monthly basis, percentage changes range between 0.01%-5.88% in that time frame. In regard to the implementation of the day cap (30 days) on 01 January 2019 in Amsterdam, although an increase in EH- and SH prices is observable, the increase is lower than for the regulation of the 60 day cap. From December 2018 to May 2019, a 2.78%, i.e. 5€ increase is perceivable in EH prices and a 7.47%, i.e. 7€ increase in SH prices. A steady increase in EH prices can be seen over the entire time period, i.e. July 2018 to May 2019. Although there are minor decreases in August 2018 and December 2018 for SH prices, and overall increasing trend in prices can be identified too.

City/Type/Date	T-6	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	T+6	Change T-1 to T+6	Change T-6 to T+6
AMS 16/17	Jul-16	Aug-16	Sep-16	no data	Nov-16	Dec-16	2017-01-01	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Dec-16 to Jun-17	Jul-16 to Jun-17
Entire	143€	142€	142€	-	143€	142€		143€	143€	144€	146€	150€	153€	+10€	+9€
Percentual change	-	-1.10%	+0.27%	-	+0.47%	-0.41%		+0.43%	+0.24%	+0.92%	+1.03%	+3.08%	+1.41%	+7.30%	+6.47%
Shared	77€	76€	76€	-	78€	77€		77€	80€	85€	88€	93€	95€	+18€	+18€
Percentual change	-	-0.45%	+0.01%	-	+2.32%	-1.27%		+0.01%	+3.81%	+5.88%	+4.22%	+5.41%	+1.82%	+22.96%	+23.66%
AMS 18/19	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	2019-01-01	Jan-19	Feb-19	Mar-19	Apr-19	May-19	no data	Dec-18 to May-19	Jul-18 to May-19
Entire	163€	164€	165€	166€	167€	169€		169€	169€	170€	170€	174€	-	+5€	+10€
Percentual change	-	+0.22%	+0.60%	+0.74%	+0.51%	+1.34%		+0.16%	+0.14%	+0.03%	+0.49%	+1.94%	-	+2.78%	+6.32%
Shared	98€	98€	99€	99€	100€	100€		101€	101€	103€	105€	107€	-	+7€	+9€
Percentual change	-	-0.44%	+1.44%	+0.17%	+0.49%	-0.19%		+0.75%	+0.83%	+1.33%	+1.81%	+2.55%	-	+7.47%	+9.05%

Figure 24. Price: Amsterdam

In Figure 25, the average price development in Barcelona can be seen from August 2016 to July 2017, and December 2017 to November 2018. In Barcelona, a regulation in the form of a limit to the number of licenses came into effect on 01 February 2017. A consistent increase in EH- and SH prices can be seen from January to July. EH prices increase by 16.35%, i.e. 19€. The percentage increase in SH prices is slightly higher as they rise by 19.60%, i.e. 7€. Before the regulation date, i.e. August 2016 to January 2017 marginal changes can be seen in both EH and SH listings. On 01 June 2018, Airbnb started passing on host information to the city of Barcelona. EH prices are quite volatile in the considered time period. From December 2016 to February 2017, only marginal changes can be seen. From there onwards the percentage changes become volatile, with percentage changes ranging from -16.88% to 19.36%. SH prices are more stable with marginal changes ranging between 0.02% and 5.52%. From May 2018 to November 2018, i.e. after the implementation of the regulation, EH prices increase by 2€, i.e. 1.06% and SH prices by 1€, i.e. 1.67%. In general, no specific trend can be identified in the price development of EH- and SH prices.

City/Type/Date	T-6	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	T+6	Change T-1 to T+6	Change T-6 to T+6
BCN 16/17	Aug-16	Sep-16	-	Nov-16	Dec-16	Jan-17	2017-02-01	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Jan-17 to Jul-17	Aug-16 to Jul-17
Entire	116€	116€	116€	118€	118€	117€		119€	122€	125€	127€	131€	136€	+19€	+20€
Percentual change	-	+0.14%	+0.00%	+1.46%	-0.44%	-0.30%		+1.46%	+2.93%	+1.86%	+2.14%	+2.83%	+4.13%	+16.35%	+17.33%
Shared	39€	39€	39€	40€	39€	37€		38€	39€	40€	42€	44€	44€	+7€	+5€
Percentual change	-	-0.99%	+0.00%	+2.41%	-1.14%	-5.07%		+1.46%	+4.86%	+1.40%	+4.55%	+4.50%	+1.49%	+19.63%	+13.84%
BCN 17/18	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	2018-06-01	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	May-18 to Nov-18	Dec-17 to Nov-18
Entire	137€	135€	137€	149€	142€	147€		160€	159€	145€	150€	179€	149€	+2€	+11€
Percentual change	-	-1.80%	+1.71%	8.34%	-4.27%	3.36%		+8.73%	-0.47%	-8.66%	+3.06%	+19.36%	-16.88%	+1.06%	+8.20%
Shared	40€	39€	39€	40€	40€	43€		44€	44€	44€	44€	44€	43€	1€	4€
Percentual change	-	-1.48%	-0.02%	+3.35%	+0.59%	5.32%		+3.43%	-1.17%	+0.63%	-0.74%	+1.12%	-1.52%	+1.67%	+9.68%

Figure 25. Price: Barcelona

Figure 26 shows the average price development in Lisbon from June 2017 to January 2018. Monthly data from January 2017 to May 2017 and January 2018 could not be obtained. On 01 July 2017, a regulatory approach in the form of a license requirement was implemented. From June 2017 to December 2017 the total increase in EH prices is 7.24%, i.e. 5€ and SH prices is 11.13%, i.e. 3€ thus a slight increase until October can be seen after which both prices decrease again.

City/Type/Date	T-6	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	T+6	Change T-1 to T+6	Change T-6 to T+6
LIS 17/18	no data	no data	no data	no data	no data	Jun-17	2017-07-01	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	no data	Jun-17 to Dec-17	Jun-17 to Dec-17
Entire	-	-	-	-	-	76€		81€	82€	82€	81€	81€	-	+5€	+5€
Percentual change	-	-	-	-	-	-		+6.68%	+1.30%	+0.20%	-0.59%	-0.38%	-	+7.24%	+7.24%
Shared	-	-	-	-	-	31€		33€	35€	38€	35€	35€	-	+3€	+3€
Percentual change	-	-	-	-	-	-		+6.33%	+4.86%	+8.62%	-7.27%	-1.05%	-	+11.13%	+11.13%

Figure 26. Price: Lisbon

In Figure 27, the average price development in Paris can be seen from June 2017 to May 2018. As previously mentioned, a regulation in the form of a license requirement (registration process) was implemented on 01 December 2017. Overall, only marginal changes can be seen. From November 2017 to May 2018, a total increase of 3.94%, i.e. 4€ can be seen in EH prices. In SH prices, a 7.98%, i.e. 4€ increase can be observed.

City/Type/Date	T-6	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	T+6	Change T-1 to T+6	Change T-6 to T+6
PRI 17/18	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	2017-12-01	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Nov-17 to May-18	Jun-17 to May-18
Entire	100€	101€	101€	101€	102€	102€		102€	102€	103€	104€	104€	107€	+4€	+8€
Percentual change	-	+1.01%	-0.38%	+0.35%	+0.61%	0.73%		-0.55%	-0.24%	+1.30%	+1.05%	-0.54%	+2.91%	+3.94%	+8.38%
Shared	51€	53€	52€	52€	56€	54€		56€	55€	56€	57€	56€	59€	+4€	+7€
Percentual change	-	+2.52%	-0.35%	-0.18%	+6.33%	-2.41%		+3.17%	-2.40%	+2.54%	+1.85%	-1.97%	+4.74%	+7.98%	+14.25%

Figure 27. Price: Paris

5.2.2.1.5. Summary of Results

In order to get a comprehensible overview of Group A, a brief summary of the regulations and findings from each metric will be provided in Table 7.

City	Main Regulatory Intervention
Amsterdam 17/18	Day cap: 60 days
Amsterdam 18/19	Day cap: 30 days
Barcelona 16/17	Maximum two licenses, i.e. listings, in the city centre
Barcelona 17/18	Sharing of host- and listings details with the authorities
Lisbon 17/18	Licensing requirement
Paris 17/18	Licensing requirement and day cap of 120 days the following month

Table 7. Overview of Regulatory Intervention: Group A

In terms of *Number of Listings*, after a slight increasing trend leading up to the regulation, the number of EH listings in Amsterdam (2016/2017) decreases after the regulation. In contrast, a slow but steady increase is observable in SH listings over the entire period. Likewise, in Amsterdam (2017/2018) a decrease in EH listings can be observed after the implementation of the regulation. However, the decline starts shortly before the regulation date, and toward the end of the time frame a slight increase can be seen. A marginal decrease in SH listings is noticeable over the entire time period. In Barcelona (2016/2017), a strong decline in EH listings is observable before the regulation. The trend continues after the regulation. In terms of SH listings, after the regulation, the decreasing trend continues but stagnates and develops into a strong increasing trend, resulting in the number of SH listings overtaking the number of EH listings. In Barcelona (2017/2018), the number of EH listings slightly fluctuates leading up to the regulation date. In the month before the regulation date, a steep drop can be seen. Then, an overall slight increase can be observed towards the end of the time frame. After a slight decrease at the beginning of the time period, a strong increase is observable in SH listings which lasts until a few months after the regulation date. Thereafter, a consistent increase can be observed. Interestingly, the number of SH listings is consistently higher than EH listing during the entire time frame. Although only six months of development can be considered in Lisbon, an increasing trend in both EH- and SH listings is observable. In Paris, a slight increase in EH listings is noticeable before the regulation and a steady decrease after the regulation. Regarding SH listings, a slow increase leading up to the regulation can be observed, which develops into an overall decrease in the overall time period after the regulation. In contrast to Barcelona, there significantly more EH listings than SH listings.

When looking at the findings from *Listings per Host*, in Amsterdam (2016/2017), a large decrease in Group 3 can be seen after the regulation. Likewise, the same is detectable in Amsterdam (2018/2019). In contrast to Amsterdam, in Barcelona (2016/2017), Group 3 is larger than Group 2. That meaning, there are more hosts with more than three listings than hosts with two listings. Furthermore, a decrease in all groups can be seen but especially Group 2 decreases. In Barcelona (2017/2018), Group 3 is also higher than Group 2. All groups follow a similar decreasing trend including a noticeable drop towards June can be seen. This also mirrors the development of *Number of Listings*. However, while Group 1

and Group 3 start increasing again after the regulation, Group 2 stays at low. Likewise, Group 3 is higher than Group 2 in Lisbon. Overall, all groups stay quite level. In contrast to Lisbon and Barcelona, in Paris, Group 3 is rather small compared to Group 1 and 2. In line with *Number of Listings*, a decrease can be seen after the regulations.

Regarding *Host Local*, a marginal increase can be seen in all cities of Group A over the considered time period. Therefore, after the regulation dates the percentage of non-local hosts increase overall. In comparison to the other cities, Lisbon and Paris have a higher percentage of non-local hosts which is almost up to 25% at certain points after the regulation. That meaning, every fourth host in Lisbon and Paris is not local. The overall increase in Lisbon is more rapid than in the other cities. In Paris, the development is more volatile.

In terms of *Price*, a steady increase can be seen in Amsterdam over the entire time period. The same development is noticeable in Barcelona (2016/2017) and Lisbon. Regarding Barcelona (2017/2018), the average prices are more volatile over the entire time period, yet an overall increase is detectible. In Paris, the prices are quite volatile both before and after the regulation, however, overall the average price of EH slightly increases, and a slightly higher increase in SH average prices.

5.2.2.2. Group B

In the upcoming sections Group B (Berlin, Brussels, and London) will be analysed regarding the development of the metrics: *Number of Listings*, *Listings per Host*, *Host Location*, and *Price*. The time period consists of six months before the enforcement date of the regulation and six months after for each city. The dotted lines in the graphs represent the regulation dates for the specific cities.

5.2.2.2.1. Number of Listings

Figure 28 shows the development of the number of listings in Berlin, split by listing type. The time period begins in February 2018 and ends in January 2019, i.e. 12 months of data is shown. On 1 May, 2018, the regulation involving a strict licensing requirement was adopted with a three month transition period before it came into effect to give hosts time to obtain a license. After the end of the transition period, a significant decrease can be observed for EHs from 7.172 listings in July to 5.678 in August, representing a 20.71% decrease. The number of listings continue to drop slightly before stabilising and slightly increasing towards the end of time period. The total percentage change between July 2018 and January 2019, an 18.77% drop for EHs can be observed. If less than 49 % of the property is sublet through an STR platform like Airbnb, the licensing requirements are not as strict. Most SHs presumably fall under that category. In the first month following the implementation date, a 5.65% increase can be

observed which steadily increases month after month until October where a slight decrease begins to emerge. A minimal difference in SH listings before and after the actual enforcement date, i.e. after the transition period, a 7.68% increase can be observed from before the implementation date to last month in the time period.

In order to test if there is a significant difference between the *Number of Listings* before - and after the regulation, a Wilcoxon rank-sum test was conducted. The result shows that there is a significant difference in the number of EH listings ($W = 4$, $p = 0.026$), and SH listings ($W = 36$, $p = 0.002$) in Berlin before- and after the regulation, as can be seen in Table 7. Since the mean of EH listings appears to be higher before than after the regulation, we conduct another Wilcoxon rank-sum test to test this hypothesis. However, the alternative hypothesis is rejected meaning that there is no statistical proof of the mean of EH listings being higher before than after the regulation ($W = 4$, $p = 0.924$). Regarding SH listings, it appears that mean of SH listings is lower before the regulation than after. Hence another Wilcoxon rank-sum test was conducted to test this hypothesis. As with EH, the results were not significant meaning that there is no statistical proof of the mean of SH listings being lower before the regulation than after ($W = 36$, $p = 1$).

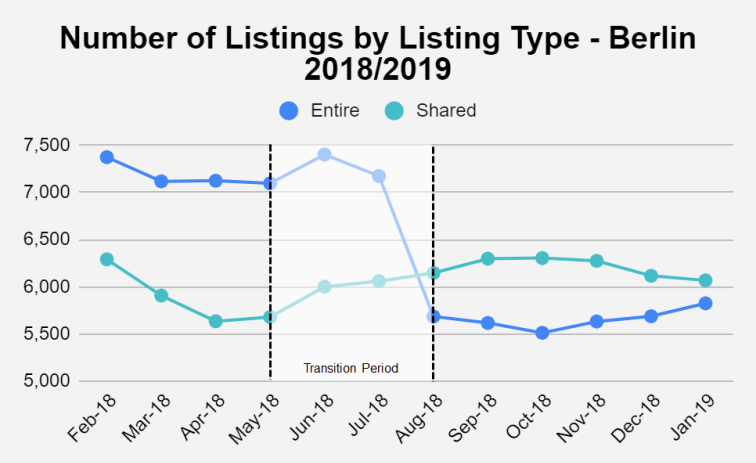

Figure 28. Number of Listings: Berlin

Figure 29 shows the development of the number of listings in Brussels, split by listing type. The time period begins in November 2015 and ends in October 2016. For the dataset, the following months of data were missing: December 2015, February and March 2016, and October 2016. Monthly changes for the affected months are therefore not observed, although the overall development can still be observed. The regulation was implemented on 24 April 2016 and included a licensing requirement, day cap (90 day), as well as numerous rules regarding what amenities the listings should provide. In contrast to Berlin, Brussels does not show as drastic changes. However, as noted above, some data points are missing. In May, just after the regulation had just been enforced, EH and SH drop by 1.85% and 7.16%

respectively. However, for both listing types, the drop stabilizes showing both minor increases and decreases. The total percentage change from April to September is -2.01% for EH listings and -7.33 % for SH listings. As there were many missing data points, especially before the regulation, no statistical test could be conducted.

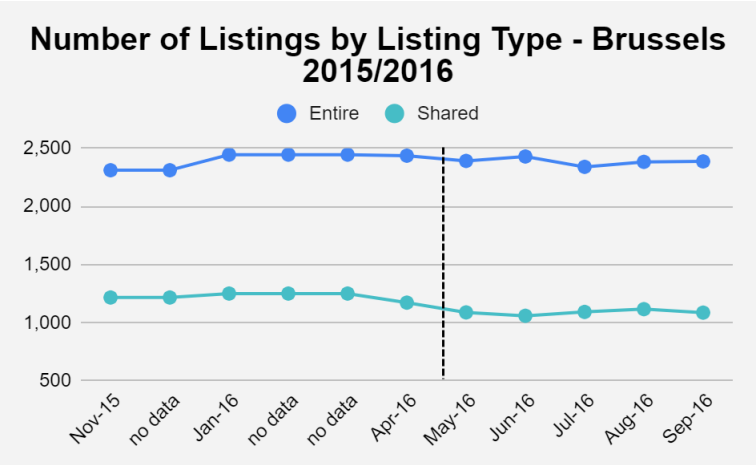

Figure 29. Number of Listings: Brussels

Figure 30 shows the development of the number of listings in London, split by listing type. The time period begins in July 2016 and ends in June 2017. The regulation came into effect on 1 January 2017 and included an automated day cap (90) in the Airbnb platform. Leading up to the implementation date, a consistent increasing trend can be observed for both listing types. In February, one month after the day cap was implemented, EH listings drop by 4.33 % and SH listings by 3.19%. However, the downward trend in the following months for both listing types begins to increase in April. When observing the entire time period after the regulation was implemented, only a slight decrease in number of EH listings can be observed (-2.31%) while EH listings has slightly increased (+2.02 %). The decrease following the regulation for both listing types may be influenced by seasonality. However, *Number of Listings* solely shows the listings on the platform and does not account for availability or whether the listing had a booking. Hosts who sublet their property during certain times when they are away, do most likely not remove their listing from the website when they are not. A more likely scenario is that they simply block their calendar. Furthermore, since SH listings show a decrease as well, it implies that seasonality does not account for the decrease since most hosts presumably are present when subletting rooms.

In order to test if there is a significant difference between the *Number of Listings* before - and after the regulation, a Wilcoxon rank-sum test was conducted. The result shows that there is a significant difference in the number of EH listings in London before- and after the regulation, as can be seen in Table 8 ($W = 4$, $p = 0.026$). For SH listings, there is not a significant difference in the number of listings

before- and after the regulation. As the number of listings for EH fluctuates throughout the time period, we conduct further tests for two different scenarios. The first is that the mean of EH listings is larger before than after the regulation. The Wilcoxon rank-sum test is not significant (W = 4, p = 0.992). The second is that the mean of EH listings is less before than after the regulation. The Wilcoxon rank-sum test is not significant (W = 12, p = 0.197). We can therefore not draw any conclusions regarding the shift of the means but only that there is a difference in general before and after the regulation.

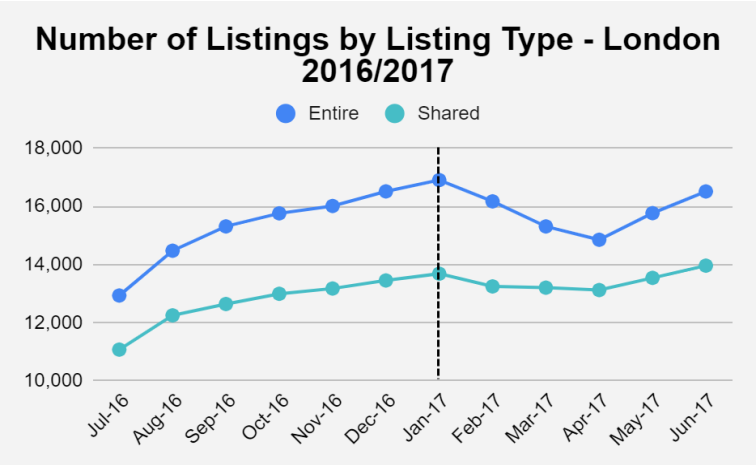

Figure 30. Number of Listings: London

Dataset / Test Statistics	Difference between groups?	W test statistic	p-value	Significance level
Berlin 18/19				
Entire	Yes	4	0.02597	*
Hypothesis	Greater	4	0.9924	-
Shared	Yes	36	0.002165	**
Hypothesis	Less	36	1	-
London 17/18				
Entire	Yes	4	0.02597	*
Hypothesis	Greater	4	0.9924	-
Hypothesis	Lower	12	0.197	-
Shared	No	12	0.3939	-

Table 8. Test Statistic for Group B

5.2.2.2.2. Listings per Host

In Figure 31, 32, and 33, *Listings per Host* is shown for EH in Berlin, Brussels, and London. In the graphs, the data is shown with a logarithmic scale, i.e. the percentage change of the data points is shown

and not the equidistant position. The decision is based on the fact that the values of three groups for each city often range in value. Therefore, it is hard to observe the development with a linear scale. Subsequently, the y-axis shows the number of hosts while the x-axis shows the timeline. Furthermore, the three different groups represents the number of hosts who have either one, two, or three or more active listings. For simplicity, the group containing hosts who have one listing will be called 'Group 1', the group containing hosts who have two listings will be called 'Group 2', and the group containing hosts who has three or more listings will be called 'Group 3'. The dotted line represents the implementation date of the regulation.

As can be seen in Figure 31, the *Number of Listings per Host (EH)* in Berlin displays a decrease for all three groups after the regulation came into effect on 01 August. However, the decrease is larger for Group 1 (-24.44%), followed by Group 2 (-16.89%), and lastly by Group 3 (4.23%). The downward trend stabilizes in September. However, Group 2 and 3 increase the following months. From July, i.e. one month before the regulation was implemented, until January, Group 3 grows by 9.86% or 21 hosts. Both Group 1 and 2 decrease during that same time period (-26.76% and 3.11% respectively).

In order to test if there is a significant difference between the *Number of Listings per Host (EH)* before - and after the regulation in London, a Wilcoxon rank-sum test was conducted for hosts with 2 listings, and hosts with 3 or more listings. Since the motivation by investigating this metric is to see the development of the number of hosts who may be subletting commercially, the number of hosts with 1 listing was not further investigated. In Berlin (Figure 9), the result presents that there is no significant difference in the number of hosts with 3 or more listings ($W = 6$, $p = 0.065$) before- and after the regulation. However, a significant difference between the groups is noticeable in the number of hosts with 2 listings ($W = 36$, $p = 0.002$). Since it appears to be more number of hosts with 2 listings before the regulation, we conduct another Wilcoxon rank-sum test specifying our hypothesis. We test whether the number of hosts with 2 listings is greater before the regulation than after the regulation which can be statistically proven ($W = 36$, $p = 0.001$).

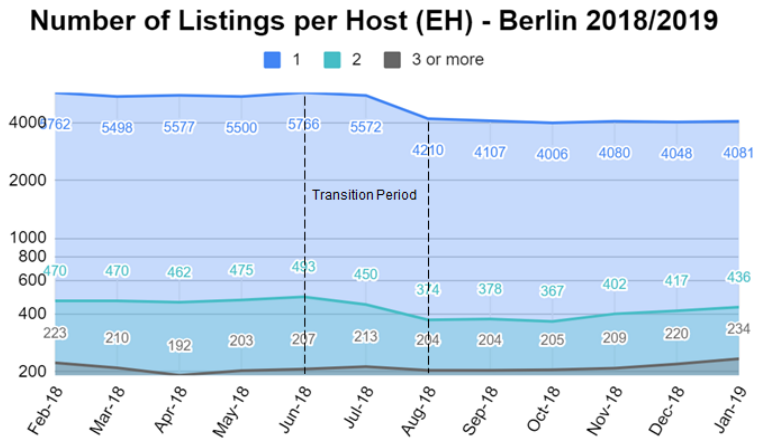

Figure 31. Listings per Hosts (EH): Berlin

Figure 32 shows the *Number of Listings per Host (EH)* in Brussels. Regarding Group 1, no major change can be seen across the entire time period or after the regulation was implemented. After the regulation, the number of hosts in Group 1 had decreased by 4.46%, which is nearly the same as the figure for the 12-month change (-5,90%). Regarding Group 2 and 3, more significant changes can be observed. After the implementation date, Group 2 had decreased by 6.32%. For the time period following the implementation, the total decrease is 11,58% or in absolute terms, 22 hosts. On the contrary, Group 3 had a total increase following the implementation of 6.84% Although it goes up and down during the entire time period, the increase appears to have started before the regulation and the overall increase from November 2015 to September 2016 is 15.74%. However, the group is in absolute number quite small and the abovementioned increases represents 8 versus 17 additional hosts. As previously mentioned, there four missing datapoints, of which three was before the regulation. Therefore, no statistical test could be conducted.

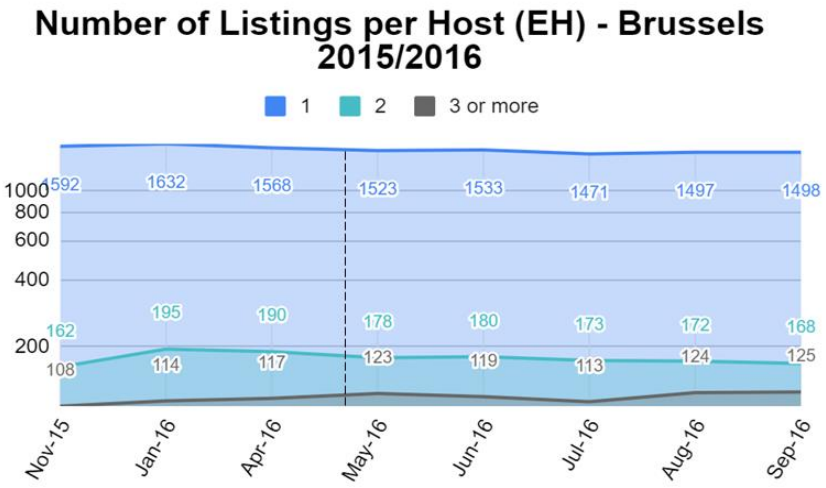

Figure 32. Listings per Host (EH): Brussels

Figure 33, shows the *Number of Listings per Host (EH)* for London. In general, an increasing trend can be observed for all three groups. In January, right after the day cap was enforced, the number of hosts in each group had in fact increased except for Group 2 that was basically unchanged. However, the following three months, i.e. February to April, a decrease can be observed for all three groups. Group 1 had the largest drop with 11.56%. However, in May and onwards the groups starts to increase again. During the time period following the implementation of the regulation, Group 1 had decreased by 3.7%. In contrast, Group 2 had increased by 2.05% and Group 3 with as much as 12.8%. The result, which can be seen in Table 9, shows that there is no significant difference in the number of hosts with 2 listings (W = 12, p = 0.394) before- and after the regulation. The same applies for the number of hosts with 3 or more listings (W = 8, p = 0.132).

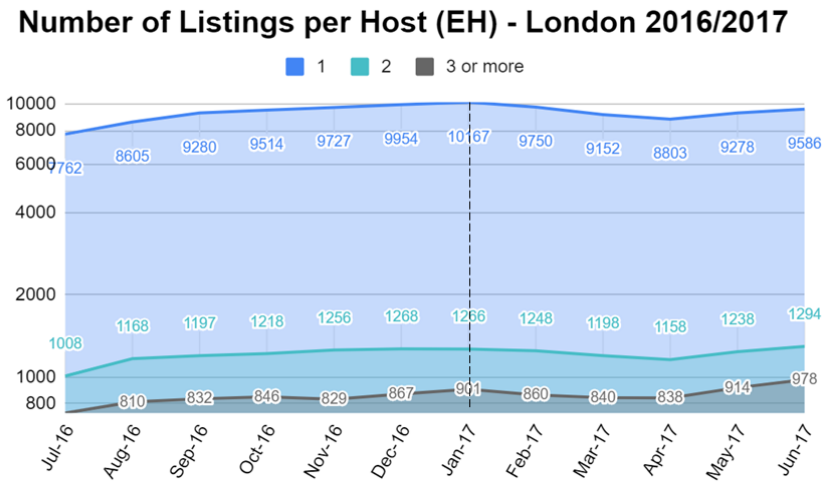

Figure 33. Listings per Host (EH): London

Dataset / Test Statistics	Difference between groups?	W test statistic	p-value	Significance level
Berlin 18/19				
2 listings	Yes	36	0.002165	**
Hypothesis	Greater	36	0.001082	**
3 or more	No	6	0.06494	-
London 16/17				
2 listings	No	12	0.3939	-
3 or more	No	8	0.132	-

Table 9. Test Statistic for Group B

5.2.2.2.3. Host Local

In Figure 34, 35 and 36 the distribution between local and non-local hosts can be found for Berlin, Brussels, and London respectively. The y-axis represents the time period, while the x-axis shows the distribution of local and non-local hosts in percent. The dotted line represents the regulation date. Common for all is that the distribution is quite similar throughout the time period, as well as consistent with marginal changes.

Berlin shows marginal differences, with the share of non-local hosts being around 20% throughout the time period. Although decreasing slightly in September and the following three months, the changes are minimal. When comparing the month before the regulation was implemented to six months after, i.e. July 2018 to January 2019, there is only a 0.15 percentage units difference in the share of non-local hosts.

As previously mentioned, the motivation of this metric is to investigate possible commercial hosts, local hosts will not be further analysed. In order to test if there is a significant difference in the number of non-local hosts before- and after the regulation in Berlin, a Wilcoxon rank-sum test was conducted. The result, which can be seen in Table 10, shows that there is a significant difference in the number of non-local hosts ($W = 36$, $p = 0.005$) before- and after the regulation in Berlin, which is presented in Figure 34. Since it appears that the number of non-local hosts is higher before than after the regulation (see Appendix J), another Wilcoxon rank-sum test was conducted. It tests if the number of non-local hosts are greater before than after the regulation, which can be statistically proven ($W = 36$, $p = 0.002$).

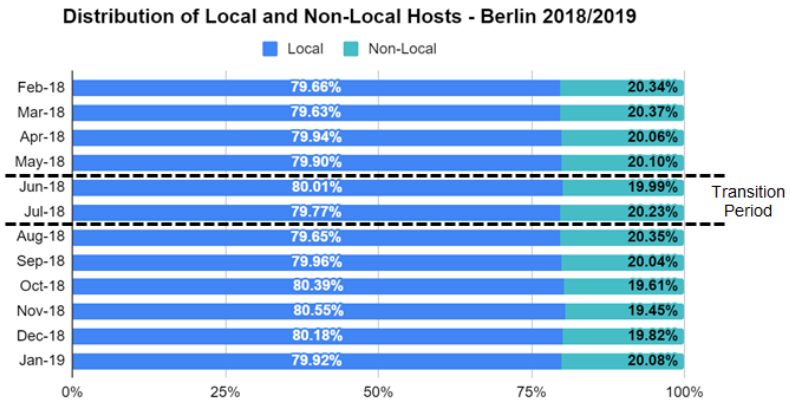

Figure 34. Host Local: Berlin

As previously mentioned, there are three months of missing data before the regulation for Brussels. However, it appears that the share of non-local hosts increases leading up to the regulation date. The time period following the implementation date shows both increases and decreases. When comparing the share of non-local hosts in April and September, i.e. one month before the regulation was

implemented and five months after, it is essentially the same. Since four data points of which three attributes to before the regulation are missing, no statistical test was made.

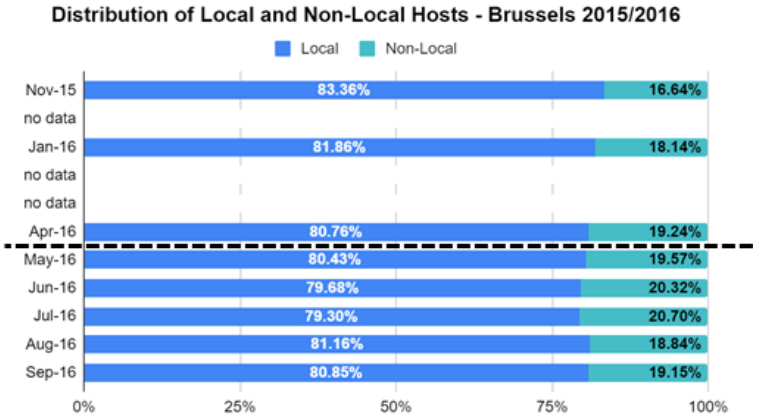

Figure 35. Host Local: Brussels

London demonstrate a slight increase of non-local hosts after the day cap (90) was implemented. The share of non-local hosts is around 18% and slightly less before the day cap was enforced. Over the 12 month time period, the increase in the share of non-local hosts is nearly three percentage units. In order to test if there is a significant difference in the number of non-local hosts before- and after the regulation, a Wilcoxon rank-sum test was conducted. The result, which can be seen in Table 10, shows that there is no significant difference in the number of non-local hosts ($W = 8$, $p = 0.132$) before- and after the regulation which is presented.

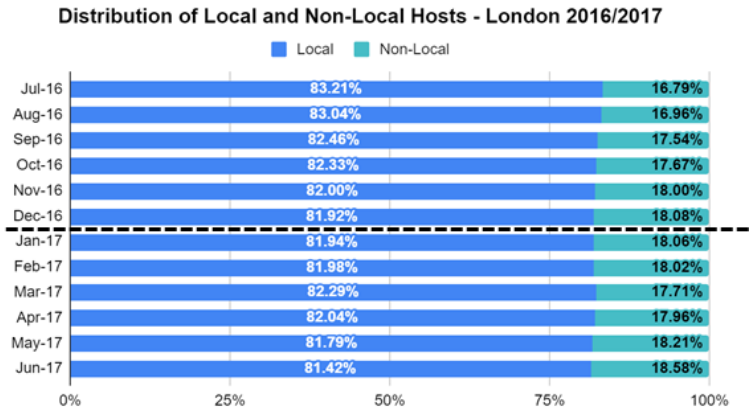

Figure 36. Host Local: London

Dataset / Test Statistics	Difference between groups?	W test statistic	p-value	Significance level
Berlin 18/19				
Non-local	Yes	36	0.004998	**
Hypothesis	Greater	36	0.002499	**
London 16/17				
Non-local	No	8	0.132	-

Table 10. Test Statistic for Group B

5.2.2.2.4. Price

Figure 37 shows the percentage change in average price per night for the different listing types. For Berlin, there are marginal increases leading up to the implementation date of the regulation for EH prices apart from March. SH prices display a similar pattern for the time period although slightly higher increases and a marginal decrease in April. Immediately after the implementation date, a 4.25% increase can be observed for EH prices and a 6.51% increase for SH prices. The increasing trend continues for both listing types the following months although it stabilizes. When observing the increase in total after the implementation date, the average price for EHs increases by 10.32% (+ 8€). For SHs, the figure is more than double with a 22.96 % (+ 9€) increase. As previously, the regulation mainly revolved around a licensing requirement where SH are subjected to less strict rules. Naturally, seasonality and specific events can play a role. However, for both listing types, the price has steadily increased and with a higher pace after the regulation.

Brussels demonstrates a consistent decreasing trend throughout the time period for both listing types, with only one exception in June for EH prices. In total, after the implementation date in late April to September, the prices for EH drop by 3.99% and for SH by 9.57%. This translates to 3€ and 4€ respectively.

Regarding the average prices for London listings, EHs show a steady increase month by month across the entire time period. The increases are all below 1% from the previous month. Since the implementation date of the regulation and the following six months, the price of EH increases by 2.3% or 3£. SH listings are more volatile leading up to the implementation date, although a small increase can be observed over all. After the implementation date, SH listing prices show a steady increase except for the last month. In total, after the implementation date, the prices for SH listings increase by 5.82% or 3£.

City/Type/Date	T-6	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	T+6	Change T-1 to T+6	Change T-1 to T+6
BER 18/19	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	2018-08-01	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Jul-18 to Jan-19	Feb-18 to Jan-19
Entire	78€	78€	78€	80€	80€	81€		84€	86€	87€	89€	90€	89€	+8€	+11€
Percentual change	-	-0.34%	+0.31%	+1.74%	+0.63%	+0.67%		+4.25%	+2.56%	+1.35%	+2.27%	+0.19%	-0.64%	+10.32%	+13.67%
Shared	36€	36€	36€	37€	38€	38€		41€	44€	47€	47€	47€	47€	+9€	+11€
Percentual change	-	+0.07%	-0.93%	+2.89%	+2.25%	+1.13%		+6.51%	+6.65%	+6.81%	+0.69%	+0.28%	+0.37%	+22.96%	+29.70%
BRU 15/16	Nov-15	no data	Jan-16	no data	no data	Apr-16	2016-04-24	May-16	Jun-16	Jul-16	Aug-16	Sep-16	no data	Apr-16 to Sep-16	Nov-15 to Sep-16
Entire	82€	-	81€	-	-	80€		80€	80€	79€	78€	77€	-	-3€	-4€
Percentual change	-	-	-1.05%	-	-	-0.52%		-0.50%	+0.10%	-1.60%	-1.65%	-0.40%	-	-3.99%	-5.50%
Shared	43€	-	42€	-	-	40€		39€	39€	38€	37€	36€	-	-4€	-7€
Percentual change	-	-	-3.56%	-	-	-3.48%		-2.12%	-1.20%	-2.68%	-2.69%	-1.26%	-	-9.57%	-15.82%
LDN 16/17	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	2017-01-01	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Dec-16 to Jun-17	Jul-16 to Jun-17
Entire	126£	127£	128£	129£	129£	129£		130£	130£	131£	132£	132£	132£	+3£	+6£
Percentual change	-	+0.84%	+0.46%	+0.94%	+0.33%	+0.07%		+0.02%	+0.34%	+0.99%	+0.42%	+0.43%	+0.08%	+2.30%	+5.04%
Shared	45£	45£	45£	46£	46£	46£		47£	47£	48£	49£	50£	49£	+3£	+4£
Percentual change	-	-0.79%	-0.51%	+2.98%	-0.08%	+0.47%		+0.78%	+0.22%	+1.94%	+3.11%	+1.78%	-2.07%	+5.82%	+7.98%

Figure 37. Price: Group B

5.2.2.2.5. Summary of Results

In order to get a comprehensible overview of Group B, a brief summary of the regulations and findings from each metric will be provided in Table 11.

City	Main Regulatory Intervention
Berlin 18/19	Licensing requirement
Brussels 15/16	Licensing requirement and day cap: 90 days
London 16/17	Day cap: 90 days

Table 11. Overview of Regulatory Intervention: Group B

Regarding *Number of Listings,* a large drop in the number of EH listings is identifiable in Berlin after the implementation date. However, it stabilises towards the end of the time period yet a slight increase can be seen. Resulting from the drop, the number of SH listings is higher than EH listings. In contrast, only marginal changes can be seen in the number of EH- and SH listings in Brussels over the entire period. In London, a similar pattern can be observed in the development of EH- and SH listings. Before the regulation date, an increasing trend is noticeable that decreases after the implementation date. Yet, towards the end of the time frame the number of both listing types begins to increase again.

In terms of *Listings per Host*, in Berlin, the development of the groups reflects the development of *Number of Listings* in Berlin. After the implementation date, a big drop is visible which stabilizes towards the end of the time frame. Furthermore, Group 3 is rather small in comparison to Group 1 and 2. In Brussels, all groups remain quite level over time and similar to Berlin, Group 3 is small in comparison to the other groups. In London, the groups remain rather level over time.

With regard to *Host Local,* in Berlin the percentage of non-local hosts remains quite level, namely around 20%. In Brussels, a minor increase is visible but the percentage of non-local hosts also stays around 20%. In London, a similar observation can be identified.

Concerning *Price,* a constant increase in EH- and SH average prices can be seen in Berlin after the regulation. In contrast, in Brussels both average prices decrease slightly over the entire time period. In London, a small increase can be observed over the entire time period.

5.2.2.3. Group C

In the upcoming sections Group C (Copenhagen and Vienna) will be analysed regarding the development of the metrics: *Number of Listings*, *Listings per Host*, *Host Location*, and *Price*. The time period consists of six months before the enforcement date of the regulation and six months after for each city. The dotted lines in the graphs represents the regulation dates for the specific cities.

5.2.2.3.1. Number of Listings

Figure 38 illustrates *Number of Listings* by listing type for Copenhagen. The timeline begins in November 2018 and ends in August 2019. The reason for the shorter time period is due to missing data. The regulation included a 70 day cap which came into effect on 01 May 2019. Important to note is that the day cap did not accumulate previous night's sublet from January to May, but started counting from May onwards. Unfortunately, no data was available for May. Since the data is scraped at the beginning of the month, it would have been valuable to have that data point as it would have provided the number of listings right before the implementation date. Furthermore, only the three consecutive months after the implementation date could be obtained.

Starting in November, a decreasing trend can be observed for EH. In March, the number of listings decrease as much as 16.19% compared to the previous month. However, directly after the implementation date, a 22% increase can be observed. Since no data is available for May and the percentage change is based on the numbers from April, i.e. one month before the regulation, the actual increase may be lower. Although there is a marginal increase of 0.16% between March and April, an increasing trend after the regulation came into effect can be observed, further implying that the 22 % might be misleading. When instead looking at the percentage change between June and August, the data shows a 8.22% increase implying that the increasing trend may have already started in May. Since one can assume that Copenhagen attracts more tourists during the summer months, it comes as no surprise that the number of listings overall shows a seasonal behaviour. However, it is important to bear in mind that the *Number of Listings* metric solely shows the listings on the platform and does not account for availability. Even though more people sublet their properties during the summer, it does not mean the hosts take their listing down during times when they do not sublet their property. Unfortunately, the three last month of the intended time period, i.e. September to November 2019, could not be scraped. Comparing the change from December 2018 to November 2019 would have provided the one year development and reduced the discussions regarding the impact of seasonality in this case. The percentage change from April to August, i.e. one month before the regulation to three months after, is

+32.02%. In absolute numbers, the number of listings in August is 9.956, nearly the same as in January (9.959).

Regarding SH, there is a continuous decrease leading up to the implementation date. In April, the number of listings went down with as much as 12.97%. However, following the implementation date, a steady increase can be observed. From April to June, a 14.39% increase can be observed, while the increase from June to August is half as large (+7.43%). However, the last data point available in August 2019 (1.922) is still lower than in December 2018 (2.073). As discussed in the previous paragraph, having more data after the implementation would benefit the analysis.

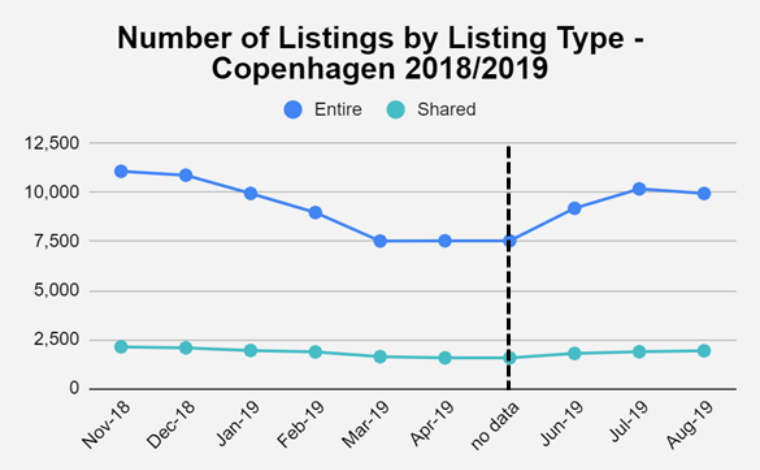

Figure 38. Number of Listings: Copenhagen

In order to test if there is a significant difference between the *Number of Listings* before - and after the regulation, a Wilcoxon rank-sum test was conducted. The result shows that there is no significant difference in the number of EH listings (W = 16, p = 0.476), and SH listings (W = 14, p = 0.762) in Copenhagen before- and after the regulation, as can be seen in Table 12.

Dataset / Test Statistics	Difference between groups?	W test statistic	p-value	Significance level
Copenhagen 18/19				
Entire	No	16	0.4762	-
Shared	No	14	0.7619	-

Table 12. Test Statistic for Group C

Figure 39 shows the Number of Listings for Vienna. The time period starts in March 2017 and ends in February 2018. The regulation implemented on 18 August 2017, stated that Airbnb needs to provide host- and listing details to the authorities. The platform claims it is in breach of the GDPR and has

subsequently not complied. In other words, the regulation does not affect hosts. Across the whole time period, the number of listings for EH shows a steady increase. For SH, the number of listings increases leading up to the regulation. However, in the following months a decrease can be observed. In total, SH listings have decreased by 12.06% from the month before the regulation, i.e. August to February. In contrast, for EHs there has been a 6.66% increase.

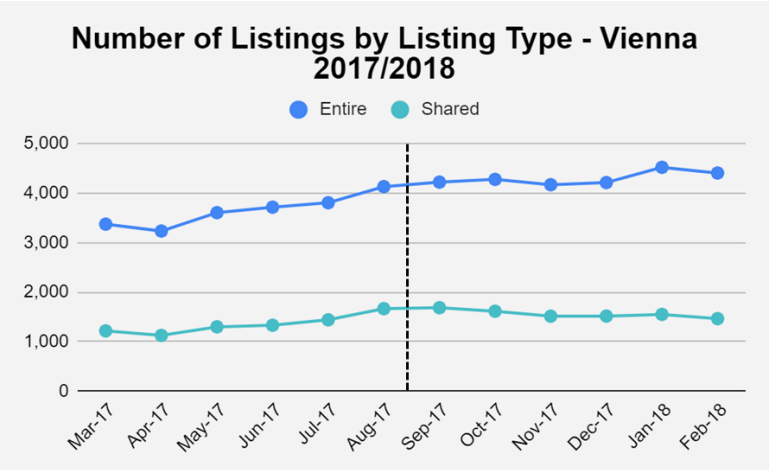

Figure 39. Number of Listings: Vienna

5.2.2.3.2. Listings per Host

In Figure 40 and 41, the *Number of Listings per Host* is shown for EHs in Copenhagen and Vienna. The data is shown with a logarithmic scale in the graphs, i.e. shows the percentage change of the data points and not the equidistant position. The decision is based on that the values for the three groups for each city often range in value and it is hard to observe the development with a linear scale. Subsequently, the y-axis shows the number of hosts while the x-axis shows the timeline. Furthermore, the three different groups represent the number of hosts who have either one, two, or three or more active listings. For simplicity, the group containing hosts who have one listing will be called 'Group 1', the group containing hosts who have two listings will be called 'Group 2', and the group containing hosts who has three or more listings will be called 'Group 3'. The dotted line represents the implementation date of the regulation.

In Figure 40, the *Number of Listings per Host (EH)* is shown for Copenhagen. As previously stated, the regulation including a day cap of 70 days and tax free allowance for hosts, was implemented on 1 May 2018. Unfortunately, no data is available for the month as well as for September and October. For all groups, a decrease can be observed leading up to the month before regulation, i.e. April. From April onwards, an increase can be observed for all group with an especially high peak in July. Group 1 increase with 21.69%, Group 2 with 18.61%, and lastly Group 3 with 28.58%. Worth noting that the nearly 30% increase for Group 3 in absolute figure represents only 67 hosts. The group represents less

than a percent of the total number of hosts for the month. From April to August, all groups have increased with around 30%. However, when observing the total development over the entire time period, the figures are quite different. For Group 1, there is an overall decrease of 11.18%. Group 2 also shows a decrease of 15.62%, while Group 3 displays an increase of 4.69%.

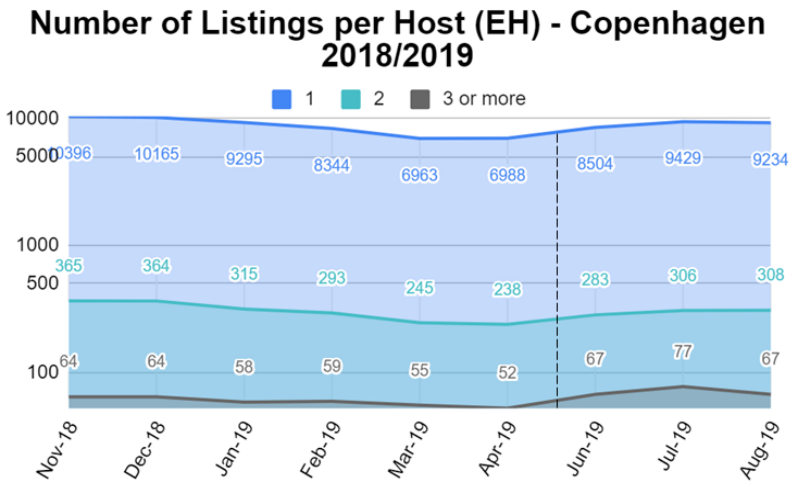

Figure 40. Listing per Hosts (EH): Copenhagen

In order to test if there is a significant difference between the *Number of Listings per Host (EH)* before- and after the regulation, a Wilcoxon rank-sum test was conducted for hosts with 2 listings, and hosts with 3 or more listings. Since the motivation by investigating this metric is to see the development of the number of hosts who may be subletting commercially, the number of hosts with 1 listing was not further investigated. The result, which can be seen in Table 13, shows that there is no significant difference in the number of hosts with 2 listings ($W = 16$, $p = 0.476$) before- and after the regulation in Copenhagen. The same applies for the number of hosts with 3 or more listings ($W = 6$, $p = 0.257$).

Dataset / Test Statistics	Difference between groups?	W test statistic	p-value	Significance level
Copenhagen 18/19				
2 listings	No	16	0.4762	-
3 or more listings	No	6	0.2571	-

Table 13. Test Statistic for Group C

In Figure 41, the *Number of Listings per Host (EH)* is shown for Vienna. In contrast to Copenhagen, there is a steady increase for all groups across the entire time period. After the regulation, there are solely marginal differences. The time period after the regulation was implemented, shows a 4.56% increase in host relating to Group 1. For Group 2, there is an increase of 11.95% while it is nearly four

times as low for Group 3 (+2.58%). When reviewing the entire time period, the increases for Group 1, 2, and 3 respectively are 29.82%, 36.10%, and 27.52%.

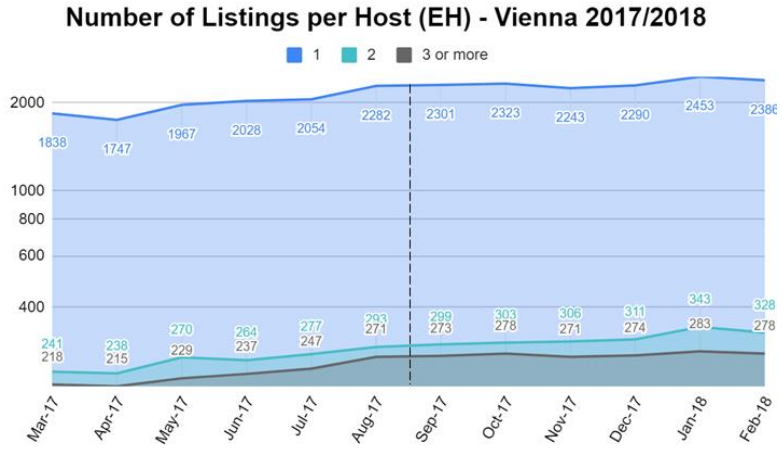

Figure 41. Listings per Host: Vienna

5.6.2.2.3.3. Host Local

Figure 42 shows the distribution of local and non-local hosts for Copenhagen and Vienna respectively. The y-axis represents the time period, while the x-axis shows the distribution of local and non-local hosts in percent. The dotted line represents the regulation date. As previously explained, some months of data for Copenhagen could not be obtained: May, September, October, and November. Furthermore, the regulation includes a day cap for both primary and secondary residences as well as a tax-free allowance for both. As can be seen in the graph, the share of non-local hosts seems to slightly increase following the regulation. In August, the share of non-local hosts is 21.43%.

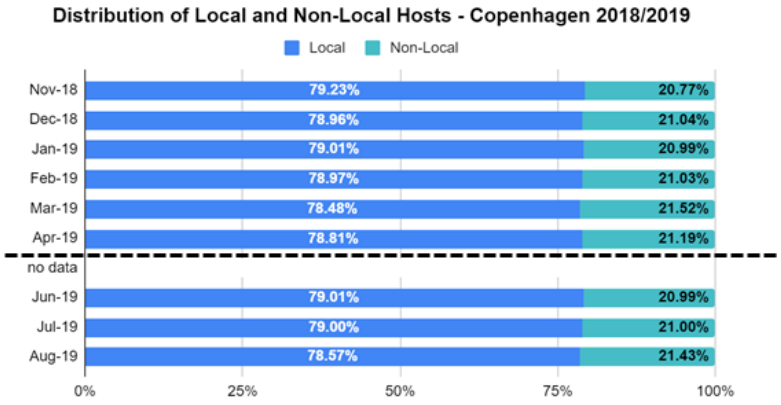

Figure 42. Host Local: Copenhagen

As previously mentioned, the motivation of this metric is to investigate possible commercial hosts, local hosts will not be further analysed. In order to test if there is a significant difference in the number of

non-local hosts before- and after the regulation in Copenhagen, a Wilcoxon rank-sum test was conducted. The result, which can be seen in Table 14, shows that there is no significant difference in the number of non-local hosts (W = 13, p = 0.914) before- and after the regulation in Copenhagen, which is presented in Figure 42.

Dataset / Test Statistics	Difference between groups?	W test statistic	p-value	Significance level
Copenhagen 18/19				
Non-local	No	13	0.9143	-

Table 14. Test Statistic for Group C

For Vienna, the share of non-local hosts shows a steady increase following up to the regulation date, increasing with four percentage units from March (16.97%) to August (21.00%). After the implementation, the trend stagnates and shows marginal decreases. The share of non-local hosts after the implementation date is around 20.5%.

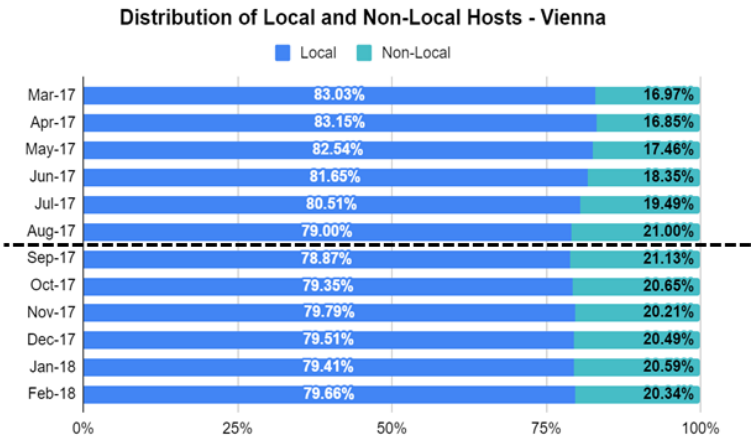

Figure 43. Host Local: Vienna

5.2.2.3.4. Price

Figure 44 shows the percentage change in average price per night for the different listing types. On 01 May, a day cap (70 days) was implemented. For Copenhagen, marginal changes can be observed leading up to the regulation for EHs. As previously mentioned, data for May, September, October, and November could not be scraped. Nevertheless, after the regulation was implemented an increase can be seen in the following months. Since there is no data for May, right before the implementation date, the percentage change refers to between April and June. As a result, it might be misleading since the increase seem to have started already in March. Overall, a 10.68% increase in price can be observed for EH between April and September, which translates to a 94kr increase. An almost identical pattern can

be noted from SH prices, although the changes are slightly more powerful. In the time period following the regulation, prices for SH increase by 16.36% or 71kr. Since data is missing for May, it is important to bear in mind that in combination with the increasing trend in both EH and SH before the implementation date, these numbers may be slightly exaggerated.

For Vienna, no specific trends or patterns can be observed for both EH- and SH prices. The prices show marginal differences throughout the time period and overall, the average price per night for both listing types have only changed marginally. This finding applies to both over the entire time period of 12 months and the months following the implementation date. As previously noted, the regulation did not imply any restrictions or likewise for hosts.

City/Type/Date	T-6	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	T+6	Change T-1 to T+6	Change T-6 to T+6
CPH 18/19	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	2019-05-01	no data	Jun-19	Jul-19	Aug-19	no data	no data	Apr-19 to Aug-19	Nov-18 to Aug-19
Entire	882kr.	881kr.	876kr.	876kr.	881kr.	885kr.		-	930kr.	935kr.	944kr.	-	-	+60kr.	+62 kr.
Percentual change	-	-0.15%	-0.54%	-0.03%	+0.54%	+0.42%		-	+5.20%	+0.48%	+1.01%	-	-	+6.77%	+7.02%
Shared	433kr.	434kr.	429kr.	420kr.	418kr.	421kr.		-	439kr.	444kr.	461kr.	-	-	+40kr.	+29kr.
Percentual change	-	+0.35%	-1.22%	-2.04%	-0.58%	+0.82%		-	+4.36%	+1.11%	+3.86%	-	-	+9.59%	+6.66%
VIE 17/18	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	2017-08-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Aug-17 to Feb-18	Mar-17 to Feb-18
Entire	78€	79€	80€	80€	81€	80€		79€	80€	79€	78€	78€	79€	-1€	0€
Percentual change	-	+0.80%	+1.81%	-0.35%	+0.82%	-0.87%		-0.63%	+0.51%	-1.21%	-0.98%	+0.15%	+0.40%	-1.77%	+0.41%
Shared	35€	35€	35€	35€	35€	34€		34€	34€	34€	35€	35€	35€	+1€	0€
Percentual change	-	-0.04%	+1.91%	-0.50%	-0.78%	-1.82%		-0.16%	+0.58%	-1.22%	+1.79%	+1.46%	-0.25%	+2.18%	+0.89%

Figure 44. Price: Group C

5.2.2.3.5. Summary of Results

In order to get a comprehensible overview of Group C, a brief summary of the regulations and findings from each metric will be provided.

City	Main Regulatory Intervention
Copenhagen 18/19	Day Cap
Vienna 17/18	Obligation for STR platforms to pass on host data

Table 15. Overview of Regulatory Intervention: Group C

For overview purposes, the findings from each metric will be summarized in the following section. With regard to *Number of Listings*, the downward trend towards the regulation turns into an increasing trend afterwards for both EH- and SH listings. Concerning Vienna, marginal increases in SH listings can be observed over the entire time period and higher increases in EH listings. As for *Listings per Host,* in Copenhagen, Group 3 is extremely small in comparison to 1 and 2. In Vienna, Group 2 and 3 increase over the entire time period. Regarding *Host Local,* in Copenhagen the percentage of non-local hosts stays level at around 20%. In Vienna, the percentage of non-local hosts increases up to the regulation and subsequently decreases. In terms of *Price*, in Copenhagen, an increase after the

regulation is observable and an overall increase in the entire time period. In Vienna, there are rather gradual in- and decreases but overall not much change.

6. Discussion and Implications

In the upcoming section, our findings will be discussed in light of our theoretical underpinning. First, a discussion regarding the results of the quantitative section. Second, a generalised discussion regarding MSPs and regulation.

6.1. Discussion of Results

In summary, the purpose of the analysis was to group the cities by motive and analyse regulatory approaches as well as their impact in order to answer our research question: *What are effective forms of regulating MSPs?*

Group A includes Amsterdam, Barcelona, Lisbon, and Paris as their primary motivations towards regulating Airbnb comprise of housing shortage, touristification, tax evasion, and unfair competition. All these cities have cooperated with Airbnb to an extent. As became evident in the findings, having the same motive and a similar regulatory approach does not mean that the outcome will be the same for the respective cities. This could be due to a number of reasons, such as varying legal landscapes, different interested stakeholders, and cultural differences. For instance, Amsterdam and Paris have similar regulatory approaches in the form of a day cap, the collection of tourist tax, and a licensing requirement. Of those three regulatory approaches, the day cap and the automatic collection of tourist taxes are enforced in the platform. Lisbon and Barcelona have a licensing requirement and collect tourist tax. In Lisbon, both these measures are enforced in Airbnb's platform while in Barcelona only the licensing requirement is enforced. Nonetheless, the findings show that the development of the examined metrics vary across all cities.

In terms of the motives housing shortage and touristification, the development of the metrics *Number of Listings*, *Listings per Host*, and *Host Local* were analysed after the most recent or relevant implementation of a regulation. While an overall decrease in Barcelona is visible in the number of EH listings and EH listings per host, an overall increase can be seen in Lisbon. What differs is that Barcelona is known for its strict enforcement of the law concerning STRs. Offering STR accommodation without a proper license is classified as a serious offense and extremely high fines are applicable for both the platform and the hosts. Before the city of Barcelona and Airbnb reached an agreement on the most recent regulation, Barcelona went to great lengths to ensure that hosts had valid STR licenses. They established a team of individuals to go from door-to-door with the goal of detecting residences that were being sublet illegally. Although at that point a regulation in the form of a licensing requirement was in fact enforced, both by law and in Airbnb's platform (as it is a mandatory field for hosts to fill out), it indicates that this form of regulation was not effective in this specific situation. Only by identifying illegal hosts through their own costly measures, as well as after long and heated discussions with

Airbnb, did the platform finally agree to gradually delete the detected illegal listings from their website. This development may mirror in the overall development of number of EH listings and EH listing per host as a strong decreasing trend is visible. As previously mentioned, in June 2018 the city of Barcelona received access to all host and listings details in Barcelona through Airbnb. A dramatic decrease can be seen in the number of EH listings and EH listings per host from May 2018 to June 2018. This development implies that it might be due to the regulatory approach. When comparing these two findings, it indicates that the sharing of host data is an effective form of regulation in this case. In contrast to the time consuming process of detecting illegal subletting by going from door-to-door, the sharing of host data is a simple and less costly approach.

The general increase in number of EH listings and EH listings per host in Lisbon may be due to various aspects. For instance, hosts with existing listings had a two-year transition period to apply for a license. This seems like an extremely long period acknowledging that one of Lisbon's primary motives is housing shortage. In contrast, Parisian hosts had a two-month transition period to register for a license. Another detail worth considering is the applicable fine. While hosts that are in breach of the law face fines up to 30.000€-600.000€ in Barcelona, fines are much lower in Lisbon and amount to 4.000€. On a different note, as mentioned in section 2.1., cross-side network effects are an essential feature of digital platforms that can lead to the growth of the user base. In that sense, even if existing hosts remove their listings, new hosts may be adding their listings, therefore the effect of the regulation could be harder to detect.

In Paris, the regulation analysed is in the form of a license requirement for EHs and a one month later implemented day cap. Hosts with existing listings had a two month transition period to register. Although the license is required by law to be displayed, it is not a mandatory field on Airbnb's website, hence it is not considered as enforced in the platform. Both the number of EH listings and the EH listings per host for all groups decreases after the regulation date of the licensing requirement. Again, this finding indicates that the same form of regulation does not necessarily have the same effect when comparing this development to the one in Lisbon. Furthermore, as the limit of the day cap is 120 days, i.e. four months, direct impacts of this regulatory approach are not expected as first impacts are not visible until 120 days of consecutive rental activity. Similarly, in Amsterdam the implementation of two different day caps was analysed. A day cap does not necessarily directly limit the number of hosts or listings but rather limits the possibility of revenue for commercial landlords. In Amsterdam's case, the first day cap was enforced in Airbnb's platform, i.e. once a host reached the number of permitted nights, their calendar was blocked. Since Amsterdam was not satisfied with the lack of results of the day cap, a stricter day cap was implemented with a 30 day limit. Airbnb was not happy with the decision arguing that it was not justified, thus they did not enforce it in the platform. In a situation like this, relying on Airbnb for enforcement does not seem like the optimal solution. Prior to the incident, the

city of Amsterdam relied on Airbnb to block a host's calendar. However since Airbnb did not want to accept the day cap, Amsterdam authorities had to take the matter into their own hands again. Considering that they only have details on hosts who actually registered, the enforcement of the day cap remains extremely difficult. When comparing the findings from all metrics, similar trends can be identified for both day cap developments. However, when looking at the effect of a day cap, it would be beneficial to consider an entire year after the implementation date as the permitted number of days is spread out over 365 days. In addition, fair competition can partly be ensured through a day cap since a level playing field is established for the hotel industry assuming that hosts do not find a way to circumvent the day cap.

The second aspect of fair competition is taxes. Except for Barcelona, all cities in Group A (Amsterdam, Lisbon, Paris) partnered with Airbnb to automatically deduct tourist taxes on behalf of the hosts and pass it on to the respective city authorities. Airbnb promotes this measure and advises all European cities to follow suit. However, one must keep in mind that in return Airbnb automatically gains more negotiating power regarding future discussion on regulatory approaches with cities. Acknowledging our research question, this approach seems like an effective form of regulation provided that cities want to cooperate with Airbnb. Some cities may not want to give Airbnb that type of power and will therefore refuse to cooperate. In the aforementioned example of Airbnb not cooperating with Amsterdam regarding the day cap, it becomes comprehensible why a city may not want to do that. What happens if Airbnb decides to stop collecting taxes? Cities will have to take the matter into their own hands again.

Group B, namely Berlin, Brussels, and London share the common motivation of the existence of housing shortage as the primary reason to regulate Airbnb. Existing regulatory approaches in Berlin and Brussels include a day cap, a licensing requirement, and tourist tax. Of those three regulatory approaches none are implemented in the platform. In comparison, the findings in Berlin are a lot more compelling than the findings in Brussels. In Brussels all metrics stay rather level over the considered time frame, except for the average price of SH which decreases over the entire time period. In Berlin on the other hand, starting in the transition period, a steep drop in the number of EH listings and *Listings per Host* for all groups is noticeable. As the fine is up to 500.000€, it may be too much of a risk for hosts to keep their listing on the platform without a license. Consequently, this would lead them to removing it before prior to the implementation date. Although the regulation was not enforced in Airbnb's platform and Airbnb did not pass on any kind of personal data on hosts like in Barcelona, the development of the metrics imply that the licensing requirement had a big impact. This indicates that the supply side is negatively affected, which leads to lowered network effects for Airbnb's platform in Berlin. Moreover, the increase in average prices, especially in SH prices to which the laws do not apply, could imply a shift in supply and demand. Consequently, the demand side is also indirectly negatively affected due to higher prices. Again, these findings imply that even with the same motive and similar

regulations approaches, the effect can be very different. As for London, only enforcing a day cap to deal with housing shortage does not seem like the best approach. Especially the rise in Group 3, i.e. the number of hosts who have three or more EH listings, indicates that the number of commercial landlords increased. It should be emphasized that the city of London is currently in discussion with Airbnb regarding the implementation of a simple registration process. This development further implies that London authorities are not satisfied with the outcome of the day cap.

Group C's, i.e. Vienna and Copenhagen's shared motive for regulatory intervention towards Airbnb is tax evasion and unfair competition. Copenhagen has implemented a day cap that is also enforced in the platform. From January 2020 onwards, the host's personal income tax will be automatically declared through the platform both ensuring that hosts comply with the law and simplifying the process. In Vienna's case the situation with Airbnb is a bit more complicated. Online rental accommodations are required to share host information with authorities by law. However, Airbnb has openly stated that they will not adhere because it is in breach of the GDPR. Furthermore, during discussions between Airbnb and the city of Vienna regarding tax collection, Airbnb advised Vienna to allow Airbnb to collect tourist taxes for the city. However, Vienna refuses to give Airbnb that kind of authority and prefers to find a solution that does not involve Airbnb. Therefore, it is not a surprise that a gradual increase, and not a decrease, can be seen after the implementation of the regulation by law since hosts are not required to take any kind of action. This is an ongoing process and further development will be interesting however cannot be considered in this thesis.

What is common for Groups A, B, and C is that the existing forms of regulatory approaches seem to have little effect on if a host is local or not. Broadly speaking, a slight increase in non-local hosts can be seen in all cities over the considered time frames. In terms of tackling the problem of housing shortage, this is an aspect regulators could additionally look into. The idea behind this metric is that non-local hosts may be commercial hosts since it can be assumed that it is not their primary residence that is being rented out. As previously mentioned, a limitation to this metric is that it is not possible to distinguish between a secondary home and a commercial residence. However, when looking at the metric *Listings per Host (EH)* there was still a considerable amount of hosts with three or more listings. In combination, this implies that commercial subletting is not being effectively targeted in terms of regulatory approach.

However, it is also important to note that the considered time frame for each city is only a period of 12 months. Previous regulatory measures are not taken into account. For instance, in Barcelona a steep decrease can be seen over the entire period in the number of EH listings. This may be the effect of a previous regulatory approach that is not taken into consideration in the analysis. Furthermore, since the regulation of Airbnb is an extremely relevant topic in cities worldwide, several cities have already

announced upcoming regulatory approaches that could not be taken into consideration. Factors such as seasonality or specific events that may influence the results are not accounted for.

6.2. Discussion of Regulating MSPs in General

As noted, licensing in various forms is a common regulatory mechanism imposed on platforms by policymakers. It is an old form of regulatory intervention where governments in some cases have adjusted current legislation or stipulated new frameworks to include platform operators. As our findings suggest, the effect varies which may be due to how well the enforcement mechanisms work. However, the question whether licensing is the way to go remains. As with the taxi industry in New York City, the idea behind the regulation was to protect the drivers from unreasonably low wages during the Great Depression. The existence of regulatory benefits that are projected to specific groups in certain cases does not necessarily mean that it is subjected to regulatory capture. However, when the medallions become a monetary asset that benefit the ones who own them instead of e.g. the drivers, then it is not the right approach to ensure social welfare or to meet other objectives such as fair competition. In Barcelona, the licensing for Airbnb hosts created a huge secondary market where they are sold. Both of these examples illustrates the market failures that arise when arbitrage opportunities and regulatory capture arise as an effect of policymakers' licensing regimes on platforms.

However, governments may only have their short term objective in mind. Therefore, by introducing restrictive licensing regimes it can evidently be a powerful form of regulation, assuming they have the means and methods to ensure compliance by platforms and their users. Whether such a totalitarian approach benefits society at large or even is possible to enforce is questionable. For instance, platforms have control of the data which they are likely resilient to provide if it were to be used for implementing tough restrictions. In addition, data is seen as a business asset by companies and is often proprietary to them by law. Furthermore, governments must take all groups connected through the platform into consideration. If platforms challenge incumbents by offering a better service, perhaps they should reconsider a more relaxed approach. However, it should be noted that licensing can take various forms, ranging from being very restrictive to a simple registration process for governments to ensure, for instance, tax compliance or control.

Regarding taxation, co-operating with platforms appears to be an efficient way of ensuring compliance. As previously mentioned, Airbnb is encouraging cities to cooperate with them in regards of collecting tourist tax. Although one can speculate about their motives, it is hard to find a more efficient approach for platform users and governments alike. Furthermore, it ensures compliance as it is enforced in the platform. Taxation issues apply to all platforms, especially the ones that are competing with incumbents subjected to industry specific taxation schemas. Not to mention, it seems reasonable that platforms

should be subjected to taxation. As discussed under section 2.3.1., if the market of which tax revenues are based upon changes, then so must the tax collection system. The tax revenues are used to ensure that public functions are maintained and there is no valid argument to why platforms should be an exception. However, if taxation is solely in control by the platforms, tax evasion could in theory occur with no way for authorities to review and audit.

The lack of transparency and access to platforms data is an ongoing discussion. If authorities did have access to the data, enforcement and possibly penalise illegal behaviour would be greatly simplified. As of now, cities are raising the issue that it is expensive and inefficient to reveal illegal conduct. In Barcelona, Airbnb has granted authorities access to their data. Before, the city had to manually go through the website to uncover illegal practises, which was not efficient. After the announcement that it was being implemented, the number of listings went down. Although we cannot determine that it was a direct effect of the regulation, it implies that it had a positive effect on discouraging misconduct. Regardless if it had an impact or not, one can argue that more people will disobey the rules in favour of earning money if they know that there is a very small risk that they will get caught, which applies to all platforms and not solely Airbnb. Information sharing is an efficient way of approaching that problem. However, as previously discussed, not all platforms necessarily want to share their data. Nevertheless, when comparing to restrictive regulations that hinders growth and innovation, it may be a suitable compromise. In a sense, data sharing could then be seen as a form of licensing that allows for control and oversight by authorities while simultaneously letting platforms operate without tough restrictions. As discussed under section 2.3.3., Grossman (2015) argues that data is key in regards to regulatory framework in the digital age. He suggests to adopt Regulation 2.0 that relies on accountability, transparency, and open innovation. In exchange for their data, platforms would be able to operate freely and continue to bring value to many users.

In order to properly investigate what effective forms of regulating MSPs are, one needs to address how and on what level the different forms could be implemented on as well as the consequences that may arise. As previously mentioned, the same motives and regulatory approach may not yield the same outcome. Additionally, the same regulatory approach can be used by cities for different reasons. The political landscape and different interest groups play a key role in policymakers' decision making. Applying existing regulatory frameworks on platforms may not be the optimal solution and sheds light on the importance of re-evaluating legislation and policy issues to suit today's society. Many existing frameworks are outdated, protectionist in nature, and ill-suited for the digital age. Top-down legislation made sense in a world of information asymmetry in order to protect consumers. Today, that function could, at least partly, be conducted more efficiently by platforms themselves. For instance, most platforms require their users to upload some kind of identification. Furthermore, top-down legislation is expensive and slow, which in turn may create a fragmented regulatory framework across nations.

Platforms illustrate how current legislation of existing industries would benefit from deregulation by showing how efficient they operate. As previously mentioned, Uber was better at matching peaks in demand than the New York City taxi companies. As platforms connect two or more interdependent parties to exchange value, it comes as no surprise that they have better prerequisites of reaching an equilibrium of supply and demand. In turn, if it provides an improved customer experience, then deregulation could in fact benefit the public to a greater extent.

In contrast, pure self-regulation is not realistic. One cannot forget that platforms are companies who wish to maximise their profit. Furthermore, when critique regarding regulatory approaches comes from platforms themselves, it is important to remember that they are acting in their own self-interest. The same applies to critique from incumbents and other interest organisations. Platforms are fast and eager to adapt to changing market conditions on the platform itself, but may not act in favour of maximising social welfare unless obliged to do so by law or public opinion. Furthermore, self-regulation could increase the power of the platforms to uphold their often dominant status. Also, if platforms are exempt from the law, the regulated market will simply shift to the unregulated market since it is no longer beneficial to stay. In other words, legislation becomes useless. As previously discussed, data sharing in exchange for free operation could be a suitable compromise. However, the approach must still rely on basic forms of top-down legislation that in reality is inevitable. Most countries have the requirements of driver's license, mandatory vehicle inspection, and speed limits to ensure road safety. The same principle applies for e.g. the pharmaceuticals, alcohol, and the food industry. Simply because food delivery platforms share their data, customers still rely on governments to ensure that the restaurants connected through the platform have proper food safety methods. In other words, regulation serves numerous essential public functions of which platforms should not be exempt from.

In general, cooperating with platforms appears to be the most suitable option in making sure policymakers objectives are met, while at the same time challenging their assumptions on what forms of regulation should be implemented. As the EU suggests, co- or self-regulation is to be preferred over top-down legislation in order to create a unified and consistent regulatory framework. Furthermore, they stress the fact the EU Member States only account for 4% of the total market capitalisation of MSPs. In the US and Asia where many successful platforms originate, they have in general not been subjected to as strict regulation. This indicates that policymakers must remove unnecessary requirements and protectionstic legislation that benefit incumbents. Furthermore, they need to create a framework that allows for efficiencies and fosters innovation, while at the same time safeguards public interests. Important to stress from this aspect is that platforms serves two interdependent groups. Regulatory frameworks should be developed based on the welfare of both. Naturally, regulatory intervention is necessary in order to prevent people from 'using the system' to avoid stricter legislation, e.g. commercial subletting or taxation. However, P2P platforms for instance, benefit ordinary people

who could make use of extra income or who find the good or service to be cheaper, more efficient, and favourable to other traditional alternatives. Additionally, allowing platforms to operate under certain control could increase social welfare. If citizens to a greater extent use car sharing services instead of owning a vehicle themselves, the pressure on parking spaces and roads will decrease while simultaneously benefiting the environment. If they use labour platforms instead of being bound by traditional set working hours, they have more flexibility in their everyday lives to care for their children. If they could purchase products the need through online retailers, inhabitants of rural areas do not need to travel long distances to acquire them. The internet has simplified peoples' lives and policymakers must be careful to not restrict the benefits that platforms entail.

In line with both the EC and many academics within the field, co-regulation appears to be the most promising approach on how platforms should be regulated. As emphasized in this report, forms of regulatory mechanisms are in turn dependent on how and what level they are implemented in terms of their effectiveness. One can argue that co-regulation combines the best of self-regulation and top-down legislation. Firstly, it is flexible and efficient. Since the platform economy is constantly evolving and new technological advancements are innovated, the flexibility of co-regulation allows for rapid adjustments of policy objectives. By simply changing the code, platforms can determine what is allowed and what not. Many policymakers struggle with enforcement and subsequent penalisation of misconduct ~~and~~. By involving platforms in the process, this issue is by far more easily manageable. Secondly, co-regulation is less expensive. Top-down legislation requires both resources and time to go from idea to reality. On the contrary, self-regulation may impose high costs on society since no oversight of e.g. fraud and competition can be conducted. However, co-regulation is built on cooperation and for cooperation to exist, both platforms and policymakers must feel that it is beneficial cooperation. Therefore, involving outside governing parties may not be a bad idea since policymakers do not want their power to be undermined by platforms. Additionally, it brings multiple stakeholders to the table which ensures that more interest groups in society is represented. As previously discussed, different concerns that arise due to platforms mobilise different actors, which may not represent society at large. Furthermore, it could result in more compromises between two extreme opinions, i.e. complete anti-platform and complete pro-platform, which may in the end benefit the society and economy to a greater extent while simultaneously safeguarding public interests. No single actor has all the knowledge in the world of platforms. A co-regulatory approach could ensure that informed polycentric decision making is conducted. Apart from ensuring that all interests are taken into consideration, the third party, or parties, should perform data auditing and subsequent evaluation of the impacts and effectiveness of the forms of regulation implemented. The third party acts as an objective and independent governing actor and the regulatory approach allows for accountability, oversight, and control. Furthermore, it allows for transparency yet protection of platform data as a business asset. In turn, co-regulation allows for innovation where especially Europe has lagged behind other continents. Worth noting is that co-

regulation within the platform economy is already in place. As discussed in this report, cities and Airbnb have cooperated in numerous cases to various degrees of success. Amsterdam and Airbnb were able collaborate for a period of time before entering a dispute, which illustrates the dangers with the power imbalances that can arise if no outside party is involved.

As discussed under section 2.3.3., co-regulation on a supra-national level could ensure certain standards being uphold and if they are not, have real power to penalise platforms. Fines, assuming they are enforced and collected, appears to be an effective way of ensuring the law is followed as previously reviewed. Furthermore, co-regulation on a supra-national level still allows for local additional variations ensuring that one does not simply implement a one-solution-fits-all approach. The regulatory framework could either be implemented on e.g. EU level. In our opinion, the first is more likely and feasible. However, perhaps the best approach would be for the independent third party to create a regulatory framework that is adopted in a co-regulatory approach. For instance, the IFRS accounting standards is adopted many countries around the world as well as in the EU, resembling a supra-national framework although the IFRS is a private interest organisation. As platforms are often global in nature, the legislation must, at least to some extent, be too.

7. Conclusion

The goal of this thesis was to identify what effective forms of regulating MSPs are. In order to contextualise the study, the legal landscape of nine European cities was analysed in regard to STR platforms: Amsterdam, Barcelona, Berlin, Brussels, Copenhagen, Lisbon, London, Paris, and Vienna. As a result, four primary forms of regulatory approaches towards MSPs were identified: Day Cap, Licensing Requirement, Fines, and Taxes. In addition, the most relevant regulation date for each city was identified. It was important to understand the underlying motives behind the cities' regulatory approach as this aspect played a crucial role in uncovering the meaning of effective. Resulting from this, the nine cities were grouped based on their primary motive towards regulating STR platforms, specifically Airbnb. Amsterdam, Barcelona, Lisbon, and Paris' common motives include the existence of housing shortage, overtourism, tax evasion, nuisances, and unfair competition. On the other hand, Berlin, Brussels, and London's main motivation is to tackle the existing housing shortage in the respective city through regulatory interventions towards STR platforms, such as Airbnb. Lastly, Copenhagen and Vienna were grouped together as their focus is on ensuring both fair competition and tax payments. In addition, we distinguished between the regulatory approaches that were enforced from Airbnb's side and ones that were only mandatory by law. As a result, a framework was established which was further used in the quantitative analysis. Thereafter, four metrics were identified in order to measure the impact of the previously identified regulatory approach on the respective city, namely *Number of Listings, Listings per Hosts, Host Local,* and *Price*. The findings revealed that although a regulatory approach is similar, it does not mean that it has the same effect in each city. Nevertheless, based on the motives there are forms of regulation that target the motives better than others. Yet, there is no one-size-fit all model that cities can implement.

Instead of focusing on specific regulatory mechanisms, a more transparent relationship between MSPs and authorities could be favourable. As platforms have the data and cities have the knowledge of their cities, it might lead to greater insights on what problems exists and to more informed decisions on how to best address them. Furthermore, it allows for a high level of enforcement which ensure rules are being followed.

Regarding the regulatory approach, co-regulation seems like the most suitable options for various reasons. It is fast, effective, and allows for flexibility. As the technological development is rapidly changing, it cannot take several years for justified and needed legislation to come into effect. Furthermore, it involves different stakeholders with different interests and motives, which can result in a more nuanced legislation. By involving an outside party beyond policymakers and MSPs, the power imbalances could in addition be reduced. As all involved actors have their own objectives in mind, the

third party may act as an intermediary leading to a compromise of two extremes. In the end, this might benefit society at large to a greater extent than if either side had their way.

The co-regulatory approach calls for less local and national legislation in the sphere of the platform economy. In order to avoid fragmentation and confusion for both platforms, users, and governments alike, a supra-national framework would be most suitable to implement effective forms of regulation. However, as emphasized throughout this approach, different regulatory mechanism may have different impacts in different cities. Platform related issues are not always evident everywhere. A supra-national framework still allows for local additions and variations to account for these differences while simultaneously ensuring that it is beneficial for all stakeholders and society at large.

Regardless of what forms of regulation are effective, platforms are not going anywhere. As they have often emerged and expanded while operating in grey zones of the law, they have managed to build a strong customer base all over the world. Policymakers might have to reconsider what outcome effective forms of regulation should result in, rather than the process itself.

To conclude, in order to regulate the platform economy, cities have implemented different forms of regulations to various degrees of success. In order to not stifle innovation and hinder the benefits platforms entail for the society, MSPs and legislators must work together. Governments must take the role of a regulatory facilitator for informed actors to create a legislative framework based on the welfare of society at large. The missing piece of the platform policy puzzle just might happen to be another intermediary.

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Appendices

Appendix A - Chosen Variables from Raw Data

Nb	Variable	Nb	Variable
1.	access	**55.**	**last_scraped**
2.	accommodates	56.	latitude
3.	amenities	**57.**	**license**
4.	availability_30	58.	listing_url
5.	availability_60	59.	longitude
6.	availability_90	60.	market
7.	availability_365	61.	maximum_maximum_nights
8.	bathrooms	62.	maximum_minimum_nights
9.	bed_type	63.	maximum_nights
10.	bedrooms	64.	maximum_nights_avg_ntm
11.	beds	65.	medium_url
12.	calculated_host_listings_count	66.	minimum_maximum_nights
13.	calculated_host_listings_count_entire_homes	67.	minimum_minimum_nights
14.	calculated_host_listings_count_private_rooms	68.	minimum_nights
15.	calculated_host_listings_count_shared_rooms	69.	minimum_nights_avg_ntm
16.	calendar_last_scraped	70.	monthly_price
17.	calendar_updated	71.	name
18.	cancellation_policy	72.	neighborhood_overview
19.	city	73.	neighbourhood
20.	cleaning_fee	74.	neighbourhood_cleansed
21.	country	75.	neighbourhood_group_cleansed
22.	country_code	76.	notes
23.	description	77.	number_of_reviews
24.	experiences_offered	78.	number_of_reviews_ltm
25.	extra_people	79.	picture_url
26.	first_review	**80.**	**price**
27.	guests_included	81.	property_type
28.	has_availability	82.	require_guest_phone_verification
29.	host_about	83.	require_guest_profile_picture
30.	host_acceptance_rate	**84.**	**requires_license**
31.	host_has_profile_pic	85.	review_scores_accuracy

32.	**host_id**	86.	review_scores_checkin
33.	host_identity_verified	87.	review_scores_cleanliness
34.	host_is_superhost	88.	review_scores_communication
35.	host_listings_count	89.	review_scores_location
36.	**host_location**	90.	review_scores_rating
37.	host_name	91.	review_scores_value
38.	host_neighbourhood	92.	reviews_per_month
39.	host_picture_url	**93.**	**room_type**
40.	host_response_rate	94.	scrape_id
41.	host_response_time	95.	security_deposit
42.	host_since	96.	smart_location
43.	host_thumbnail_url	97.	space
44.	host_total_listings_count	98.	square_feet
45.	host_url	99.	state
46.	host_verifications	100.	street
47.	house_rules	101.	summary
48.	**id**	102.	thumbnail_url
49.	instant_bookable	103.	transit
50.	interaction	104.	weekly_price
51.	is_business_travel_ready	105.	xl_picture_url
52.	is_location_exact	106.	zipcode
53.	jurisdiction_names		
54.	**last_review**		

Appendix B – Our Variables

Variables	Description
Existing variables	
id	Unique ID for a listing
last_scraped	Date when the data for each month was scraped
host_id	Unique ID for a host
host_location	Location of where the host resides
room_type	Listing type by Airbnb's classification - Entire home/apt, Private room, Shared room
price	Listing price per night
last_review	Date of when the last review for the listing made
requires_license	True or False value depending on if a license is required for the listing type
license	True or False value depending on if the host has entered a license number
Additional variables	
date_diff	Difference in days between last_scraped and last_reviewed
room_type_NV	Listing type by our classification. Entire home for 'Entire home/apt', Shared home for 'Private room' or 'Shared room' based on [room_type]
host_local	Categorical dummy based on [host_location]. 0 if [host_location] is not the same as the city in question, 1 if it is.
count_of_listings	Number of listings per host for the given month
count_of_listings_EH	Number of Entire home listings per host for the given month
count_of_listings_SH	Number of Shared home listings per host for the given month
count_of_listings_group	Categorical variable based on count_of_listings. 1 if count_of_listings = 1, 2 if count_of_listings = 2, 3 if count_of_listings >= 3.
count_of_listings_group_EH	Categorical variable based on count_of_listings_EH. 0 if count_of_listings_EH = 0, 1 if count_of_listings_EH = 1, 2 if count_of_listings_EH = 2, 3 if count_of_listings_EH >= 3.
count_of_listings_group_SH	Categorical variable based on count_of_listings_SH. 0 if count_of_listings_SH = 0, 1 if count_of_listings_SH = 1, 2 if count_of_listings_SH = 2, 3 if count_of_listings_SH >= 3.

Appendix C - Informant Interview: Zimmer Christensen & Sebastian Skougaard Markfoged

Interviewees: Felicia Nathhorst Malmgren and Nathalie Williams
Interviewed: Jens Zimmer and Sebastian Christiansen
Date: Aug 20th , 2019

[00:00:00.390] - Sebastian
As part of this do you define it as sharing economy or platform economy?

[00:00:03.960] - Nathalie
Sharing economy, and we're looking at Airbnb as a digital platform so as a multi-sided platform. Yeah.

[00:00:14.700] - Felicia
Yeah. Which connects two parties basically. Can you. Yeah of course. So sorry.

[00:00:22.330] - Jens
When would you look at the Airbnb economy you know there's so many ways of attacking this but you can also look at it as a private person renting something out that has happened before. People even have thought about this a form of travelling that you stay with private people. That is what it is. But of course it has increased because of visibility the other aspect is who is renting out and what we are. Sure the industry is worried about that. Do you have some people who are renting out 20, 30, 40 apartments. And today you see a building being built with the sole purpose of renting out apartments as if they were private. So it's a kind of hotel business without the restrictions and regulations that we see as a problem.

[00:01:29.790] - Felicia
Yeah because the regulation that we talked about in the last project that was implemented last year in May. And as we understood it, it kind of restricted if you have a secondary home it restricts to renting out for 30 days or 70 days so your primary home like in order to control that commercial subletting that you were referring to. So do you think that has kind of... that has helped. No?

[00:02:01.470] - Sebastian
Also there is the thing about...you said 70 days. Today there is a possibility for every municipality to set it up to 100. We know some municipalities have done it and presumably more will follow.

[00:02:14.350] - Sebastian
Yeah and another thing I'm not sure. I brought this just because I thought it might...maybe could be interesting. Do you read Danish as a Swedish person.

[00:02:21.690] - Felicia
Yeah.

[00:02:22.250] - Sebastian
So there's been a few things but when the law was implemented and so the meetings were held in Copenhagen they have already said that they don't believe that there is any tool to actually monitor Airbnb and to actually follow the regulation through. I can also send the entire document afterwards. Because regulation but there's no one to implement the regulation. I mean what's the regulation there for then.

[00:02:45.840] - Felicia
Yeah. So it's just...

[00:02:46.870] - Jens
But the regulation then we are talking about they shouldn't be talking about what it was they had. This has been done under the assumption that apartments are being rented out through Airbnb to an And then there will be a time you couldn't count that you couldn't eventually count how many days a certain property has been rented out but certain property can be rented out through several channels. It could be two or three of these. It could also be peer to peer, customer to customer. Yeah I mean nobody will ever find out if you have...if you have rented out through Airbnb and you have a satisfied customer. If

that customer would like to return, more often than not then the contact has been established. And then they share the information so to speak. The savings. So it's very difficult to regulate.

[00:04:00.760] - Felicia
So basically that it's only limited to Airbnb this case is a problem then because as we understand it the day caps as such, it was implemented in the platform but basically for tax purposes. So the Danish government would ensure that people would pay the proper amount of tax but that the day cap was also supposed to be implemented. So if you as a landlord through Airbnb is renting it out you can't rent it out for more than 70 days.

[00:04:31.520] - Sebastian
Yeah I suppose that's the least regulation but but if you look at numbers for example in Copenhagen you have I think it's 27 percent of apartments that's rented out more than hundred and twenty days a year and..

[00:04:40.620] - Nathalie
Entire apartments or both?

[00:04:44.310] - Sebastian
So that's of course a problem because the definition is that you can always rent out a single room that doesn't have the limit. But what what if you then rent out two rooms and an apartment but the entire apartment is rented out in those two different rooms. Then, it's just a question of definition. So maybe like regulation wise it's...it's OK because you don't rent out the entire apartment. But the entire apartment is rented out just in two separate rooms. So maybe... maybe they can sort of go around the regulation in that sense on the platform if they have a cap or something. But in reality you will see an entire apartment being rented out for more than a hundred days. And then again we have a municipality that is not able to control it because there is no control instance for it.

[00:05:26.750] - Nathalie
And from your organization do you have a voice like in the regulations or can you... What is your standpoint?

[00:05:36.990] - Jens
We are... we represent hotel interests. We have a...we are here in partner. We are being voice our opinions in the press and then before regulation is published it comes out normally. And then we have the opportunity to voice against. But we are not the only ones of course.

[00:06:11.140] - Nathalie
Since it's been over a year now that the first like real regulation has been implemented that was kind of targeting Airbnb. From your standpoint it hasn't helped as much as it should have? Do you have an idea what can be done to....

[00:06:32.230] - Jens
Nothing has happened. There was an agreement and then it should be implemented about this time. So you cannot... you cannot talk about it before and after.

[00:06:46.220] - Nathalie
Okay. But I think...wasn't it implemented in May 2018?

[00:06:50.330] - Jens
The law was passed but there was a grace period.

[00:06:54.610] - Sebastian
That's also why it's not until now that municipalities they have to take a stance on whether or not to cap should be a 70 or 100 days. So that's a process going on right now and I think..is it as of 1st of August maybe they had the opportunity to do so which they have already done and then of course time will show how many municipalities to choose to enact 100 days. So I'm pretty sure implementation is kind of right now.

[00:07:24.190] - Felicia
So around a year after it was passed

[00:07:26.770] - Sebastian
That's pretty normal.

[00:07:27.760] - Felicia
Yeah, okay.

[00:07:28.500] - Sebastian
There is sort of a period between passing of legislation and implementing them.

[00:07:33.190] - Jens
But Airbnb in Denmark as in many other places... I've been working behind the scenes politically with some success.. they are arguing their own case..

[00:07:53.900] - Sebastian
There is a em..do you know visit Denmark?

[00:07:58.250] - Nathalie
Yeah.

[00:07:59.020] - Sebastian
So they have a report on Airbnb in Denmark which is made in collaboration with the Airbnb. You can have it afterwards if you want to. And the interesting part is also Airbnb is very good at only recording the numbers that they think the public should see. So in here it will only tell you how many Airbnb guests were in Denmark but there is no way of seeing how many actually stays.. like.. how many nights you have things rented out. So it will tell you sort of between in Copenhagen maybe an average stay is two point eight days, in Aarhus three point something days but it won't tell you how many stays were actually done a year. But it will tell you how many were here. So we know that in Copenhagen there was half a million guests using Airbnb. We don't know how many days they stayed. So we don't know how many sort of nights we're actually spent in an Airbnb instead of a hotel. So I mean it's also...as Jens said, they're very good at working behind the scenes but they're also very good at when they say of course we want transparency and we want to inform numbers then it's not always the numbers we want but it's the numbers they want to give.

[00:08:57.310] - Nathalie
Yeah. And have you seen...in the hotel industry since the launch of Airbnb a big change, a big difference like less guests in the hotel industry?

[00:09:11.330] - Jens
Not now but up to and including 2018. There has been an increased number of guests in general also for the hotel. As a matter of fact this year there's also an increase of about 3 percent.

[00:09:31.310] - Felicia
Okay.

[00:09:32.410] - Jens
So there's so far been enough for everybody. Nobody really knows if there'd been no Airbnb what would have happened..now.. in Copenhagen and Aarhus. We see a large number of new hotels increased capacity. And that means that even if we have an increased number of guests we will have the occupancy rate will decrease and when that decreases also the prices. So what would be exciting to see if we ever find out is whether traditional Airbnb guests if they will go to the hotels or actually back hotels...what's going to happen but the Airbnb market, so commercial and guided these days that they are also working out of you know if they have Airbnb they come with recommendations whether people should increase or decrease the price. So it's a commercial market. It has nothing to do with sharing anything.. it is..now it is money. So we don't know what's going to happen. Will the people go from one way of staying to another.. what's going to happen that's gonna be exciting to see. But I would say in Denmark you cannot measure yet the laws passed.

[00:11:16.570] - Nathalie
OK. Because it's just too new.

[00:11:20.220] - Felicia
And you talked about that it was... that the incentive behind it was the tax purposes, right?

[00:11:25.570] - Jens

So the Danish government has a tax purpose...

[00:11:28.440] - Felicia
And do you know if they have any more...any more incentives about regulating it further or if it's...

[00:11:37.290] - Jens
It is...when you have this discussion it has normally been on...on a town, on a city level for instance Copenhagen and where the good lord mayor here, he has been turning around 360 days several times or 180 days several times. And that's because the politicians they have to choose between very simplified agonizing the people who went out but say they're not allowed to. All right. Aginizing the people who are not renting out who are complaining about noise and strange people in the building and in the end politician o then choose where the votes are. And I don't really know where the votes are but...but I know a lot of people are renting out. Through Airbnb but also through all the channels. I know one thing for sure that the phenomenon of B and B with a commercial approach, it's here to stay. It will never disappear or it will disappear but it won't for many years. It's here to stay. The question is how will it be regulated in Copenhagen where we are as far as this is concerned behind compared to others. I don't know if you heard but Amsterdam has now closed down for the city at all. We're talking about all tourism and I'm sure that all tourism in Amsterdam has a lot to do with the Airbnb business. Barcelona you know is a problem, Venice is a problem. And what happens is when you come to that situation then cities and to a certain extent governments they try to do something to ease the situation. But when a government tries to do something and Airbnb don't agree then they normally take the case to the EU with success. And there have been some laws in France and I also believe in Spain where the EU is saying you've gone too far. So basically the regulation will then be left to region or city. Also... they have building regulations, zoning regulations what you're allowed to do within a certain part of the city and some of the cities they are falling back on that and saying what you are doing you are not allowed to do this in the city or you're not allowed to do this in a specific building but a few times governments have tried to regulate and where they didn't have an agreement with Airbnb then Airbnb take it to court.

[00:15:11.670] - Nathalie
Do you think that approach is good to do it on city level or do you think like national level or even European level will be better?

[00:15:19.800] - Jens
I believe on a European level. As far as at least the taxes are concerned so that you get even terms on...on the information that a certain state government should receive from companies like Airbnb. But that's easier said than done. Otherwise the way it looks now is that the regulations..that Denmark has made this deal. But in other places the regulation has been agreed on the city level.

[00:15:57.070] - Sebastian
One could also imagine sort of a race to the bottom. Just like we see with corporate taxes in Europe at the moment. If you have several cities negotiating each then you always have someone trying to purchase just a bit lower regulation or lower taxation to try to compete with each other. So I mean national levels or European levels makes a more transparent market right. Also because Airbnb never negotiates publicly it's always sort of in a very closed environment so that will just sort of play out cities against each other.

[00:16:28.860] - Felicia
That's a good point.

[00:16:29.790] - Jens
Denmark has a special history with.. the renting out of private property. We have on summer houses which was really I believe the beginning of larger scale commercial tourism after the war and there are certain rules favoring people renting out summer houses. And once that discussion started here with Airbnb in the end the politicians, the government have taken these rules more or less and implemented them, carried them on to the renting out of private apartments. So today the terms are similar. Uh.. you have to get a great tax break but it requires that you have rented out through an OGA. And once you've reached the limit there even after that you only pay a tax of 40 percent of the income. And that's yeah..that's Denmark.

[00:17:37.850] - Nathalie
Is Airbnb the biggest problem or is booking.com or...

[00:17:47.510] - Jens

We don't have problems, we only have challenges. In people's mind what Airbnb is doing is seen as more of a competition to hotels than say hotels.com or Expedia. But that's in people's mind. In reality I mean they are all OGAs with a speciality. And as I said before using merger together...The biggest problem for the hotels are really that in this process we have seen especially since the financial crisis 10 years ago is that hotels have lost control with their inventory. At that time they just gave the OGAs everything that just sell our homes to sell them at any price will do. And then they have lost control of the process. The strength of the OGAs and the strength of Airbnb is that they have a fantastic IT digital based platforms...interactive very good..better than most hotels. Probably better than any...and people who wants to travel they can go to one source one address on the Internet and then once you are there then you can decide whether you go to Denmark or Portugal and when you have decided for one or the other then you could decide for a city. You do it at one place and it's very very hard to compete with across the big international hotel chains. They have similar systems but it's only for their own brand and their own product whereas the OGAs is everybody and that is just something which has happened. So I'll talk about how can we change that. It's extremely difficult because all hotels are dependent on people who are renting out private apartments that say even a private person who has two apartments but is getting used to renting one out to live a little bit on that and travel for that money. If not...if they are not already now there will eventually also be dependent on a good relation with Airbnb as the hotels are today with the OGAs.

[00:20:51.290] - Felicia
Since we talked about the different cities like in Berlin for example which we investigated last time too they implemented that you have to like...the bottom... the baseline is that it's illegal. And then you'd have to get a permit from the municipality from Berlin in order to rent it out. But it's not at all regulated or it's not at all restricted in the platform so it's also it's separated on the platform Airbnb and the law. So...but do you then if it's..that that could be a benefit too that you have...that you need to get a permit from the municipality if you were also to implement it in the platform which then has then been done I think it's Copenhagen.

[00:21:33.250] - Jens
I think a permanent or call it a permanent or call it an ID number which follows a certain property is a good idea because that would solve to a certain extent but also it would be able to trace the property for tax and an ID number is quite common. Different countries, we have it in California and France if nothing else and I think that's a good idea.

[00:22:06.990] - Felicia
But you then...what do you think about Airbnbs motivation to actually do that too because as you were talking about that they show the numbers that they want you to see that they.. they have a hidden agenda basically that they want to say they are transparent and open and...

[00:22:26.580] - Jens
They would eventually prefer to operate in peace with the various governments and that would be their incentive too. And they do strike deals...Danish politicians, Denmark for that matter very proud of their deal with Airbnb. But they have made other deals which are better for other governments than the ones we see. They're basically tough traders and there is only one language that I understand that is

[00:23:08.400] - Sebastian
But I think the law is already up a for re-evaluation in autumn actually as far as I have read so it would be sort of looked on and see if there is something that could be changed and I think that is probably the way we can see at least is that it is also an evaluation that maybe the law is not as bulletproof as initially thought because why would you otherwise already schedule a reevaluation of the law within a year

[00:23:34.260] - Felicia
So you're talking about definitions and stuff

[00:23:36.710] - Sebastian
Maybe. Well I mean it depends on how the re..re-evaluation takes shape. But there will be one at least of the law.

[00:23:43.010] - Felicia
Yes since that's also been official for the European Commission right. That it is how you should interpret the law...

[00:23:52.110] - Jens
The European Commission has reached a deal with Airbnb. That has to do with the way they market themselves. It should be clear on Airbnb's website when you look at property whether it is...whether it's professional of renting out or whether it is a

private person renting out. They have promised to do that but it is still not implemented. But that's one of the deals they have reached but they are certain places like in...New York is a good example. You have in New York a very strong xxx militant...much more militant than we are here. That's good I think. You also have associations of apartment owners and whoever is renting apartments and strong associations. They are really....they're going after Airbnb...changing the laws and they made a rule that if you rent something out in New York you could not rent it out legally for less than 30 days.

[00:25:18.200] - Felicia
Yeah. So it's to kind of like prevent the short term holiday subletting.

[00:25:23.360] - Jens
The second issue is if you rent it out for 30 days in New York, then you cannot throw people out either. Then they have kind of a right to stay. So I mean...today if you rent...often if you rent an Airbnb in New York and then you are met two blocks away by somebody at a corner who discreetly takes you to...to where you are going to stay.

[00:25:57.180] - Nathalie
Would you say it can be seen here that housing is really taken from the long term market onto the short rental market and that rents are rising or can that..can you not really blame that on Airbnb?

[00:26:14.190] - Jens
That the prices or...

[00:26:15.800] - Nathalie
Prices and that there is less available on the market because commercial landlords are renting out apartments.

[00:26:24.210] - Sebastian
I think not in a quantitative level. We don't have numbers saying that because of Airbnb we see this percentage of increase but at least on the level it makes sense that if you go to look on the Airbnb platform you see a lot of very... a lot of professional set up apartments that looks very much like hotels and I mean it is of course logic the more apartments you have in the center of Copenhagen the least...I think those apartments are to be rented out or to be bought by people living in Copenhagen. And I think I can look while we speak on but I think there is like a number in here telling us how many apartments is rented out in Copenhagen. I mean of course it has an impact. I don't have a specific number saying that prices have gone up 15 percent because of Airbnb because we are also in a boom economically. Yeah. So it's hard to say exactly. I mean that would be a lie if I was sitting here saying it has risen by 15 percent and that's only because of Airbnb. I mean that's too simplified right. But looking in Europe looking on the stories that goes on it makes sense. Also I think in Copenhagen right now a daily rate at an air Airbnb is 900 a day. That's way more than you can make on renting it out to a student right. So let's say a municipality sets up the cap for days to 100 days a year with 900 kroner a day, that's ninety thousand. That's way more than what a student would be able to pay every month in rent for example. But but but that's only a sort of small qualitative guess because I don't have a number telling you it's 8 percent.

[00:27:55.210] - Nathalie
And there are some hosts that have 8 apartments on Airbnb and there I think like you can think that they are obviously doing it commercially. Do you think it would help if Airbnb limited them to like two apartments that people are not allowed to have more...

[00:28:10.830] - Jens
In certain places also in the states I believe, people are limited to have a max two listings. But they just do

[00:28:26.510] - Nathalie
Yeah just a different account

[00:28:29.620] - Sebastian
Yeah but it does seem a bit odd right. That you can actually rent out eight homes and the second home is only allowed to be rented out for...is it 30 days a year in Copenhagen..

[00:28:53.420] - Jens
There will have to be eventually some rules...some common rules of what people can do and what Airbnb can accept...

[00:29:08.760] - Nathalie

And how to maybe enforce it because I feel like that's the actual problem. Like the ideas I think they sound like they should like if they were enforced it should work but yeah how do you enforce that. I think that's the real problem. The day cap..how can you make sure that that is actually enforced.

[00:29:28.650] - Jens
In some cities they have a city tax that hotels collect from their customers and in the United States there is also a law saying that people staying in private apartments and are paying for it. They should also pay the tax...it should be collected which has not happened.

[00:29:49.750] - Nathalie
I think in Amsterdam I think they started collecting tax

[00:29:52.430] - Sebastian
Prague as well.

[00:29:53.520] - Nathalie
But that's probably up to each city to the...

[00:29:59.240] - Jens
Now we are getting near...near...it's not sharing economy.

[00:30:03.130] - Nathalie
That's true. The definition is not quite correct...

[00:30:08.580] - Sebastian
I mean I...that depends on the definition of course what is sharing economy. But usually it is set to be something that would have been consumed anyway but if you rent out an apartment let's say 70 or 100 days a year. I mean would you then not have been in it in case you didn't. Because I mean who has holidays of a hundred days a year. No one not even Denmark, right. So... So I'd say it's probably because it's already empty and then then of course then it's platform economy. Yeah renting out like a.. An empty space just like a hotel room would be. So I mean yeah I think a lot of times people believe it's not sharing economy when you don't share. It's just renting out.

[00:30:46.690] - Nathalie
Yeah. That might be something that they'd have to define differently in the future cause it's true like it's not...

[00:30:54.490] - Jens
But you started saying the question how does how will legislation influence Airbnb business and then Amsterdam is a good example because the use of Airbnb has decreased. The listings has decreased and that is attributed to the fact that there are now regulations in place in Amsterdam what people are allowed to do and not allowed to do. After all it's not everybody well but the majority are honest and most follow the law. So that is an example of if you put in legislation and limitations then there would be a limit to how much they can grow and how big a share of the market they can take.

[00:31:55.190] - Felicia
And so we're talking about this...the holiday homes, vacation homes and summer houses and so on...since it's also one of the big issues also in cities and just in Europe in general is the Housing that there are it's hard to get accommodation nationally summer houses are not in cities most of the time. But what do you see then if you were to look like isn't it a positive thing that you can when you're not staying in your summer house or make a show like you rented out shows you are opposed to seeing if you have an apartment and called me.

[00:32:32.240]
Yeah. You want to go. George we which already that you can rent it out to somebody who comes here.

[00:32:38.630]
Of course is supposed to see that's what happening. We also see and see young people there somebody are moving and they start doing to go to flats and productive lives that don't so they've rent out to a B and B. And that means that's one flat place for rent or for use by in London where housing is still Brexit an operation extremely expensive. There are about 80000 units on the market in London alone. And if it was not like that that meant that maybe a hundred and sixty thousand two hundred thousand people that are placed at something.

[00:33:38.690]
So mostly it's a commercial subletting. That's yeah.

[00:33:44.150]
But it also becomes a time political problem because you would like to have taxpayers individual tax free of where the government would choose to put taxpayers even.

[00:34:09.490]
I think it owes a lot of it boils down to fair competition is always good idea.

[00:34:13.960]
But with emphasis on the fair I mean what is the regulations for commercial private renting out and then the regulations that are for hotels or summer houses. I mean as long as there are fair regulations and they are somewhat the same then it's easier. But but when there are different tax regulations when there are different caps it gets unfair and at least two hotels have a lot of things where you have to report into different authorities there is a duty to educate the people working at hotels. It's true of course a lot of things that the original commercial businesses have to do that are not within the new regulation.

[00:34:57.550]
So I mean it's true is the competition than fairy and that's of course the question but what we're looking at is we have hotel owners running hotels and then you had some private people who have seen the line and started renting out and I said initially it was private.

[00:35:32.670]
People rent rented out and then some just showed up and then you just showed up.

[00:35:39.660]
The private people said What is this. This is unfair. You have somebody the city of Copenhagen people first to have more needs for public money and all the ones who rent it out of the time they. That was unfair.

[00:35:57.400]
So I mean things are changing and this is just one step away and the dangers for little children to industry is much greater than being been.

[00:36:14.410]
If you look at Google who are slowly cutting out the O'Jays The O'Jays are the biggest customers by the way search engines but slowly they're trying to do taking all the business and once they do that then they would set off on.

[00:36:43.650]
So do you think that that will happen in the near future that Google and those fake search ends will acquire and move into.

[00:36:54.870]
Because I know this started with you can do flights come then on the long known Sky Scanner and those platforms.

[00:37:03.090]
Do you think they would also start going into them you have where you're going to start with better read in the news pages.

[00:37:18.570]
It's always hard to predict especially with search engines because we also have some competition authorities in Europe that can be strict and sometimes they can take the process back a bit and find people for monopoly evens and so on so forth. So it is always hard to predict when it comes to a monopoly on stuff like this. And also sort of pushing out for example LTE. I mean I think you said last year that we got a fine of 2 billion euros.

[00:37:47.880]
So maybe there will be a reaction to that as well.

[00:37:54.300]
Do you have anything. I always think Well I think it's an interesting.

[00:37:59.080]
But when dealing with very much open times of course this is it's only been possible because of the ticket civilization and the internet.

[00:38:13.240]
Whether you think about the Internet came to in line to form such it's not that maybe no really physical development is going like this then think ever manuals 2009 just 10 years.

[00:38:33.550]
So that's crazy.

[00:38:34.960]
How much can happen. I lesson will be in the figures. Eventually they will go public.

[00:38:42.920]
Do you think that at all with the figures that they were designed to support that they grow properly or is it a correct business report.

[00:38:57.130]
But if they go public then they will also need to be more transparent right with their numbers. So perhaps it's not I guess those depends on what does go public.

[00:39:06.740]
But if the IPO or something. Yeah yeah it's interesting.

[00:39:14.980]
And I bet I guess we still have a lot of subsidy regarding the other cities that we're investigating and it's also a bit of a language barrier. For instance you don't speak German English and then Swedish Danish Norwegian but for the other languages it's hard for us to ask. So we're getting some help from other professors to speak though SAP so we can really dive into those regulations as well but it's it's a very interesting topic.

[00:39:42.640]
And began at the end was to basically try to develop a framework that cities can look at maybe and get a framework for. It's now trying to tackle every problem under city. So that's the goal of philosophy but we kind of want to develop in the end. Yeah. It's probably easier said than done but. We have in a European context we have a voice as a member of subject called which is a European to moved into President states and there worked out some guidelines.

[00:40:26.200]
Could give you a. I regret to where we kind of talk about registration number taxation. And you said this was. You never know which way to go on a worldwide going. Go. Down super.

[00:40:52.150]
Professors also been in contact with some of the European Commission and also had a meeting with the president of EMEA for IBM.

[00:41:04.320]
It has been nice to get their opinion on it since it's not that easy always to get information from themselves.

[00:41:17.110]
You as I said I only two have brought the three patients wishes which is not to hearing the 5th of February 2019. So this is a response from Community Party. But I can send you the entire file which contains response from a lot of the Danish organizations within it can be business could be politics to resources different agencies within government of obstacles and so on so forth.

[00:41:40.790]
You can have that if you want to. Even I can send you the entire file. It's very long and you can read organizations that you deem interesting and do things on under the.

[00:41:51.140]
Get a copy of this. What you think they need a lot. And so what was your name again just so for the record I'm Sebastian Sebastian. Yeah. Okay. So happy birthday. Can I get an e-mail. Yeah of course. What do you hope I.

[00:42:07.770]
Do.

Appendix D - Informant Interview: Pons

Interview: Sergi MArí Pons

http://www.bcn.cat/estadistica/castella/dades/anuari/cap21/C2101030.htm

Sergi Marí Pons: I'm Manager of Tourism, Commerce and Markets.
B: And your responsibilities?
Sergi Marí Pons: Well, the different services of the City Council. Here at the City Hall my position is political. It's not a politician, I do not participate in the deliberations, because it is an executive political position. The managers come to be, as General Director of the other administrations, a political appointment positions, that have to direct the administration and what I direct are 3 areas. Tourism, we will enter more into it now, the services of the city commerce and the services of the municipal markets, you know that in Barcelona are important, speaking of 40 markets, of one institute, one public agency, which runs functioning of 40 markets. Well, my responsibility embarks this area, within the area of economy of the entire City Council. As for tourism, the City Council's responsibility in tourism is shared. The direction of the municipal tourism is dedicated to the political management of tourism, but the promotion of the tourism is not done directly by Barcelona City Council, but there is another corporation called Turisme de Barcelona, which is a consortium between the City Council and the Chamber of the Industrial Trade of Barcelona. So, it's like a public-private consortium that is responsible for what promotion of tourism is, what is a very important part of the tourism issue of a city. But it is not the only one. Everything that is not the promotion, what is ordering, management with other areas and negotiations of a more political nature, strategic planning and even data collection and reporting, of the situation, all this is done by the City Council and tourism management.
B: What we are trying to understand is the process from the moment of entry of Airbnb to the Barcelona market to date. The platform behaviour, the critical events, the changes that have caused in the market, changes in regulations, everything you can tell me. We want to know your opinion, your point of view.
Sergi Marí Pons: Yes, the first thing you have to keep in mind is that Airbnb is not the only platform.
B: Yes, we already know that.
Sergi Marí Pons: I do not know if your case study is only, we have worked with all the platforms, with the whole problem. It is true that Airbnb is the largest one.
B: But there are differences in the behaviour between the platforms?
Sergi Marí Pons: Totally. Yes, yes, yes, there are differences and we can enter into it. But I mean that, although there are differences, our policy, from the City Council, has to be generic, it can't be a policy directed to a single subject. Then, we have worked on the tourist management from here. The city government comes to power in 2015, on the tourist management of ... addressing problems of the new platforms for tourist accommodation in general. Then, between these platforms, the Airbnb case stands out, but we have tackled it as a new situation, different from how it had been done in 2015. The current municipal government of Ada Colau goes to elections, among other things, with a commitment to moderate tourism problems, because this claim came from the city. The citizens already, let's say, we had protests, we even had very clear political actions, calling for a brake on uncontrolled tourism growth. And suddenly, after the 1992 Olympics, Barcelona becomes a global destination, becomes a city on the world's tourist cities map. And Barcelona is an international brand since then, even more powerful brand than Catalonia, although Catalonia had a tourism much before and very powerful. But suddenly Barcelona becomes an international brand. Tourism is growing. The Tourism Consortium, Turisme de Barcelona, which is public - private, is created for the tourism

promotion purposes. All this is very successful, and we arrived to the moment when new platforms for tourist accommodation appeared on the internet.
B: At what moment?
Sergi Marí Pons: In 2008 these platforms begin to appear. We arrived to the moment in time when Barcelona was already a tourist success, but it was a ... and that in terms of pressure that visitors exercised on the city was within the margin of accommodation control. Until that moment basically it was hotel accommodation. But suddenly these platforms, as you know, they mean a disruption, a disruptive innovation, that changes the situation and the city. The cities in the world lose control of their ability to limit accommodation because a tourist suddenly can stay anywhere, with a simple business - technological innovation. So, this concern ... when tourism, which was already very important, begins to grow in an unwanted way, or at least not controlled ... not controllable. Desired by some and not desired by others, but not controllable. So, the question is addressed in many cities, Amsterdam, Berlin ... we are in permanent contact with European cities that have the same problem. Amsterdam coordinated a group of these cities, which include Barcelona, Madrid, Vienna, Berlin, Reykjavik, Brussels, and so on. But many of the cities have addressed the new problems from the problems themselves. I will explain, the fact is that there are many people who stay in apartments, so those apartments stop being on the housing market. By reducing the supply of housing, prices rise. And also, because the rent paid by those who stay in these apartments, the income capacity is much higher. Then, by comparison, many people want to rent to tourists and throw the residents and so on, you know the process, we can go into more details. But that makes many cities begin to set standards in the field of housing. Barcelona, on the other hand, and this is an important point to start, Barcelona instead decides to approach the issue as a tourist problem, not just as a housing problem. And for this reason, what Barcelona does is - draft a strategic tourism plan, in which, one of the pieces of this strategic vision is an urban plan that limits the tourist accommodation of all modalities. Not only of apartments, but also of hotels, of all modalities in the city. It is the Special Urbanistic Plan of Tourist Accommodation, PEUAT. The PEUAT is an option that makes a reflection on tourism, and not only housing problems, says the housing problem is a side effect of a larger problem, which is losing the ability to control the total of tourists in the city. Then, there is a need to regain that control. But we can't recover it by limiting one modality. We must limit the whole set of modalities. And that is why the PEUAT also puts limits on hotels, also on shelters, etc., et cetera. This is the Barcelona option and it is quite original.
B: Yes, sure. And the different areas? Can you explain it to me?
Sergi Marí Pons: The PEUAT makes an option. There are 4 areas, very urbanistic. Yes, we have a problem of control of the total accommodation limit, but we also have a differential impact problem in different areas of the city. Therefore, we not only want to limit the total set of tourists, but also expand them, fluff them in the whole urban fabric. That they are not so concentrated in certain neighbourhoods, because that is what harms housing in this neighbourhood, the identity of this neighbourhood, the changes in trade, and so on. There was and an idea also to protect the identity of the neighbourhoods, and therefore it is necessary to "split", it is necessary to disperse the accommodation offer in the whole city. And that is why the red areas are defined, where there can't be more tourist accommodation.
B: And what if one closes?
Sergi Marí Pons: If one closes, it closes and does not reopen, not if it is in a red zone. But you can use this closure to open another one in the peripheral zone, third zone. There is a fourth area, which is an exception, the very small area. But, basically, logic works in ... ... too congested area where new licenses can't be given. And if the tourist accommodation closes, the license do not return to be given, but those licences can be given in the third zone. And a second zone, where the total number is frozen, can't be given anymore, but if one closes, that one becomes free again, no. The fact is to try to move

licenses from the most congested area to the least congested area. The PEUAT has functioned as the global limit of the entire city, and we can also explain more details. But it has not worked to fluff, to say it that way, we have very few changes of tourist accommodation from the center to the periphery.
B: And why is that?
Sergi Marí Pons: Well, we have to think about it, and surely revise the idea. Because the tourist licenses are so profitable that they do not close, very few are closed. They are being passed between them. There is always a way, there is a way to not abandon that business. Because when closing the quota a (...) has been created. So, having a tourist flat is a value. And nobody loses a value. You always find a way to keep that value. I suppose that the solution is, and that is a technical reflection, that we still have to do, I say it as a technician and for an academic study, if the licenses were not permanent, if they are temporary, we would have more capacity to play with ups and downs in some areas and others and the model would become more dynamic. Now it is very stagnant. But that is a secondary problem, what is inside Barcelona. The main problem was to put a global limit in the city of Barcelona, that has worked.
B: So, at this moment there is no way to get a new license?
Sergi Marí Pons: Only in those very strange cases if one is discarded, etc., etcetera. In practice, no. In practice it is very difficult, now that all have been given, to get a new license ... not all have been given, there are still some for hotels, but apartments have been given all, have been given all.
B: There are about 9600 licenses?
Sergi Marí Pons: Exactly that number.
B: And in the future? What about the new licences in the future?
Sergi Marí Pons: We can't talk about it. If we differentiate whole apartments from rooms renting, the another problem appears.
B: We're going to talk about this, but I'm interested why you said that Airbnb stands out from other platforms?
Sergi Marí Pons: Ok, then, that reality of the PEUAT is accompanied by other important instruments in our strategic plans. One of them is inspection, because the rules are useless if they can't be enforced. So, how this is a new sector and very difficult to inspect, because there are ads on platforms on the Internet, thousands of ads, one says, it is impossible to inspect this. And it is not true. We have shown that you can inspect this sector, but it is expensive. And, then, Barcelona tripled the number of people dedicated to inspect, has put resources, sufficient economic resources. And during these years has been checking all the ads in the city, locating all those who did not have a license.
B: City Council is doing that?
Sergi Marí Pons: Yes, the City Council has done it. City Council has continuously inspected and has detected all cases of advertisements without license number. Why can we do that? Not all cities can do it. Barcelona can do it thanks to the Catalan tourism law. Because all the tourist offers are obliged to have a number, the number of the tourist license, also the hotels, all the tourist accommodations – RTC, Registration of Tourism of Catalonia is obligatory. And if you do not have it, it is a serious fault. To get RTC, you just have to make a communication through the European Services Directive, I communicate that I open my business and they give you the number. But the Catalan law says - to present that communication you have to attach an urban conformity, because the City Council, all the City Councils are competent in urban planning. And therefore in the uses of (...) for economic activity, like Barcelona, that the objective of stopping that has set up a rapid and effective system, answer all communications immediately giving very quickly a certification of whether or not it has ability to open according to the PEUAT. When you do not have that, from a certain moment in all cases, when you do not have the capacity to open you can not ask for the Catalan Registry number, because the City Council document says - use not allowed according to the PEUAT. This means that all the ads in Barcelona that do not have a number are already illegal, simply because they do not have

that number. So, this has allowed us to pursue all cases to the extent that 2 years ago, we estimated, more than 6000 of the ads in Barcelona did not have a license number, and currently they do not reach 100, okay. We have cancelled many announcements because of the collaboration of the platforms, and, in fact, if it wasn't because of the collaboration of the platforms, we could only go through the inspection route - detect the case, denounce the apartment and at the end of a complicated process, because there are guarantees, etc., for the affected one, to seal the apartment - we have sealed a couple of thousand, meaning we have already sealed many and we have put many fines.
B: And can you tell me, what is the fine?
Sergi Marí Pons: The fine can be up to € 30,000 for owners.
B: And for the platform?
Sergi Marí Pons: For the platform it can be up to € 600,000, which is the case of Airbnb, because it is the second by reiteration. The first was also 30,000, well and the second 600,000.
B: And what was Airbnb's reaction to the fines?
Sergi Marí Pons: They appealed them. Yes, they have appealed and we are waiting what the courts will say. Private owners can also appeal, but their reaction has been double. The owners who have received a fine and their apartment have been sealed, some have appealed, others have paid. But an important part of them has denounced Airbnb. They have made an Association of Affected by Airbnb, because they felt cheated. Because Airbnb had told them it was very easy and had not warned them that it could be illegal. It is doubtful who will win that lawsuit, but it is the reality, that I am explaining to you. At the moment, that demand of Affected by Airbnb due to municipal fines has been accepted by a judge and is pending trial.
B: This happened recently?
Sergi Marí Pons: Yes, but it has been presented a long time ago. A judge has admitted it for processing this October. We have to see what happens.
B: So, you are saying that Airbnb has never paid the fine?
Sergi Marí Pons: They do not have to do it because, because they have appealed, but we will see what the courts will say. But I was telling you, in the case of the inspection routes, we have fined and sealed many apartments. After a certain moment, the platforms accepted to collaborate with the City Council. We have spoken with all of them and we have told them, we can talk about what you want, but after fulfilling the rules, after fulfilling the law. The law is not for negotiating. The administration is responsible for enforcing it, but not negotiating, that's it. So, we could not in any way have a productive dialogue with the platforms, and with Airbnb, if first they did not accept the law, and for us to comply with the law was that there had to be no ads from Barcelona without the RC (Registro de Catalunya) number. Little by little all the platforms were accepting to play by rules, and that is the moment that you asked me about the difference. In 2017, all the platforms, except Airbnb, agreed to comply with that.
B: And what has Airbnb done?
Sergi Marí Pons: They did not comply. But wait, we have organized meetings, periodic meetings with all the platforms that complied the rules. To comply means simply that all the listings of advertisements without number that the City Council sent them, were removed. 48 hours were gave to explain the reasons, if it was a mistake, but if they did not have a number, the ads would be removed from the platform and stopped from further announcing. All the platforms began to do that except Airbnb, although a year later they accepted for the first time to remove the listings. In the summer of 2017, one thousand ads were removed. The conversations continued etc. and it was not until 2018, in January that we reached an agreement, and agreement was that they would comply with the law and Airbnb began to comply, we started talking about fulfilling last year, in this year 2018, and they accepted complying and they cancelled the lists of announcements that the City Council sent them. In fact, I think it was in May or June we sent them fifteen hundred more ads without number and they

were also removed. But otherwise, they also made us an offer, to sign an agreement so that as of September 1, 2018 they would not publish any announcement in Barcelona if it did not have the registration number. All ads were removed, until September 1, 2018, all announcements up to September 1, 2018 without registration number, that we sent them the list, were removed. This made that at the end of the entire process, they have removed 4500 ads at our request. This, announcements until September 1. But, also, from September 1 of this past year, to upload an ad to Airbnb, the host who wants to do that, the owner or the one who rents the apartment, has to sign, has to accept that their data can be sent to the City Council. In both cases, if you have a registration number, as if you do not have it. That is to say that from September 1 all those who have Airbnb announcements, have accepted that Airbnb will send us their data, with which we will be able to detect, and we are doing that, all the announcements without number very easily. But, also, just for that reason, many people, since they know they can not do it, now they know, not like in the beginning, now everyone knows that it can be an illegal advertisement. Because of that sign many people do not put the ad. With which, at this moment Airbnb is a platform that in Barcelona complies with the regulations, even a little more. Because they are providing us with data directly from all the ads.
B: But what has changed? What do you think? What has led to this change?
Sergi Marí Pons: A, that's another thing. It is a very important change, because it means that some platforms at the beginning behave well and other ones don't, the biggest one. That is uncomfortable for a City Council, because those who behave well, have a tendency to say, and can say it legitimately, I am complying, but there are some that don't, my main competitor is not. This is making unfair competition and the City can only say, we are doing what I can, inspect and fine. From the moment Airbnb changes the attitude, which is, it must be said, the product of long dialogues. It doesn't happen in one day, or one morning, they didn't get up that way, you have to negotiate it, see the ways, we want this, this we can not, well, it is a negotiation that I have basically taken. After a certain moment an agreement is reached that is, at first place, to comply with the regulations, which for us was a fundamental condition. And second, they put a new technological solution, which is the commitment of the hosts that Airbnb, the commitment or let's say the acceptance of the hosts that Airbnb can pass on their data. That's the reality. We are at that moment. We are in November now, this happened on September 1st, well now we are already in December. Three months have passed and we are still working on the new system and we are going to see what is the result. For now, the result, the number of ads is radical. Very few ads, less than a hundred, the last time, without a license number. If you are asking me the reason why Airbnb changes the opinion…
B: Yes, what are critical events…
Sergi Marí Pons: I can give you my opinion. Partly because, I already mentioned it to you before, Airbnb users felt cheated. Therefore, they have received pressure from people for who care a lot because they are the hosts of Airbnb, which are their, lets say it that way, social base, those who rely on the platform to rent their apartment. In addition, Airbnb has a very powerful image, because the hosts are the locals who know the city, who show the city to visitors, the part of the experience that you will have, is to live with real citizens, etc. All that image is badly damaged from the moment the hosts say, Airbnb cheats me, tells me that this is easy and beautiful and I have a fine of 30,000 euros. Therefore, that is one element of pressure on Airbnb. Second element of pressure, a fine of 600,000 euros from the City Council. Third element of pressure, damage of the image. Barcelona is a global destination, we said that at the beginning. That also means that millions of people around the world talk about Barcelona. And that hurts the global image of Airbnb. Barcelona has been, has made an effort to spread publicly that Airbnb was a problem. And it said, I do not say it, my citizens say it, that they are losing a lot, neighborhoods are changing, tourist accommodation expels neighbors, changes shops, there are difficulties of living together, of the night life and such things. All that, the image of "sharing economy" and good vibes of Airbnb, it is something like modern and cool people use, and

suddenly it is said no, no, no, this platform is a multinational that harms the poor people. Here there is a contradiction of image in the world, not only in Barcelona. And that worries them. And finally, I think they also have a strategic reflection, because we are always talking about entire tourist apartments. Which is what allows us, let's say, to regulate and inspect by the Catalan law. In that sector they compete with other platforms, they are not the only ones, Booking, Homeway, 9 Flats… there are many. But there is another, all other world, which is renting rooms in homes where the host lives, where they are almost the only ones. They are almost a monopoly in that sector. And in Catalonia and Barcelona that sector we have not been able to pursue because the regulation that the Generalitat had to approve is in a drawer for more than a year. The Catalan law says, the case of shared homes, rent of individual rooms, will have to be developed by a regulation. And that regulation has not been done. We've been waiting for it, everyone, the City Council and Airbnb, we're waiting for that. They have not been waiting, they are doing meetings, repression, lobbying. You play a lot in room rentals, because that is where they are very strong. For the other platforms, this topic is not so interesting. To negotiate the rental of rooms well and have a good image in that sector, they had to stop being the bad guys in the movie in the other sector. So, there was a strategic idea of, perhaps, we are going to lower our resistance to legality in the matter of the whole apartments and we are going to bet on recovering our image that is very important, for something as sensitive as renting rooms in homes of people. And there, too, there was a business model issue for them. They now bet much more for experiences. For selling the fact that, through Airbnb, you go to a real city. And that, is no longer a simple platform. It is a tourist business with its own policy. All those phenomena, all those factors that I have been numbering, surely some more, make that at a certain time Airbnb changes its attitude in Barcelona. But it does not change it in Barcelona because Barcelona's Airbnb changes his mind. Those are decisions made in San Francisco.

B: So, now, today, we can say that initiative of cooperation between Airbnb and City Council really exist?

Sergi Marí Pons: Yes, it exist, at this moment a cooperation mechanism works. We can verify the information of the Airbnb hosts, who have accepted that we can verify this information. But only for the whole apartments.

B: Meaning that for a room renting there is no regulation? If you want to rent a room, do not you need any type of license, or anything?

Sergi Marí Pons: It is a legal vacuum. If you rent it for more than 31 days.

B: Yes, you're talking about the short-term rental.

Sergi Marí Pons: Yes.

B: Can explain it to me more?

Sergi Marí Pons: Let's say that, in the law, the figure of 31 days has been used to differentiate renting from tourism. That's a convention, why 31 days, well that's what was chosen. For now, and in the absence of seeing this regulation that has not been approved. For now, it is considered if you rent less than 31 days, you are in the tourist business. And if you rent more than 31 days, it is not a tourist business, it is the law of urban leases in which everyone can rent their things, without it's been considered business. You can rent your house and you do not have to be a company. You simply have to declare the rent on your taxes, but for a tourist business, it needs to be recognized as a business, as an economic activity. That border has been established at this point. For whole apartments it is very easy, so the missing regulation is the other, because the whole apartment being rented or not, 31 days or not, or less or more. It is not a home where someone lives. It is an economic resource. And if you rent it for short days you are in tourist business. If you rent for long periods, you are doing the apartment rent. The problem is renting a room, because when you are renting a room, that is a private address, yours and you are renting a part of your house. We are no longer talking about an economic resource. We are talking about home, which also has elements of inviolability. Therefore, for

example, to inspect it, we would have to previse very specific regulations, because you can not enter people's homes. Therefore, there is a problem in definition that still needs to be resolved. And that has slowed down the solution. And there are different positions in policies that are about to discern. 31 days will serve as it has served in the entire apartments, as a limit. Renting rooms for more than 31 days is not going to be tourist? Will it be for students? Or 31 days is only a limit for the entire apartments and for rooms we have to think about another system. Is there going to be a limit for a year? As other cities have done, including other countries. Here, the legislations are first Spanish, then Catalan and then of Barcelona City. Who is responsible for that? All that is to be seen. But it is a complex problem. For the fact that you are renting a part of a home, protected by the constitution. Here, talking about it would be talking about what I can know about other cases, like Madrid and Amsterdam. We know about other cases. The Barcelona model does not exist. Because the Barcelona model for apartments has been developed from the possibilities given by the Catalan law and from a conception, it is important, that this is a business, it is an economic activity and as an economic activity the city has very strong competences, very own, very autonomous urban regulation. Therefore, we have used the urbanistic instrument, like San Sebastian, but not like other cities in Europe, to say this is an economic activity, and we say where it can be and where it can not be. Renting a room will be considered an economic activity, if we apply the same system, but we would have to revise the PEUAT. Why? The number you said, the 9600, are just the apartments, the rooms are not included. If we say no, renting a room is not an economic activity, then, you have to think about other, new rules. How many days can you rent a room, how do you guarantee that the person lives there, can you rent a room whenever you want, and also when you are on vacation you can rent a whole floor. There are a number of things to be solved, which, I recognize that with the current Barcelona model, which we have designed for entire apartments, creates problems for us, it will create problems for us. The only way to avoid creating problems would be to prohibit something that is obvious. But apart from that, it would be considered an economic activity and then we should reform the PEUAT. Or make an addendum, I do not know. Yes, reform the PEUAT. It's a problem, we're in one, I talk to you like that because it's for an academic study, you understand me. When we face the regulation, when it starts to be managed, when Generalitat begins to manage this regulation, obviously we will participate and put our opinions on the table, saying, whether this regulation suits us or not suits us. But now, at this moment it is difficult to say more. But, we need, on the one hand, we need to regulate that, because of course, you can understand. Many of those who rented entire apartments, who now can not do it any more, because the City Council policy has been approaching, they are now renting rooms. And there, we are in a field that needs to be inspected, because theoretically you rent rooms of your house, sharing home. But, you can imagine that there must be people renting all the rooms of the apartment and they are not there. So, they are cheating because they are renting rooms without a need for tourist license number, because they are rooms, but in reality they are renting the apartment without a tourist license number. But, to inspect that we need a capacity and the law has not offered it to us easily. I've explained it well?

B: Yeah sure. So, can you tell me know what is the main cause that led Government to make decisions that has made, to act as it has acted? Is that the situation on the market or the behaviour of the platforms? What is the main reason?

Sergi Marí Pons: The main reason behind our policy is, the problems of the people. Of course, we have, from the first moment we have been worried about the housing problem of Barcelona. This is the main engine. We, the current Government came to the City Council to govern and in the first place to start making a different housing policy. This is the first time an important policy of public, protected housing is being made. We are working with different instruments to favor humble people to have a right, have access to decent housing. That, the deliberate policy, never before had been done by so decidedly. Of course, it needs time. On the housing market you can not say, by decree, now

everyone is going to have a house. That is naive. It is a complex market in which you have to build living space. And we must put legal instruments, so that prices are reasonable. So, that is, it is complex but that housing policy is one of the most important elements of the current Government. What makes the price of housing go up? Many things. One of them, this phenomenon that we have commented. An important one. Because from the moment you can rent to tourists and earn a lot of money, not renting to tourists is like losing money. Then, the renting prices are influenced right away. The only way was to prevent that the whole house is being rented to tourists. Because if not, even if you do not rent it to tourists, you will raise the rent. Because you say, I could rent it to tourists, I explain it well? The prices are signals. And if the same good can be sold expensive, rent expensive in this case, you will not rent it cheap. And whoever wants to rent it for the whole year, you're going to say sorry, the prices went up. Man, but I can not pay that much. But tourists can. Although you do not rent it for tourists, it's more expensive, always. Then, that signal had to be stopped. The only way was to set a limit. It is the only way. Then, rents continue to rise due to other factors, but not so powerful, but of course that was a very important one and that is why we did it. Second, not only the problem of housing, but the problem of coexistence. We believe that tourists are citizens and residents are citizens. It bothers us that there is a difference between visitors and residents. They are all citizens, we want to treat everyone as citizens and coexistence is complicated whenever citizens have very different lives. Some work, others are partying. Then, there were also problems of coexistence in the neighborhoods. Therefore, we had to put some modelling instruments. In third place, not only the coexistence, but also the urban landscape. That is, the type of businesses in the neighborhoods also depend on the type of population that exists in the neighborhoods, always, not only for tourism. You just have to compare different types of neighborhoods, rich neighborhoods, residental neighborhoods, they are always different. Tourism changes very quickly the landscape of that neighborhood and the people of the neighborhood, in Barcelona at least, greatly value the identity of the neighborhood, social life and its landscape. A tapas bar is much more profitable, when there is tourism, than a haberdashery or a dry cleaner's. Then, in the end, neighbors are also expelled because services disappear for the people who live there and there are a lot of services for the people who are passing through. It is the other element. So, those are the elements, perhaps, less important than the housing, but also enough to say, we will protect the identity of the neighborhoods. But there is also this last element, identity that is something a little bit subtle, it seems that we defend alone, that we defend something that is typical of the locals, of the residents in the neighborhood, but also has a tourist value. This element of identity and urban landscape turns out to be an attractive factor for tourists that may even be counterproductive to lose it. One of the attractions of urban tourism is diversity and authenticity. The cities are interesting if they are alive, if the tourist sees a real Barcelona. When there is a neighborhood full of tourists, with businesses for tourists and you can’t see a city that works day to day with its own residents, that city loses value, loses interest. In fact, we were talking before about the image of Airbnb, Airbnb even makes image of that, right? The authentic city. Authenticity is part of the tourist attraction. In other words, by protecting the identity of the neighborhoods and by moderating tourist pressure in the densest areas, we not only protect the residents, first, but also improve the quality of the tourism product we offer. We defend our own tourist image. That's why, I told you, we have not acted only from the housing policy. We have acted as a strategic, touristic plan that, and this is a bit the end of my reasoning, almost the end of my speech, we intend to promote the city not at the service of those who want to come, but at the service of what we want to be. The tourism promotion that we do now is not autonomous, although it is done by the Turisme de Barcelona, but it is derived from the management. We do not sell Barcelona to anyone, we do not want any kind of tourism. First, we define what we can offer, what is authentic and after that our citizens are satisfied with the city, then we can manufacture marketing. That is what we want to sell, not the other way around, because marketing has always been used after we see what the demand

wants and what we can offer. No, in tourism that has to end. Marketing can no longer be studying demand. Tourism marketing, and I do not say it, it is said by the European DMO Association, Destination Marketing Organization, has to be derived from management. Management and then promotion, not the other way around. Therefore, the DMOs at the level of European Association, are making the speeches of DMMOs - Destination Management and Marketing Organization. And the Management first. Why? And this is what we are trying to do here. Authentic neighborhoods, authentic mobility that absorbs tourists, does not send them through different channels, does not separate tourist areas from resident areas. We are trying to be all citizens in an authentic city. Where tourists see the real Barcelona and citizens enjoy the services that there are also for tourists. We are all tourists in the afternoon, no? So, that combination demands this philosophy. First, let's manage, this is the city we want, this is the city we offer, not the other way around.
B: If you have anything else to tell us, to add something about Airbnb platform, any data, any information you want to share.
Sergi Marí Pons: No, well, I think that, the ways to find information about Airbnb there are many, there is Inside Airbnb, etc. I could only add that we are working together with other cities at European Commission level, so that there are regulatory changes at European level. And I believe that the Commission has to recognize that cities have taught them that there are real problems in the population and that we do not try to harm the functioning of the market. We know that with the platforms, there is no turning back. We know that tourism, we do not want, we do not intend to stop Airbnb from operating. We are perfectly aware of that.
B: They are here to stay.

Appendix E - Informant Interview: Tom Leenders

Memo interview via Skype, Tuesday 23/7/19, 14.00-14.50
Interviewee: Tom Leenders (TL), PvdA (*Partij van de Arbeid*, the Dutch labour party), part-time Member of the City Council (sits in two Commissions - Building/Housing and Urban Development) and Digital Strategist at the Dutch Ministry of Finance.

What specifically motivated the regulatory response to Airbnb in Amsterdam? When and how did it all start?

 Started around 2014, Amsterdam one of first cities to regulate hosting on Airbnb, strategy was to cooperate with Airbnb.

 Airbnb and City of Amsterdam signed agreement that Airbnb would collect tourism tax on behalf of Amsterdam form Airbnb hosts, agreement is kept secret

 Overall there was a very positive climate towards Airbnb at the beginning, city first and foremost considered it an advantage to get taxes

 Tide has turned only very recently, during the last 1-2 years that there was strong backlash from city centre inhabitants against Airbnb because hosts were regularly in breach of housing regulation

 Only in the last months has Laurens Ivens (LI - Elderman in the City Government of Amsterdam – from the Socialist Party) started blogging critically about Airbnb – previously he had had an attitude along the lines of collaboration with Aribnb being the only option that Amsterdam has (little power of a city against a huge platform)

 Motivation for regulation:

o Pressure/backlash against tourism boom in general, but especially in Amsterdam city center

o Housing prices are rising a lot

o Houses in the city center are old and simply not made for tourism, walls are thin, sound travels very much, and houses are somewhat fragile. According to TL, there are whole streets exclusively used for hosting via Aribnb by now.

 * Tom suggests that the downside of Airbnb has something to do with the power/set-up of the platform itself

What regulations are in place for Airbnb hosts in Amsterdam?

 Obligation to register as a host under certain conditions (rules somewhat similar as in Paris or Barcelona, but not as strict)

 Tourism tax – collected by Airbnb

 Day cap: 30 days (before 1 January 2019 it was 60 days)

 You can only rent out a house/flat that you own

 Flat can be rented out to maximum of 4 ppl

 Approval of owners of the association of a building necessary to host via Airbnb

How are regulations enforced?

 Through city council unit enforcing housing law in general ("knocking on doors"), one section focuses on Airbnb, imposing fines, use of data scraping methods (but this is usually not sufficient evidence to impose fines)

2

 Fines were apparently in the millions of Euros and growing over time

 TL has questioned whether fines have ever been collected. LI did not reply to this question when asked, estimate is that only around 20% of fines are actually collected

 TL claims that the current approach based on housing laws (a "legal approach") is simply not working, and that other regimes from tax law to other laws would need to be explored to see whether Airbnb can be more efficiently regulated – the question remains at which level on should regulate (local-national-European?) but cities should keep powers to regulate

Is Airbnb helping to enforce regulations?

 Airbnb is helping in terms of tourist tax collection

 When the 60-day cap was still in place, Airbnb claimed that it was informing hosts whenever they were surpassing the 60 days of hosting, but voices were increasingly critical that Airbnb was actually not doing anything about hosts offering their places for more than 60 days

 Since the cap was reduced to 30 days on 1 January 2019, Airbnb is no longer talking to Amsterdam, it only stated that it considered the 30-days cap to be unjustified.

How are things going forward with the regulation of Airbnb?

 National government is currently considering a change in the registration system for hosts, possibly moving towards a more similar model as Barcelona

 Airbnb lobby has shifted from City Council of Amsterdam (which is leftwing – similar to Berlin and Barcelona?) to national level (which is conservative). TL expects that Airbnb's lobby efforts will be more fruitful with conservatives at national government.

 Compared to other cities, like Barcelona, Amsterdam is much less independent and has less tools to enforce regulation. One critical area is the sharing of data, where regulations (GDPR) in NL are very strict, whereas other cities in Europe have more lenient data protection laws that allow them to get more data from Airbnb

Is there consensus among political parties in Amsterdam City Council when it comes to the regulation of Airbnb?

 Overall yes. All parties agree that there is a problem and that something needs to be done

 Within the governing coalition (PvdA is coalition partner with GroenLinks (Greens) and D66 (*Democraten 66* - liberals)) there are small disagreements. The liberals opposed, e.g., total Airbnb ban for some streets in Amsterdam city centre, since they thought this infringed too much on property rights of house owners

Could you say something about the interplay of local regulation with EU regulation and give us an idea about how the Network that Amsterdam has started among various European cities is working?

 LI regularly claims that Amsterdam cannot do much to regulate Airbnb that the city has to wait for what happens at national and EU level.

 EU Services Directive is regularly invoked to fend off suggestions for regulation.

3

 Network is still in its infancy
 The network is only established among civil servants, and not used at a political level. TL considers it almost a form of “window dressing” to further promote Amsterdam as a ‘digital city’
 Network is not being used to form a common position of major European cities against Airbnb – actually Airbnb is playing cities against each other!
 TL is contacting colleagues in Barcelona and Paris on his own intiative

Anything else you would like to add?
 Effects of gig economy platforms on social fabric in cities is underexplored, but is a real problem that politicians need more information on
 We need an alternative approach for regulating Airbnb
 Follow TL on Twitter for news: @tomleenders

Appendix F - Informant Interview: Pieter Guldemond

Memory protocol of interview on Wednesday, Aug 8th 2019
Interviewee: Pieter Guldemond, Head of Policy (NL/Nordics) AirBnB
Interviewer: Philipp Hukal, CBS
—> *responses marked by an asterisk (*) require fact checking before next steps*

Theme Motivation / Cooperation:

1. **What motivates regulation in Europe?**

Mainly three problems
over-tourism
tension on the housing market
'nuisance' (—> hosts or guests behaving unruly or unlawful)
taxation
These motifs differ across markets and cities.
E.g., AMSTERDAM suffers all three (majorly)
Scandi-markets (SWE/NOR/FIN) not so much; these encourage more tourism and see AirBnB as one vehicle to achieve that goal.
COPENHAGEN communicated that taxation was their main concern.

2. **How effective is regulation?**

Depends. Not very according to AirBnB data; e.g., over-tourism or 'nuisance' in AMSTERDAM will not be addressed by capping the number of days per listing; quotes data for AMSTERDAM: 8% of all booked nights per year are on AirBnB, leaving 92% of nights for hotels and other accommodation; AirBnB hence not responsible for overtourism.
ALSO: day cap on entire listings (60/30 days) does not make a difference because hosts still have to own and life in apartments they rent out; so restricting AirBnB does free up objects on the housing market
On there other hand; DANISH example seen as a success from AirBnB's perspective; integration with taxation infrastructure makes host income traceable and taxable for authority. If hosts register they benefit from tax rules for extra income. Also: flexibility is seen as effective; In DK, local authorities interpret the day cap for listings individually (70-120 nights) depending on what they deem necessary for their municipality.
BUT in DK: the 'quasi-hotel' argument is 'moot'; from AirBnB data this is not evident that hosts operate quasi hotels. Cooperation with tax (SKAT) would show up hosts with high incomes. The absence of such hosts hence indicates that this is not happening.

3. **What are modes of collaboration between AirBnB and local authorities?**

coordination and dialogue work well if "in line with EU law and feel as fair and proportional", if that is not the case, AirBnB does not cooperate
AirBnB requested AMSTERDAM authorities to share 'nuisance' complaints so that AirBnB can react; This never materialised as the negotiations were abandoned in July 2019.
AirBnB is willing to cooperate and enforce 'just and aligned' rules and regulation by addressing hosts directly (e.g. 'nuisance' motivation aligns with AirBnBs interest of providing good experiences). Hosts in excess of that cap got blocked on the platform.
Within bounds; AirBnB 'voluntary' puts up restrictions; e.g. in AMSTERDAM and LONDON , the day cap is enforced on the AirBnB platform (in AMSTERDAM was 60 days, new 30 days rule imposed by city is not enforced and challenged in court). These are (were) the only two places worldwide where that action was taken.
Also successful; modes of enforcement through authority; (e.g. in BERLIN where hosts

need a registration to run on AirBnB). If this is written in law, AirBnB checks for a registration number and is compliant while local authority deals with procedure and enforcement. BUT: process efficiency varies; hosts are observed to circumvent legislation if process take too long (BERLIN)
MISC points:
NL cities align with policy in AMSTERDAM (to AirBnB's frustration)
AirBnB wishes for more coordinated and unified regulation across Europe
AirBnB claims to embrace cooperation and regulation as long as it is lawful, evidencebased, and proportional.

Appendix G - Informant Interview: Ramme Nielsen

Informant Interview: Lars Ramme Nielsen (Dansk Erhverv)
Memory protocol of interview on Tuesday, July 2nd 2019
Interviewee: Lars Ramme Nielsen, Policy Officer, Dansk Erhverv (DE = Danish Chamber of Commerce)
Interviewer: Philipp Hukal, CBS
—> *responses marked by an asterisk (*) require fact checking before next steps*
Theme Motivation:
1. **What is the role of DE / what is the target of regulatory action?**
Answers:
DE bundles interests of member organizations
DE represents interests towards policy makers
DE advises in policy formulation and assessment
2. **What specifically motivated the regulatory response to AirBnB in Denmark/Copenhagen?**
Answers:
In the case of AirBnB DE was asked to represent the interests of the following parties:
Hoteliers
Real-Estate Owners
Tenants
In the case of AirBnB, regulatory response was motivated by:
Balancing competing interests which made regulatory response challenging
a) One hand, ensuring Prosperity:
growth
innovation
business
b) On the other hand, ensuring fairness for three groups of stakeholders:
Hoteliers: Hosts running quasi-Hotels w/o permit; no legislation, no tax, no regulation for guest safety
Real-Estate Owners: tenants protected and rent capped; if tenants rent out via AirBnB there is little owners can do
Tenants: AirBnB home listings prevent object availability on rental market, driving up prices and forcing tenants into different areas of the city; this effect is stronger for lower income groups with demand for smaller apartments; students, young couples, families.
Theme Measures:
3. **What measures were included in the regulatory proposal?**
Answers:
Tax integration of host income with SKAT systems
—> not new, but modeled after agreement with holiday home owner's association (ca. 1960s)
*Day cap for listings (entire flat and room): 70-100 days (up to local municipalities)
*private individuals enjoy VAT exemption from AirBnB income; businesses do not
*if day cap is exceeded: individuals require a CVR number and register as business
Theme Enforcement:
4. **How is regulation controlled/enforced?**

*tax: integration with SKAT system, automates enforcement; AirBnB had to integrate with SKAT platform
*day cap: hard to enforce; Loop hole allows to rent out entire flat first, and then offer single rooms, circumventing the the day cap
*days booked per apartment is not tracked by officials, AirBnB does not report numbers
CVR registration: controlled and enforced by Erhvervs Styrelse (gov. agency); but little insight into accurate booking numbers from AirBnB

Theme sources of law:

5. **How does local/national/supra-national (EU) policy making interact?**

Answer:
national law -> suggests frame for local law that can be interpreted by municipalities (e.g., day cap)
supra-national law (EU) -> national law; compliance with EU directives; i.e. consumer protection (here esp. disclaimer information of hosts) as well as e-commerce directive.

Theme Outcome:

6. **How successful was the regulatory response?**

Answer:
unclear;
a) evaluation of the bill scheduled for Autumn 2019
b) * AirBnB likely uses loop holes to circumvent accurate reporting of booking numbers
c) AirBnB lobbying activity likely helped water down policy proposal*
follow up contacts:
HORECA EU
Jens Zimmer (?)
Frank Jensen
Policy Officer at Major's Office / Lord Major Kobenhavns Kommune

Appendix H – Number of Listings

	T-6	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	T+6	Change T-1 to T+6	Change T-6 to T+6
Amsterdam 16/17	Jul-16	Aug-16	Sep-16	no data	Nov-16	Dec-16	2017-01-01	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Dec-16 to Jun-17	Jul-16-Jun-17
Entire	7,601	8,380	9,114	9,114	9,269	9,144		8,994	8,564	7,619	7,100	7,526	8,006	-1,138	405
Percentual Change	-	10.25%	8.76%	-	1.70%	-1.35%		-1.64%	-4.78%	-11.03%	-6.81%	6.00%	6.38%	-12.45%	5.33%
Shared	1,920	2,042	2,134	2,134	2,158	2,163		2,167	2,210	2,317	2,409	2,575	2,781	618	861
Percentual Change	-	6.35%	4.51%	-	1.12%	0.23%		0.18%	1.98%	4.84%	3.97%	6.89%	8.00%	28.57%	44.84%
Amsterdam 18/19	Jul-18	Aug-18	Sep-18	no data	Nov-18	Dec-18	2019-01-01	Jan-19	Feb-19	Mar-19	Apr-19	May-19	no data	Dec-18 to May-19	Jul-18 to May-19
Entire	8,013	8,684	9,127	9,265	9,117	8,796		8,463	8,020	7,131	6,675	6,887	-	-1,909	-1,126
Percentual Change	-	8.37%	5.10%	-	-0.11%	-3.52%		-3.79%	-5.23%	-11.08%	-6.39%	3.18%	-	-21.70%	-14.05%
Shared	2,726	2,765	2,746	2,759	2,772	2,729		2,672	2,598	2,560	2,513	2,603	-	-126	-123
Percentual Change	-	1.43%	-0.69%	-	0.95%	-1.55%		-2.09%	-2.77%	-1.46%	-1.84%	3.58%	-	-4.62%	-4.51%
Barcelona 16/17	Aug-16	Sep-16	no data	Nov-16	Dec-16	Jan-17	2017-02-01	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Jan-17 to Jul-17	Aug-16 to Jul-17
Entire	7,441	7,474	-	6,842	6,699	6,583		6,254	6,036	6,006	6,105	6,210	6,025	-558	-1,416
Percentual Change	-	0.44%	-	-8.46%	-2.09%	-1.73%		-5.00%	-3.49%	-0.50%	1.65%	1.72%	-2.98%	-8.48%	-19.03%
Shared	7,032	7,333	-	6,388	6,177	5,989		5,587	5,516	5,314	5,732	6,266	6,515	-652	-517
Percentual Change	-	4.28%	-	-12.89%	-3.30%	-3.04%		-6.71%	-1.27%	-3.66%	7.87%	9.32%	3.97%	-8.64%	-7.35%
Barcelona 17/18	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	2018-06-01	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	May-18 to Nov-18	Dec-17 to Nov-18
Entire	6,028	6,035	5,806	5,687	5,974	5,899		4,905	5,308	5,355	5,829	5,736	5,712	-187	-316
Percentual Change	-	0.12%	-3.79%	-2.05%	5.05%	-1.26%		-16.85%	8.22%	0.89%	8.85%	-1.60%	-0.42%	-3.17%	-5.24%
Shared	6,682	6,577	6,158	5,966	5,959	6,272		6,519	6,901	7,339	7,018	6,820	6,567	295	662
Percentual Change	-	-1.57%	-6.37%	-3.12%	-0.12%	5.25%		3.94%	5.86%	6.35%	-4.37%	-2.82%	-3.71%	4.70%	-1.72%
Berlin 18/19	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	2018-08-01	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Jul-18 to Jan-19	Feb-18 to Jan-19
Entire	7,372	7,116	7,123	7,095	7,400	7,172		5,687	5,618	5,514	5,634	5,689	5,826	-1,346	-1,546
Percentual Change	-	-3.47%	0.10%	-0.39%	4.30%	-3.08%		-20.71%	-1.21%	-1.85%	2.18%	0.98%	2.41%	-18.77%	-20.97%
Shared	6,291	5,908	5,636	5,681	6,002	6,060		6,147	6,298	6,305	6,275	6,117	6,069	9	-222
Percentual Change	-	-6.09%	-4.60%	0.80%	5.65%	0.97%		1.44%	2.46%	0.11%	-0.48%	-2.52%	-0.78%	0.15%	-3.53%
Brussels 15/16	Nov-15	no data	Jan-16	no data	no data	Apr-16	2016-04-24	May-16	Jun-16	Jul-16	Aug-16	Sep-16	no data	Apr-16 to Sep-16	Nov-15 to Sep-16
Entire	2,311	-	2,445	-	-	2,436		2,391	2,429	2,340	2,383	2,387	-	-49	76
Percentual Change	-	-	5.80%	-	-	-0.37%		-1.85%	1.59%	-3.66%	1.84%	0.17%	-	-2.01%	3.29%
Shared	1,217	-	1,251	-	-	1,173		1,089	1,060	1,093	1,117	1,087	-	-86	-130
Percentual Change	-	-	2.79%	-	-	-6.24%		-7.16%	-2.66%	3.11%	2.20%	-2.69%	-	-7.33%	-10.68%
Copenhagen 18/19	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	2019-05-01	no data	Jun-19	Jul-19	Aug-19	no data	no data	Apr-19 to Aug/19	Nov-18 to Aug-19
Entire	11,086	10,888	9,959	8,983	7,529	7,541		-	9,200	10,191	9,956	-	-	2,415	-1,130
Percentual Change	-	-1.79%	-8.53%	-9.80%	-16.19%	0.16%		-	22.00%	10.77%	-2.31%	-	-	32.02%	-10.19%
Shared	2,125	2,073	1,939	1,866	1,624	1,564		-	1,789	1,877	1,922	-	-	358	-203
Percentual Change	-	-2.45%	-6.46%	-3.76%	-12.97%	-3.69%		-	14.39%	4.92%	2.40%	-	-	22.89%	-9.55%

Lisbon 17	no data	no data	no data	no data	no data	Jun-17	2017-07-01	no data	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jun-17 to Dec-17	-
Entire	-	-	-	-	-	8,590		-	10,489	10,845	10,974	10,928	10,800	2,210	-
Percentual Change	-	-	-	-	-	-		-	22.11%	3.39%	1.19%	-0.42%	-1.17%	25.73%	-
Shared	-	-	-	-	-	2,248		-	2,946	3,039	3,138	3,224	3,068	820	-
Percentual Change	-	-	-	-	-	-		-	31.05%	3.16%	3.26%	2.74%	-4.84%	36.48%	-
London 16/17	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	2017-01-01	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Dec-16 to Jun-17	Jul-16 to Jun-17
Entire	12,937	14,477	15,313	15,762	16,015	16,517		16,906	16,174	15,312	14,854	15,769	16,515	-2	3,578
Percentual Change	-	11.90%	5.77%	2.93%	1.61%	3.13%		2.36%	-4.33%	-5.33%	-2.99%	6.16%	4.73%	-0.01%	27.66%
Shared	11,078	12,255	12,645	12,997	13,178	13,455		13,687	13,250	13,207	13,125	13,544	13,964	509	2,886
Percentual Change	-	10.62%	3.18%	2.78%	1.39%	2.10%		1.72%	-3.19%	-0.32%	-0.62%	3.19%	3.10%	3.78%	26.05%
Paris 17/18	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	2017-12-01	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Nov-17 to Jun-18	Jul-16 to Jun-17
Entire	26,601	28,151	31,924	31,579	31,693	30,981		28,964	28,485	26,947	25,431	26,545	25,648	-5,333	-953
Percentual Change	-	5.83%	13.40%	-1.08%	0.36%	-2.25%		-6.51%	-1.65%	-5.40%	-5.63%	4.38%	-3.38%	-17.21%	-3.58%
Shared	3,641	3,947	4,120	4,094	4,135	4,097		3,920	3,995	3,623	3,509	3,829	3,469	-628	-172
Percentual Change	-	8.40%	4.38%	-0.63%	1.00%	-0.92%		-4.32%	1.91%	-9.31%	-3.15%	9.12%	-9.40%	-15.33%	-4.72%
Vienna 17/18	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	2017-08-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Aug-17 to Feb-18	Mar-17 to Feb-18
Entire	3,373	3,234	3,605	3,715	3,805	4,130		4,221	4,276	4,169	4,212	4,519	4,405	275	1,032
Percentual Change	-	-4.12%	11.47%	3.05%	2.42%	8.54%		2.20%	1.30%	-2.50%	1.03%	7.29%	-2.52%	6.66%	30.60%
Shared	1,219	1,127	1,301	1,333	1,442	1,667		1,686	1,616	1,515	1,517	1,551	1,466	-201	662
Percentual Change	-	-7.55%	15.44%	2.46%	8.18%	15.60%		1.14%	-4.15%	-6.25%	0.13%	2.24%	-5.48%	-12.06%	20.26%

Appendix I – Number of Listings per Host

	T-6	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	T+6	Change T-1 to T+6	Change T-6 to T+6
Amsterdam 16/17	Jul-16	Aug-16	Sep-16	no data	Nov-16	Dec-16	2017-01-01	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Dec-16 to Jun-17	Jul-16-Jun-17
1	6,229	6,857	7,413	-	7,632	7,543		7,509	7,236	6,535	6,107	6,490	6,891	-652	662
Percentual Change	-	10.08%	8.11%	-	2.95%	-1.17%		-0.45%	-3.64%	-9.69%	-6.55%	6.27%	6.18%	-8.64%	10.63%
2	334	348	379	-	382	360		371	346	316	281	308	336	-24	2
Percentual Change	-	4.19%	8.91%	-	0.79%	-5.76%		3.06%	-6.74%	-8.67%	-11.08%	9.61%	9.09%	-6.67%	0.60%
3 or more	140	145	155	-	153	152		155	141	121	118	113	117	-35	-23
Percentual Change	-	3.57%	6.90%	-	-1.29%	-0.65%		1.97%	-9.03%	-14.18%	-2.48%	-4.24%	3.54%	-23.03%	-16.43%
None	1,568	1,656	1,724	-	1,786	1,782		1,783	1,796	1,877	1,957	2,100	2,254	472	686
Percentual Change	-	5.61%	4.11%	-	3.60%	-0.22%		0.06%	0.73%	4.51%	4.26%	7.31%	7.33%	26.49%	43.75%
Amsterdam 18/19	Jul-18	Aug-18	Sep-18	no data	Nov-18	Dec-18	2019-01-01	Jan-19	Feb-19	Mar-19	Apr-19	May-19	no data	Dec-18 to May-19	Jul-18 to May-19
1	6,995	7,455	7,807	-	7,785	7,604		7,337	6,950	6,155	5,723	5,947	-	-1,657	-1,048
Percentual Change	-	6.58%	4.72%	-	-0.28%	-2.32%		-3.51%	-5.27%	-11.44%	-7.02%	3.91%	-	-21.79%	-14.98%
2	342	372	370	-	357	366		351	317	301	278	272	-	-94	-70
Percentual Change	-	8.77%	-0.54%	-	-3.51%	2.52%		-4.10%	-9.69%	-5.05%	-7.64%	-2.16%	-	-25.68%	-20.47%
3 or more	116	127	129	-	129	120		120	118	112	115	113	-	-7	-3
Percentual Change	-	9.48%	1.57%	-	0.00%	-6.98%		0.00%	-1.67%	-5.08%	2.68%	-1.74%	-	-5.83%	-2.59%
None	2,236	2,278	2,256	-	2,290	2,258		2,216	2,137	2,079	2,052	2,098	-	-160	-138
Percentual Change	-	1.88%	-0.97%	-	1.51%	-1.40%		-1.86%	-3.56%	-2.71%	-1.30%	2.24%		-7.09%	-6.17%
Barcelona 16/17	Aug-16	Sep-16	no data	Nov-16	Dec-16	Jan-17	2017-02-01	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Jan-17 to Jul-17	Aug-16 to Jul-17
1	3,022	2,991	-	2,676	2,631	2,567		2,419	2,339	2,307	2,394	2,430	2,323	-244	-699
Percentual Change	-	-1.03%	-	-10.53%	-1.68%	-2.43%		-5.77%	-3.31%	-1.37%	3.77%	1.50%	-4.40%	-9.51%	-23.13%
2	547	576	-	527	519	505		485	458	444	456	456	411	-652	-136
Percentual Change	-	5.30%	-	-8.51%	-1.52%	-2.70%		-3.96%	-5.57%	-3.06%	2.70%	0.00%	-9.87%	-8.64%	-24.86%
3 or more	656	636	-	580	560	558		515	497	503	500	509	491	-67	-165
Percentual Change	-	-3.05%	-	-8.81%	-3.45%	-0.36%		-7.71%	-3.50%	1.21%	-0.60%	1.80%	-3.54%	-12.01%	-25.15%
None	4,916	5,090	-	4,533	4,357	4,199		3,969	3,916	3,773	4,101	4,453	4,623	424	-293
Percentual Change	-	3.54%	-	-10.94%	-3.88%	-3.63%		-5.48%	-1.34%	-3.65%	8.69%	8.58%	3.82%	10.10%	-5.96%
Barcelona 17/18	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	2018-06-01	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	May-18 to Nov-18	Dec-17 to Nov-18
1	2,256	2,244	2,150	2,062	2,157	2,103		1,404	1,497	1,461	1,555	1,509	1,462	-641	-794
Percentual Change	-	-0.53%	-4.19%	-4.09%	4.61%	-2.50%		-33.24%	6.62%	-2.40%	6.43%	-2.96%	-3.11%	-30.48%	-35.20%
2	391	406	370	348	372	357		271	295	271	282	293	276	-81	662
Percentual Change	-	3.84%	-8.87%	-5.95%	6.90%	-4.03%		-24.09%	8.86%	-8.14%	4.06%	3.90%	-5.80%	-22.69%	-29.41%
3 or more	486	478	462	444	456	448		380	411	431	448	435	434	-14	-52
Percentual Change		-1.65%	-3.35%	-3.90%	2.70%	-1.75%		-15.18%	8.16%	4.87%	3.94%	-2.90%	-0.23%	-3.13%	-10.70%
None	4,757	4,658	4,347	4,236	4,257	4,461		4,585	4,802	5,025	4,809	4,694	4,541	80	-216
Percentual Change	-	-2.08%	-6.68%	-2.55%	0.50%	4.79%		2.78%	4.73%	4.64%	-4.30%	-2.39%	-3.26%	1.79%	-4.54%

Berlin 18/19	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	2018-08-01	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Jul-18 to Jan-19	Feb-18 to Jan-19
1	5,762	5,498	5,577	5,500	5,766	5,572		4,210	4,107	4,006	4,080	4,048	4,081	-1,491	-1,681
Percentual Change	-	-4.58%	1.44%	-1.38%	4.84%	-3.36%		-24.44%	-2.45%	-2.46%	1.85%	-0.78%	0.82%	-26.76%	-29.17%
2	470	470	462	475	493	450		374	378	367	402	417	436	-14	-34
Percentual Change	-	0.00%	-1.70%	2.81%	3.79%	-8.72%		-16.89%	1.07%	-2.91%	9.54%	3.73%	4.56%	-3.11%	-7.23%
3 or more	223	210	192	203	207	213		204	204	205	209	220	234	21	11
Percentual Change	-	-5.83%	-8.57%	5.73%	1.97%	2.90%		-4.23%	0.00%	0.49%	1.95%	5.26%	6.36%	9.86%	4.93%
None	5,684	5,312	5,085	5,106	5,368	5,425		5,489	5,606	5,593	5,561	5,423	5,349	-76	662
Percentual Change	-	-6.54%	-4.27%	0.41%	5.13%	1.06%		1.18%	2.13%	-0.23%	-0.57%	-2.48%	-1.36%	-1.40%	-5.89%
Brussels 15/16	Nov-15	no data	Jan-16	no data	no data	Apr-16	2016-04-24	May-16	Jun-16	Jul-16	Aug-16	Sep-16	no data	Apr-16 to Sep-16	Nov-15 to Sep-16
1	1,592	-	1,632	-	-	1,568		1,523	1,533	1,471	1,497	1,498	-	-70	-94
Percentual Change	-	-	2.51%	-	-	-3.92%		-2.87%	0.66%	-4.04%	1.77%	0.07%	-	-4.46%	-5.90%
2	162	-	195	-	-	190		178	180	173	172	168	-	-22	6
Percentual Change	-	-	20.37%	-	-	-2.56%		-6.32%	1.12%	-3.89%	-0.58%	-2.33%	-	-11.58%	3.70%
3 or more	108	-	114	-	-	117		123	119	113	124	125	-	8	17
Percentual Change	-	-	5.56%	-	-	2.63%		5.13%	-3.25%	-5.04%	9.73%	0.81%	-	6.84%	15.74%
None	1,032	-	1,058	-	-	990		922	900	927	950	916	-	-74	-116
Percentual Change	-	-	2.52%	-	-	-6.43%		-6.87%	-2.39%	3.00%	2.48%	-3.58%	-	-7.47%	-11.24%
Copenhagen 18/19	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	2019-05-01	no data	Jun-19	Jul-19	Aug-19	no data	no data	Apr-19 to Aug/19	Nov-18 to Aug-19
1	10,396	10,165	9,295	8,344	6,963	6,988		-	8,504	9,429	9,234	-	-	2,246	-1,162
Percentual Change	-	-2.22%	-8.56%	.102313071	-16.55%	0.36%		-	21.69%	10.88%	-2.07%	-	-	32.14%	-11.18%
2	365	364	315	293	245	238		-	283	306	308	-	-	70	-57
Percentual Change	-	-0.27%	-13.46%	-6.98%	-16.38%	-2.86%		-	18.91%	8.13%	0.65%	-	-	29.41%	-15.62%
3 or more	64	64	58	59	55	52		-	67	77	67	-	-	15	3
Percentual Change	-	0.00%	-9.38%	1.72%	-6.78%	-5.45%		-	28.85%	14.93%	-12.99%	-	-	28.85%	4.69%
None	1,891	1,850	1,729	1,668	1,464	1,421		-	1,586	1,421	1,667	-	-	246	-224
Percentual Change	-	-2.17%	-6.54%	-3.53%	-12.23%	-2.94%		-	11.61%	-10.40%	17.31%	-	-	17.31%	-11.85%
Lisbon 17	no data	no data	no data	no data	no data	Jun-17	2017-07-01	no data	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jun-17 to Dec-17	-
1	-	-	-	-	-	3,595		-	4,423	4,571	4,599	4,580	4,544	949	-
Percentual Change	-	-	-	-	-	-		-	23.03%	3.35%	0.61%	-0.41%	-0.79%	26.40%	-
2	-	-	-	-	-	654		-	793	791	803	789	776	122	-
Percentual Change	-	-	-	-	-	-		-	21.25%	-0.25%	1.52%	-1.74%	-1.65%	18.65%	-
3 or more	-	-	-	-	-	735		-	895	927	933	934	915	180	-
Percentual Change	-	-	-	-	-	-		-	21.77%	3.58%	0.65%	0.11%	-2.03%	24.49%	-
None	-	-	-	-	-	1,273		-	1,475	1,474	1,482	1,521	1,492	219	-
Percentual Change	-	-	-	-	-	-		-	15.87%	3.35%	3.35%	3.35%	3.35%	17.20%	-

London 16/17	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	2017-01-01	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Dec-16 to Jun-17	Jul-16 to Jun-17
1	7,762	8,605	9,280	9,514	9,727	9,954		10,167	9,750	9,152	8,803	9,278	9,586	-368	1,824
Percentual Change	-	10.86%	7.84%	2.52%	2.24%	2.33%		2.14%	-4.10%	-6.13%	-3.81%	5.40%	3.32%	-3.70%	23.50%
2	1,008	1,168	1,197	1,218	1,256	1,268		1,266	1,248	1,198	1,158	1,238	1,294	26	286
Percentual Change	-	15.87%	2.48%	1.75%	3.12%	0.96%		-0.16%	-1.42%	-4.01%	-3.34%	6.91%	4.52%	2.05%	28.37%
3 or more	738	810	832	846	829	867		901	860	840	838	914	978	111	240
Percentual Change	-	9.76%	2.72%	1.68%	-2.01%	4.58%		3.92%	-4.55%	-2.33%	-0.24%	9.07%	7.00%	12.80%	32.52%
None	8,369	9,153	9,502	9,812	9,975	10,113		10,148	9,877	9,787	9,671	9,971	10,228	115	1,859
Percentual Change	-	9.37%	3.81%	3.26%	1.66%	1.38%		0.35%	-2.67%	-0.91%	-1.19%	3.10%	2.58%	-8.64%	22.21%
Paris 17/18	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	2017-12-01	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Nov-17 to Jun-18	Jul-16 to Jun-17
1	21,310	22,547	25,627	25,460	25,608	24,979		23,718	23,495	22,120	20,764	21,767	20,886	-4,093	-424
Percentual Change	-	5.80%	13.66%	-0.65%	0.58%	-2.46%		-5.05%	-0.94%	-5.85%	-6.13%	4.83%	-4.05%	-16.39%	-1.99%
2	1,022	1,066	1,221	1,186	1,221	1,216		1,085	1,062	998	936	984	936	-280	-86
Percentual Change	-	4.31%	14.54%	-2.87%	2.95%	-0.41%		-10.77%	-2.12%	-6.03%	-6.21%	5.13%	-4.88%	-23.03%	-8.41%
3 or more	504	529	578	568	553	540		488	463	450	448	470	463	-77	-41
Percentual Change	-	4.96%	9.26%	-1.73%	-2.64%	-2.35%		-9.63%	-5.12%	-2.81%	-0.44%	4.91%	-1.49%	-14.26%	-8.13%
None	3,224	3,491	3,640	3,597	3,654	3,607		3,458	3,486	3,132	3,013	3,266	2,954	-653	-270
Percentual Change	-	8.28%	4.27%	-1.18%	1.58%	-1.29%		-4.13%	0.81%	-10.15%	-3.80%	8.40%	-9.55%	-18.10%	-8.37%
Vienna 17/18	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	2017-08-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Aug-17 to Feb-18	Mar-17 to Feb-18
1	1,838	1,747	1,967	2,028	2,054	2,282		2,301	2,323	2,243	2,290	2,453	2,386	104	548
Percentual Change	-	-4.95%	12.59%	3.10%	1.28%	11.10%		0.83%	0.96%	-3.44%	2.10%	7.12%	-2.73%	4.56%	29.82%
2	241	238	270	264	277	293		299	303	306	311	343	328	35	662
Percentual Change	-	-1.24%	13.45%	-2.22%	4.92%	5.78%		2.05%	1.34%	0.99%	1.63%	10.29%	-4.37%	11.95%	36.10%
3 or more	218	215	229	237	247	271		273	278	271	274	283	278	7	60
Percentual Change	-	-1.38%	6.51%	3.49%	4.22%	9.72%		0.74%	1.83%	-2.52%	1.11%	3.28%	-1.77%	2.58%	27.52%
None	1,032	951	1,088	1,123	1,205	1,390		1,421	1,365	1,279	1,275	1,284	1,236	-154	204
Percentual Change	-	-7.85%	14.41%	3.22%	7.30%	15.35%		2.23%	-3.94%	-6.30%	-0.31%	0.71%	-3.74%	-11.08%	19.77%

Appendix J – Host Local

City/Type/Date	T-6	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	T+6
AMS 16/17	Jul-16	Aug-16	Sep-16	no data	Nov-16	Dec-16	2017-01-01	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17
Local	8,489	9,286	9,971	-	10,086	9,992		9,813	9,481	8,731	8,344	8,806	9,384
Percent of Tot	89.51%	89.26%	88.79%	-	88.43%	88.57%		88.12%	88.19%	88.02%	87.91%	87.54%	87.28%
Non-Local	995	1,117	1,259	-	1,319	1,289		1,323	1,270	1,188	1,148	1,253	1,367
Percent of Tot	10.49%	10.74%	11.21%	-	11.57%	11.43%		11.88%	11.81%	11.98%	12.09%	12.46%	12.72%
Tot Hosts	9,484	10,403	11,230	-	11,405	11,281		11,136	10,751	9,919	9,492	10,059	10,751
AMS 18/19	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	2019-01-01	Jan-19	Feb-19	Mar-19	Apr-19	May-19	no data
Local	9,142	9,778	10,146	10,257	10,123	9,824		9,500	9,048	8,218	7,778	8,045	-
Percent of Tot	85.30%	85.57%	85.58%	85.40%	85.22%	85.35%		85.40%	85.29%	84.88%	84.75%	84.93%	-
Non-Local	1,575	1,649	1,709	1,753	1,756	1,686		1,624	1,560	1,464	1,400	1,428	-
Percent of Tot	14.70%	14.43%	14.42%	14.60%	14.78%	14.65%		14.60%	14.71%	15.12%	15.25%	15.07%	-
Tot Hosts	10,717	11,427	11,855	12,010	11,879	11,510		11,124	10,608	9,682	9,178	9,473	-
BCN 16/17	Aug-16	Sep-16	no data	Nov-16	Dec-16	Jan-17	2017-02-01	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17
Local	12,111	12,291	-	10,962	10,710	10,476		9,805	9,558	9,371	9,724	10,177	10,212
Percent of Tot	83.85%	83.18%	-	83.01%	83.31%	83.45%		83.14%	82.90%	82.94%	82.28%	81.97%	81.65%
Non-Local	2,333	2,486	-	2,244	2,145	2,078		1,989	1,971	1,928	2,094	2,239	2,295
Percent of Tot	16.15%	16.82%	-	16.99%	16.69%	16.55%		16.86%	17.10%	17.06%	17.72%	18.03%	18.35%
Tot Hosts	14,444	14,777	-	13,206	12,855	12,554		11,794	11,529	11,299	11,818	12,416	12,507
BCN 17/18	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	2018-06-01	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18
Local	10,303	10,145	9,657	9,429	9,555	9,746		9,212	9,813	10,085	10,203	10,025	9,798
Percent of Tot	81.24%	80.71%	81.16%	81.14%	80.33%	80.51%		80.73%	80.51%	79.55%	79.47%	79.90%	79.85%
Non-Local	2,379	2,424	2,242	2,191	2,340	2,360		2,199	2,376	2,592	2,635	2,522	2,472
Percent of Tot	18.76%	19.29%	18.84%	18.86%	19.67%	19.49%		19.27%	19.49%	20.45%	20.53%	20.10%	20.15%
Tot Hosts	12,682	12,569	11,899	11,620	11,895	12,106		11,411	12,189	12,677	12,838	12,547	12,270
BER 18/19	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	2018-08-01	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19
Local	10,814	10,317	10,148	10,137	10,677	10,514		9,392	9,494	9,472	9,562	9,435	9,481
Percent of Tot	79.66%	79.63%	79.94%	79.90%	80.01%	79.77%		79.65%	79.96%	80.39%	80.55%	80.18%	79.92%
Non-Local	2,762	2,639	2,546	2,550	2,667	2,667		2,400	2,380	2,311	2,309	2,332	2,382
Percent of Tot	20.34%	20.37%	20.06%	20.10%	19.99%	20.23%		20.35%	20.04%	19.61%	19.45%	19.82%	20.08%
Tot Hosts	13,576	12,956	12,694	12,687	13,344	13,181		11,792	11,874	11,783	11,871	11,767	11,863
BRU 15/16	Nov-15	no data	Jan-16	no data	no data	Apr-16	2016-04-24	May-16	Jun-16	Jul-16	Aug-16	Sep-16	no data
Local	2,936	-	3,019	-	-	2,909		2,795	2,773	2,716	2,834	2,803	-
Percent of Tot	83.36%	-	81.86%	-	-	80.76%		80.43%	79.68%	79.30%	81.16%	80.85%	-
Non-Local	586	-	669	-	-	693		680	707	709	658	664	-

Percent of Tot	16.64%	-	18.14%	-	-	19.24%		19.57%	20.32%	20.70%	18.84%	19.15%	-
Tot Hosts	3,522	-	3,688	-	-	3,602		3,475	3,480	3,425	3,492	3,467	-
CPH 18/19	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	2019-05-01	no data	Jun-19	Jul-19	Aug-19	no data	no data
Local	10,442	10,211	9,376	8,546	7,163	7,156		-	8,656	9,505	9,243	-	-
Percent of Tot	79.23%	78.96%	79.01%	-	78.48%	78.81%		-	79.01%	79.00%	78.57%	-	-
Non-Local	2,737	2,721	2,491	2,276	1,964	1,924		-	2,299	2,526	2,521	-	-
Percent of Tot	20.77%	21.04%	20.99%	-	21.52%	21.19%		-	20.99%	21.00%	21.43%	-	-
Tot Hosts	13,179	12,932	11,867	10,822	9,127	9,080		-	10,955	12,031	11,764	-	-
LIS 17	no data	no data	no data	no data	no data	Jun-17	2017-07-01	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17
Local	-	-	-	-	-	8,400		-	10,106	10,387	10,408	10,591	10,377
Percent of Tot	-	-	-	-	-	77.66%		-	75.47%	75.05%	74.55%	75.04%	75.09%
Non-Local	-	-	-	-	-	2,417		-	3,284	3,453	3,554	3,523	3,443
Percent of Tot	-	-	-	-	-	22.34%		-	24.53%	24.95%	25.45%	24.96%	24.91%
Tot Hosts	-	-	-	-	-	10,817		-	13,390	13,840	13,962	14,114	13,820
LDN 16/17	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	2017-01-01	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17
Local	19,940	22,142	22,997	23,620	23,878	24,486		24,985	24,027	23,404	22,881	23,895	24,734
Percent of Tot	83.21%	83.04%	82.46%	82.33%	82.00%	81.92%		81.94%	81.98%	82.29%	82.04%	81.79%	81.42%
Non-Local	4,024	4,521	4,891	5,068	5,240	5,403		5,507	5,283	5,036	5,010	5,319	5,643
Percent of Tot	16.79%	16.96%	17.54%	17.67%	18.00%	18.08%		18.06%	18.02%	17.71%	17.96%	18.21%	18.58%
Tot Hosts	23,964	26,663	27,888	28,688	29,118	29,889		30,492	29,310	28,440	27,891	29,214	30,377
PRI 17/18	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	2017-12-01	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18
Local	23,980	25,085	27,861	27,750	27,935	27,309		25,590	24,405	23,490	22,264	22,597	22,231
Percent of Tot	79.29%	78.15%	77.30%	77.79%	77.97%	77.85%		77.82%	75.14%	76.84%	76.93%	74.40%	76.35%
Non-Local	6,262	7,013	8,183	7,923	7,893	7,769		7,294	8,075	7,080	6,676	7,777	6,886
Percent of Tot	20.71%	21.85%	22.70%	22.21%	22.03%	22.15%		22.18%	24.86%	23.16%	23.07%	25.60%	23.65%
Tot Hosts	30,242	32,098	36,044	35,673	35,828	35,078		32,884	32,480	30,570	28,940	30,374	29,117
VIE 17/18	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	2017-08-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18
Local	3,798	3,613	4,036	4,103	4,208	4,555		4,636	4,653	4,517	4,535	4,787	4,656
Percent of Tot	83.03%	83.15%	82.54%	81.65%	80.51%	79.00%		78.87%	79.35%	79.79%	79.51%	79.41%	79.66%
Non-Local	776	732	854	922	1,019	1,211		1,242	1,211	1,144	1,169	1,241	1,189
Percent of Tot	16.97%	16.85%	17.46%	18.35%	19.49%	21.00%		21.13%	20.65%	20.21%	20.49%	20.59%	20.34%
Tot Hosts	4,574	4,345	4,890	5,025	5,227	5,766		5,878	5,864	5,661	5,704	6,028	5,845

Appendix K – Price

City/Type/Date	T-6	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	T+6	Change T-1 to T+6	Change T-6 to T+6
Amsterdam 16/17	Jul-16	Aug-16	Sep-16	no data	Nov-16	Dec-16	2017-01-01	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Dec-16 to Jun-17	Jul-16 to Jun-17
Entire	143€	142€	142€	-	143€	142€		143€	143€	144€	146€	150€	153€	+ 10€	+9€
Percentual change	-	-1.10%	0.27%	-	0.47%	-0.41%		0.43%	0.24%	0.92%	1.03%	3.08%	1.41%	7.30%	6.47%
Shared	77€	76€	76€	-	78€	77€		77€	80€	85€	88€	93€	95€	+ 18€	+ 18€
Percentual change	-	-0.45%	0.01%	-	2.32%	-1.27%		0.01%	3.81%	5.88%	4.22%	5.41%	1.82%	22.66%	23.66%
Amsterdam 17/18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	2019-01-01	Jan-19	Feb-19	Mar-19	Apr-19	May-19	no data	Dec-18 to May-19	Jul-18 to May-19
Entire	163€	164€	165€	166€	167€	169€		169€	169€	170€	170€	174€	-	+ 5€	+ 10€
Percentual change	-	0.22%	0.60%	0.74%	0.51%	1.34%		0.16%	0.14%	0.03%	0.49%	1.94%	-	2.78%	6.32%
Shared	98€	98€	99€	99€	100€	100€		101€	101€	103€	105€	107€	-	+ 7€	+ 9€
Percentual change	-	-0.44%	1.44%	0.17%	0.49%	-0.19%		0.75%	0.83%	1.33%	1.81%	2.55%	-	7.47%	9.05%
Barcelona 16/17	Aug-16	Sep-16	-	Nov-16	Dec-16	Jan-17	2017-02-01	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Jan-17 to Jul-17	Aug-16 to Jul-17
Entire	116€	116€	116€	118€	118€	117€		119€	122€	125€	127€	131€	136€	+ 19€	+ 20€
Percentual change	-	0.14%	0.00%	1.48%	-0.44%	-0.30%		1.48%	2.93%	1.86%	2.14%	2.83%	4.13%	16.35%	17.33%
Shared	39€	39€	39€	40€	39€	37€		38€	39€	40€	42€	44€	44€	+ 7€	+ 5€
Percentual change	-	-0.99%	0.00%	2.41%	-1.14%	-5.07%		1.46%	4.86%	1.40%	4.55%	4.50%	1.49%	18.63%	13.84%
Barcelona 17/18	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	2018-06-01	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	May-18 to Nov-18	Dec-17 to Nov-18
Entire	137€	135€	137€	140€	142€	147€		160€	156€	145€	150€	170€	149€	+ 2€	+ 11€
Percentual change	-	-1.80%	1.71%	8.34%	-4.27%	3.38%		8.73%	-0.47%	-8.68%	3.08%	19.36%	-16.88%	1.08%	8.20%
Shared	40€	39€	39€	40€	40€	43€		44€	44€	44€	44€	44€	43€	1€	4€
Percentual change	-	-1.46%	-0.02%	3.35%	0.59%	5.32%		3.43%	-1.17%	0.63%	-0.74%	1.12%	-1.52%	1.67%	9.68%
Berlin 18/19	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	2018-08-01	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Jul-18 to Jan-19	Feb-18 to Jan-19
Entire	78€	78€	78€	80€	80€	81€		84€	86€	87€	89€	90€	89€	+9€	+11€
Percentual change	-	-0.34%	0.31%	1.74%	0.83%	0.67%		4.25%	2.58%	1.35%	2.27%	0.19%	-0.04%	10.32%	13.67%
Shared	36€	36€	36€	37€	38€	38€		41€	44€	47€	47€	47€	47€	+9€	+11€
Percentual change	-	0.07%	-0.93%	2.89%	2.25%	1.13%		6.51%	6.65%	6.81%	0.69%	0.28%	0.37%	22.86%	29.70%
Brussels 15/16	Nov-15	no data	Jan-16	no data	no data	Apr-16	2016-04-24	May-16	Jun-16	Jul-16	Aug-16	Sep-16	no data	Apr-16 to Sep-16	Nov-15 to Sep-16
Entire	82€	-	81€	-	-	80€		80€	80€	79€	78€	77€	-	-3€	-4€
Percentual change	-	-	-1.05%	-	-	-0.52%		-0.50%	0.10%	-1.80%	-1.65%	-0.40%	-	-3.89%	-5.50%
Shared	43€	-	42€	-	-	40€		39€	39€	38€	37€	38€	-	-4€	-7€
Percentual change	-	-	-3.58%	-	-	-3.48%		-2.12%	-1.20%	-2.89%	-2.69%	-1.28%	-	-9.57%	-15.82%
Copenhagen 18/19	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	2019-05-01	no data	Jun-19	Jul-19	Aug-19	no data	no data	Apr-19 to Aug-19	Nov-18 to Aug-19
Entire	882kr.	881kr.	876kr.	878kr.	881kr.	885kr.		-	930kr.	935kr.	944kr.	-	-	+60kr.	+62 kr.
Percentual change	-	-0.15%	-0.54%	-0.03%	0.54%	0.42%		-	5.20%	0.48%	1.01%	-	-	6.77%	7.02%
Shared	433kr.	434kr.	429kr.	420kr.	418kr.	421kr.		-	439kr.	444kr.	461kr.	-	-	+40kr.	+28kr.
Percentual change	-	0.35%	-1.22%	-2.04%	-0.58%	0.82%		-	4.36%	1.11%	3.86%	-	-	9.59%	8.66%
Lisbon 17	no data	no data	no data	no data	no data	Jun-17	2017-07-01	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	no data	Jun-17 to Dec-17	Jun-17 to Dec-17

Entire	-	-	-	-	-	76€		81€	82€	82€	81€	81€	-	+5€	+5€
Percentual change	-	-	-	-	-	-		6.68%	1.30%	0.20%	-0.59%	-0.38%	-	7.24%	7.24%
Shared	-	-	-	-	-	31€		33€	35€	38€	35€	35€	-	+3€	+3€
Percentual change	-	-	-	-	-	-		6.33%	4.86%	8.62%	-7.27%	-1.05%	-	11.13%	11.13%
London 16/17	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	2017-01-01	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Dec-16 to Jun-17	Jul-16 to Jun-17
Entire	126£	127£	128£	129£	129£	129£		130£	130£	131£	132£	132£	132£	+3£	+6£
Percentual change	-	0.84%	0.46%	0.94%	0.33%	0.07%		0.02%	0.34%	0.99%	0.42%	0.43%	0.08%	2.30%	5.04%
Shared	45£	45£	45£	46£	46£	46£		47£	47£	48£	49£	50£	49£	+3£	+4£
Percentual change	-	-0.79%	-0.51%	2.98%	-0.08%	0.47%		0.78%	0.22%	1.94%	3.11%	1.78%	-2.07%	5.82%	7.98%
Paris 17/18	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	2017-12-01	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Nov-17 to May-18	Jun-17 to May-18
Entire	100€	101€	101€	101€	102€	102€		102€	102€	103€	104€	104€	107€	+4€	+6€
Percentual change	-	1.01%	-0.38%	0.35%	0.61%	0.73%		-0.55%	-0.24%	1.30%	1.05%	-0.54%	2.91%	3.94%	6.38%
Shared	51€	53€	52€	52€	56€	54€		56€	55€	56€	57€	56€	59€	+4€	+7€
Percentual change	-	2.52%	-0.35%	-0.18%	6.33%	-2.41%		3.17%	-2.40%	2.54%	1.85%	-1.97%	4.74%	7.98%	14.25%
Vienna 17/18	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	2017-08-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Aug-17 to Feb-18	Mar-17 to Feb-18
Entire	78€	79€	80€	80€	81€	80€		79€	80€	79€	78€	78€	79€	-1€	0€
Percentual change	-	0.80%	1.81%	-0.35%	0.82%	-0.87%		-0.63%	0.51%	-1.21%	-0.98%	0.15%	0.40%	-1.77%	0.41%
Shared	35€	35€	35€	35€	35€	34€		34€	34€	34€	35€	35€	35€	+1€	0€
Percentual change	-	-0.04%	1.91%	-0.50%	-0.78%	-1.82%		-0.16%	0.58%	-1.22%	1.79%	1.46%	-0.25%	2.18%	0.89%

Appendix L – Statistical tests

Amsterdam

```
> # NUMBER OF LISTINGS PER HOSTS
> # HOSTS w/ ENTIRE HOMES
> df.temp <- AMS2019 %>%
+   select(host_group_listings_EH, last_scraped, regulation) %>% # select the two variables we need for efficiency
+   group_by(last_scraped, regulation) %>% # aggregate data for each month
+   # for each month; hosts with 1,2,3 listings (of ALL types) // adjust for the category you need.
+   summarise(no_hosts_EH_listings_1 = length(which(host_group_listings_EH == 1)),
+             no_hosts_EH_listings_2 = length(which(host_group_listings_EH == 2)),
+             no_hosts_EH_listings_3 = length(which(host_group_listings_EH == 3)))
Adding missing grouping variables: `host_id`
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> # X we assume to be bigger before the regulation so we want y to be less than that -> after the regulation the number of two or more hosts went down
> # two sided: are they different at all?
>
> wilcox.test(x = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test with continuity correction

data:  df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1]
W = 29, p-value = 0.0135
alternative hypothesis: true location shift is not equal to 0

Warning message:
In wilcox.test.default(x = df.temp$no_hosts_EH_listings_2[df.temp$regulation ==  :
  kan ikke beregne præcis p-værdi med bindinger
>
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1]
W = 25, p-value = 0.08225
alternative hypothesis: true location shift is not equal to 0

>
> wilcox.test(x = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1],
+             alternative = 'greater')

        Wilcoxon rank sum test with continuity correction

data:  df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1]
W = 29, p-value = 0.006749
alternative hypothesis: true location shift is greater than 0

Warning message:
In wilcox.test.default(x = df.temp$no_hosts_EH_listings_2[df.temp$regulation ==  :
  kan ikke beregne præcis p-værdi med bindinger
>
```

```
> # HOST LOCAL #
> #Non-Local
>
> df.temp <- AMS2019 %>%
+   select(host_local, last_scraped, regulation) %>% # select the two variables we need for efficiency
+   group_by(last_scraped, regulation) %>% # aggregate data for each month
+   # for each month; hosts with 1,2,3 listings (of ALL types) // adjust for the category you need.
+   summarise(non_local_hosts = length(host_local[which(host_local == 0)]))
Adding missing grouping variables: `host_id`
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> # 'two.sided' test if the two groups  are different at all
> wilcox.test(x = df.temp$non_local_hosts[df.temp$regulation == 0],
+             y = df.temp$non_local_hosts[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$non_local_hosts[df.temp$regulation == 0] and df.temp$non_local_hosts[df.temp$regulation == 1]
W = 29, p-value = 0.008658
alternative hypothesis: true location shift is not equal to 0

>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> # 'two.sided' test if the two groups  are different at all
> wilcox.test(x = df.temp$non_local_hosts[df.temp$regulation == 0],
+             y = df.temp$non_local_hosts[df.temp$regulation == 1],
+             alternative = 'greater')

        Wilcoxon rank sum test

data:  df.temp$non_local_hosts[df.temp$regulation == 0] and df.temp$non_local_hosts[df.temp$regulation == 1]
W = 29, p-value = 0.004329
alternative hypothesis: true location shift is greater than 0

>
```

```
> # NUMBER OF LISTINGS #
> df.temp <- AMS2017 %>%
+   group_by(last_scraped, regulation) %>%
+   summarise(no_listings = length(unique(id)),
+             no_listings_shared = length(unique(id[which(room_type_NV_numeric == 1)])),
+             no_listings_entire = length(unique(id[which(room_type_NV_numeric == 0)])))
>
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_entire[df.temp$regulation == 0],
+             y = df.temp$no_listings_entire[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_listings_entire[df.temp$regulation == 0] and df.temp$no_listings_entire[df.temp$regulation == 1]
W = 0, p-value = 0.004329
alternative hypothesis: true location shift is not equal to 0

>
>
> # the one-sided alternative less tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_shared[df.temp$regulation == 0],
+             y = df.temp$no_listings_shared[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_listings_shared[df.temp$regulation == 0] and df.temp$no_listings_shared[df.temp$regulation == 1]
W = 24, p-value = 0.1255
alternative hypothesis: true location shift is not equal to 0

>
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_entire[df.temp$regulation == 0],
+             y = df.temp$no_listings_entire[df.temp$regulation == 1],
+             alternative = 'less')

        Wilcoxon rank sum test

data:  df.temp$no_listings_entire[df.temp$regulation == 0] and df.temp$no_listings_entire[df.temp$regulation == 1]
W = 0, p-value = 0.002165
alternative hypothesis: true location shift is less than 0

>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_entire[df.temp$regulation == 0],
+             y = df.temp$no_listings_entire[df.temp$regulation == 1],
+             alternative = 'greater')

        Wilcoxon rank sum test

data:  df.temp$no_listings_entire[df.temp$regulation == 0] and df.temp$no_listings_entire[df.temp$regulation == 1]
W = 0, p-value = 1
alternative hypothesis: true location shift is greater than 0
```

```
> # NUMBER OF LISTINGS PER HOSTS
> # HOSTS w/ ENTIRE HOMES
> df.temp <- AMS2017 %>%
+   select(host_group_listings_EH, last_scraped, regulation) %>% # select the two variables we need for efficiency
+   group_by(last_scraped, regulation) %>% # aggregate data for each month
+   # for each month; hosts with 1,2,3 listings (of ALL types) // adjust for the category you need.
+   summarise(no_hosts_EH_listings_1 = length(which(host_group_listings_EH == 1)),
+             no_hosts_EH_listings_2 = length(which(host_group_listings_EH == 2)),
+             no_hosts_EH_listings_3 = length(which(host_group_listings_EH == 3)))
Adding missing grouping variables: `host_id`
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> # X we assume to be bigger before the regulation so we want y to be less than that -> after the regulation the number of two or more hosts went down
> # two sided: are they different at all?
>
> wilcox.test(x = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test with continuity correction

data:  df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1]
W = 26, p-value = 0.05468
alternative hypothesis: true location shift is not equal to 0

Warning message:
In wilcox.test.default(x = df.temp$no_hosts_EH_listings_2[df.temp$regulation ==  :
  kan ikke beregne præcis p-værdi med bindinger
>
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1]
W = 29, p-value = 0.008658
alternative hypothesis: true location shift is not equal to 0

> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1],
+             alternative = 'greater')

        Wilcoxon rank sum test

data:  df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1]
W = 29, p-value = 0.004329
alternative hypothesis: true location shift is greater than 0

>
```

```
> df.temp <- AMS2017 %>%
+   select(host_local, last_scraped, regulation) %>% # select the two variables we need for efficiency
+   group_by(last_scraped, regulation) %>% # aggregate data for each month
+   # for each month; hosts with 1,2,3 listings (of ALL types) // adjust for the category you need.
+   summarise(non_local_hosts = length(host_local[which(host_local == 0)]))
Adding missing grouping variables: `host_id`
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> # 'two.sided' test if the two groups  are different at all
> wilcox.test(x = df.temp$non_local_hosts[df.temp$regulation == 0],
+             y = df.temp$non_local_hosts[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$non_local_hosts[df.temp$regulation == 0] and df.temp$non_local_hosts[df.temp$regulation == 1]
W = 11, p-value = 0.5368
alternative hypothesis: true location shift is not equal to 0
```

```
> # NUMBER OF LISTINGS #
> df.temp <- AMS2019 %>%
+   group_by(last_scraped, regulation) %>%
+   summarise(no_listings = length(unique(id)),
+             no_listings_shared = length(unique(id[which(room_type_NV_numeric == 1)])),
+             no_listings_entire = length(unique(id[which(room_type_NV_numeric == 0)])))
>
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_entire[df.temp$regulation == 0],
+             y = df.temp$no_listings_entire[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_listings_entire[df.temp$regulation == 0] and df.temp$no_listings_entire[df.temp$regulation == 1]
W = 30, p-value = 0.004329
alternative hypothesis: true location shift is not equal to 0

>
>
> # the one-sided alternative less tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_shared[df.temp$regulation == 0],
+             y = df.temp$no_listings_shared[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_listings_shared[df.temp$regulation == 0] and df.temp$no_listings_shared[df.temp$regulation == 1]
W = 28, p-value = 0.01732
alternative hypothesis: true location shift is not equal to 0

>
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_entire[df.temp$regulation == 0],
+             y = df.temp$no_listings_entire[df.temp$regulation == 1],
+             alternative = 'greater')

        Wilcoxon rank sum test

data:  df.temp$no_listings_entire[df.temp$regulation == 0] and df.temp$no_listings_entire[df.temp$regulation == 1]
W = 30, p-value = 0.002165
alternative hypothesis: true location shift is greater than 0

>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_shared[df.temp$regulation == 0],
+             y = df.temp$no_listings_shared[df.temp$regulation == 1],
+             alternative = 'greater')

        Wilcoxon rank sum test

data:  df.temp$no_listings_shared[df.temp$regulation == 0] and df.temp$no_listings_shared[df.temp$regulation == 1]
W = 28, p-value = 0.008658
alternative hypothesis: true location shift is greater than 0
```

Barcelona

```
> # NUMBER OF LISTINGS PER HOSTS
> # HOSTS w/ ENTIRE HOMES
> df.temp <- BCN2018 %>%
+   select(host_group_listings_EH, last_scraped, regulation) %>% # select the two variables we need for efficiency
+   group_by(last_scraped, regulation) %>% # aggregate data for each month
+   # for each month; hosts with 1,2,3 listings (of ALL types) // adjust for the category you need.
+   summarise(no_hosts_EH_listings_1 = length(which(host_group_listings_EH == 1)),
+             no_hosts_EH_listings_2 = length(which(host_group_listings_EH == 2)),
+             no_hosts_EH_listings_3 = length(which(host_group_listings_EH == 3)))
Adding missing grouping variables: `host_id`
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> # X we assume to be bigger before the regulation so we want y to be less than that -> after the regulation the number of two or more hosts went down
> # two sided: are they different at all?
>
> wilcox.test(x = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1]
W = 36, p-value = 0.002165
alternative hypothesis: true location shift is not equal to 0

>
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test with continuity correction

data:  df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1]
W = 4.5, p-value = 0.03704
alternative hypothesis: true location shift is not equal to 0

Warning message:
In wilcox.test.default(x = df.temp$no_hosts_EH_listings_3[df.temp$regulation ==  :
  kan ikke beregne præcis p-værdi med bindinger
>
> wilcox.test(x = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1],
+             alternative = 'greater')

        Wilcoxon rank sum test

data:  df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1]
W = 36, p-value = 0.001082
alternative hypothesis: true location shift is greater than 0

>
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1],
+             alternative = 'greater')

        Wilcoxon rank sum test with continuity correction

data:  df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1]
W = 4.5, p-value = 0.9876
alternative hypothesis: true location shift is greater than 0

Warning message:
In wilcox.test.default(x = df.temp$no_hosts_EH_listings_3[df.temp$regulation ==  :
  kan ikke beregne præcis p-værdi med bindinger
```

```
> # HOST LOCAL #
> #Non-Local
>
> df.temp <- BCN2018 %>%
+   select(host_local, last_scraped, regulation) %>% # select the two variables we need for efficiency
+   group_by(last_scraped, regulation) %>% # aggregate data for each month
+   # for each month; hosts with 1,2,3 listings (of ALL types) // adjust for the category you need.
+   summarise(non_local_hosts = length(host_local[which(host_local == 0)]))
Adding missing grouping variables: `host_id`
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> # 'two.sided' test if the two groups  are different at all
> wilcox.test(x = df.temp$non_local_hosts[df.temp$regulation == 0],
+             y = df.temp$non_local_hosts[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$non_local_hosts[df.temp$regulation == 0] and df.temp$non_local_hosts[df.temp$regulation == 1]
W = 7, p-value = 0.09307
alternative hypothesis: true location shift is not equal to 0

>
```

```
> # NUMBER OF LISTINGS #
> df.temp <- BCN2017 %>%
+   group_by(last_scraped, regulation) %>%
+   summarise(no_listings = length(unique(id)),
+             no_listings_shared = length(unique(id[which(room_type_NV_numeric == 1)])),
+             no_listings_entire = length(unique(id[which(room_type_NV_numeric == 0)])))
>
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_entire[df.temp$regulation == 0],
+             y = df.temp$no_listings_entire[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_listings_entire[df.temp$regulation == 0] and df.temp$no_listings_entire[df.temp$regulation == 1]
W = 25, p-value = 0.08225
alternative hypothesis: true location shift is not equal to 0

>
>
> # the one-sided alternative less tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_shared[df.temp$regulation == 0],
+             y = df.temp$no_listings_shared[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_listings_shared[df.temp$regulation == 0] and df.temp$no_listings_shared[df.temp$regulation == 1]
W = 30, p-value = 0.004329
alternative hypothesis: true location shift is not equal to 0

>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_shared[df.temp$regulation == 0],
+             y = df.temp$no_listings_shared[df.temp$regulation == 1],
+             alternative = 'greater')

        Wilcoxon rank sum test

data:  df.temp$no_listings_shared[df.temp$regulation == 0] and df.temp$no_listings_shared[df.temp$regulation == 1]
W = 30, p-value = 0.002165
alternative hypothesis: true location shift is greater than 0

> |
```

```
> # NUMBER OF LISTINGS PER HOSTS
> # HOSTS w/ ENTIRE HOMES
> df.temp <- BCN2017 %>%
+   select(host_group_listings_EH, last_scraped, regulation) %>% # select the two variables we need for efficiency
+   group_by(last_scraped, regulation) %>% # aggregate data for each month
+   # for each month; hosts with 1,2,3 listings (of ALL types) // adjust for the category you need.
+   summarise(no_hosts_EH_listings_1 = length(which(host_group_listings_EH == 1)),
+             no_hosts_EH_listings_2 = length(which(host_group_listings_EH == 2)),
+             no_hosts_EH_listings_3 = length(which(host_group_listings_EH == 3)))
Adding missing grouping variables: `host_id`
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> # X we assume to be bigger before the regulation so we want y to be less than that -> after the regulation the number of two or more hosts went down
> # two sided: are they different at all?
>
> wilcox.test(x = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1]
W = 30, p-value = 0.004329
alternative hypothesis: true location shift is not equal to 0

>
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1]
W = 30, p-value = 0.004329
alternative hypothesis: true location shift is not equal to 0

> wilcox.test(x = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1],
+             alternative = 'greater')

        Wilcoxon rank sum test

data:  df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1]
W = 30, p-value = 0.002165
alternative hypothesis: true location shift is greater than 0

>
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1],
+             alternative = 'greater')

        Wilcoxon rank sum test

data:  df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1]
W = 30, p-value = 0.002165
alternative hypothesis: true location shift is greater than 0

> |
```

```
> # HOST LOCAL #
> #Non-Local
>
> df.temp <- BCN2017 %>%
+   select(host_local, last_scraped, regulation) %>% # select the two variables we need for efficiency
+   group_by(last_scraped, regulation) %>% # aggregate data for each month
+   # for each month; hosts with 1,2,3 listings (of ALL types) // adjust for the category you need.
+   summarise(non_local_hosts = length(host_local[which(host_local == 0)]))
Adding missing grouping variables: `host_id`
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> # 'two.sided' test if the two groups  are different at all
> wilcox.test(x = df.temp$non_local_hosts[df.temp$regulation == 0],
+             y = df.temp$non_local_hosts[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$non_local_hosts[df.temp$regulation == 0] and df.temp$non_local_hosts[df.temp$regulation == 1]
W = 24, p-value = 0.1255
alternative hypothesis: true location shift is not equal to 0
```

```
> # NUMBER OF LISTINGS #
> df.temp <- BCN2018 %>%
+   group_by(last_scraped, regulation) %>%
+   summarise(no_listings = length(unique(id)),
+             no_listings_shared = length(unique(id[which(room_type_NV_numeric == 1)])),
+             no_listings_entire = length(unique(id[which(room_type_NV_numeric == 0)])))
>
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_entire[df.temp$regulation == 0],
+             y = df.temp$no_listings_entire[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_listings_entire[df.temp$regulation == 0] and df.temp$no_listings_entire[df.temp$regulation == 1]
W = 4, p-value = 0.02597
alternative hypothesis: true location shift is not equal to 0

>
>
> # the one-sided alternative less tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_shared[df.temp$regulation == 0],
+             y = df.temp$no_listings_shared[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_listings_shared[df.temp$regulation == 0] and df.temp$no_listings_shared[df.temp$regulation == 1]
W = 32, p-value = 0.02597
alternative hypothesis: true location shift is not equal to 0

>
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_entire[df.temp$regulation == 0],
+             y = df.temp$no_listings_entire[df.temp$regulation == 1],
+             alternative = 'greater')

        Wilcoxon rank sum test

data:  df.temp$no_listings_entire[df.temp$regulation == 0] and df.temp$no_listings_entire[df.temp$regulation == 1]
W = 4, p-value = 0.9924
alternative hypothesis: true location shift is greater than 0

>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_entire[df.temp$regulation == 0],
+             y = df.temp$no_listings_entire[df.temp$regulation == 1],
+             alternative = 'less')

        Wilcoxon rank sum test

data:  df.temp$no_listings_entire[df.temp$regulation == 0] and df.temp$no_listings_entire[df.temp$regulation == 1]
W = 4, p-value = 0.01299
alternative hypothesis: true location shift is less than 0

>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_shared[df.temp$regulation == 0],
+             y = df.temp$no_listings_shared[df.temp$regulation == 1],
+             alternative = 'greater')

        Wilcoxon rank sum test

data:  df.temp$no_listings_shared[df.temp$regulation == 0] and df.temp$no_listings_shared[df.temp$regulation == 1]
W = 32, p-value = 0.01299
alternative hypothesis: true location shift is greater than 0
```

Berlin

```
> # NUMBER OF LISTINGS #
> df.temp <- BER2018 %>%
+   group_by(last_scraped, regulation) %>%
+   summarise(no_listings = length(unique(id)),
+             no_listings_shared = length(unique(id[which(room_type_NV_numeric == 1)])),
+             no_listings_entire = length(unique(id[which(room_type_NV_numeric == 0)])))
>
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_entire[df.temp$regulation == 0],
+             y = df.temp$no_listings_entire[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_listings_entire[df.temp$regulation == 0] and df.temp$no_listings_entire[df.temp$regulation == 1]
W = 4, p-value = 0.02597
alternative hypothesis: true location shift is not equal to 0

>
>
> # the one-sided alternative less tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_shared[df.temp$regulation == 0],
+             y = df.temp$no_listings_shared[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_listings_shared[df.temp$regulation == 0] and df.temp$no_listings_shared[df.temp$regulation == 1]
W = 36, p-value = 0.002165
alternative hypothesis: true location shift is not equal to 0

>
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_entire[df.temp$regulation == 0],
+             y = df.temp$no_listings_entire[df.temp$regulation == 1],
+             alternative = 'greater')

        Wilcoxon rank sum test

data:  df.temp$no_listings_entire[df.temp$regulation == 0] and df.temp$no_listings_entire[df.temp$regulation == 1]
W = 4, p-value = 0.9924
alternative hypothesis: true location shift is greater than 0

>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_shared[df.temp$regulation == 0],
+             y = df.temp$no_listings_shared[df.temp$regulation == 1],
+             alternative = 'less')

        Wilcoxon rank sum test

data:  df.temp$no_listings_shared[df.temp$regulation == 0] and df.temp$no_listings_shared[df.temp$regulation == 1]
W = 36, p-value = 1
alternative hypothesis: true location shift is less than 0

>
```

```
> # NUMBER OF LISTINGS PER HOSTS
> # HOSTS w/ ENTIRE HOMES
> df.temp <- BER2018 %>%
+   select(host_group_listings_EH, last_scraped, regulation) %>% # select the two variables we need for efficiency
+   group_by(last_scraped, regulation) %>% # aggregate data for each month
+   # for each month; hosts with 1,2,3 listings (of ALL types) // adjust for the category you need.
+   summarise(no_hosts_EH_listings_1 = length(which(host_group_listings_EH == 1)),
+             no_hosts_EH_listings_2 = length(which(host_group_listings_EH == 2)),
+             no_hosts_EH_listings_3 = length(which(host_group_listings_EH == 3)))
Adding missing grouping variables: `host_id`
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> # X we assume to be bigger before the regulation so we want y to be less than that -> after the regulation the number of two or more hosts went down
> # two sided: are they different at all?
>
> wilcox.test(x = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1]
W = 36, p-value = 0.002165
alternative hypothesis: true location shift is not equal to 0

>
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1]
W = 6, p-value = 0.06494
alternative hypothesis: true location shift is not equal to 0

> wilcox.test(x = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1],
+             alternative = 'greater')

        Wilcoxon rank sum test

data:  df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1]
W = 36, p-value = 0.001082
alternative hypothesis: true location shift is greater than 0

>
```

```
> # HOST LOCAL #
> #Non-Local
>
> df.temp <- BER2018 %>%
+   select(host_local, last_scraped, regulation) %>% # select the two variables we need for efficiency
+   group_by(last_scraped, regulation) %>% # aggregate data for each month
+   # for each month; hosts with 1,2,3 listings (of ALL types) // adjust for the category you need.
+   summarise(non_local_hosts = length(host_local[which(host_local == 0)]))
Adding missing grouping variables: `host_id`
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> # 'two.sided' test if the two groups  are different at all
> wilcox.test(x = df.temp$non_local_hosts[df.temp$regulation == 0],
+             y = df.temp$non_local_hosts[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test with continuity correction

data:  df.temp$non_local_hosts[df.temp$regulation == 0] and df.temp$non_local_hosts[df.temp$regulation == 1]
W = 36, p-value = 0.004998
alternative hypothesis: true location shift is not equal to 0

Warning message:
In wilcox.test.default(x = df.temp$non_local_hosts[df.temp$regulation ==  :
  kan ikke beregne præcis p-værdi med bindinger
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> # 'two.sided' test if the two groups  are different at all
> wilcox.test(x = df.temp$non_local_hosts[df.temp$regulation == 0],
+             y = df.temp$non_local_hosts[df.temp$regulation == 1],
+             alternative = 'greater')

        Wilcoxon rank sum test with continuity correction

data:  df.temp$non_local_hosts[df.temp$regulation == 0] and df.temp$non_local_hosts[df.temp$regulation == 1]
W = 36, p-value = 0.002499
alternative hypothesis: true location shift is greater than 0

Warning message:
In wilcox.test.default(x = df.temp$non_local_hosts[df.temp$regulation ==  :
  kan ikke beregne præcis p-værdi med bindinger
> |
```

```
>
>
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_entire[df.temp$regulation == 0],
+             y = df.temp$no_listings_entire[df.temp$regulation == 1],
+             alternative = 'less')

        Wilcoxon rank sum test

data:  df.temp$no_listings_entire[df.temp$regulation == 0] and df.temp$no_listings_entire[df.temp$regulation == 1]
W = 4, p-value = 0.01299
alternative hypothesis: true location shift is less than 0

>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_shared[df.temp$regulation == 0],
+             y = df.temp$no_listings_shared[df.temp$regulation == 1],
+             alternative = 'greater')

        Wilcoxon rank sum test

data:  df.temp$no_listings_shared[df.temp$regulation == 0] and df.temp$no_listings_shared[df.temp$regulation == 1]
W = 36, p-value = 0.001082
alternative hypothesis: true location shift is greater than 0

> |
```

Copenhagen

```
> # NUMBER OF LISTINGS PER HOSTS
> # HOSTS w/ ENTIRE HOMES
> df.temp <- CPH2019 %>%
+   select(host_group_listings_EH, last_scraped, regulation) %>% # select the two variables we need for efficiency
+   group_by(last_scraped, regulation) %>% # aggregate data for each month
+   # for each month; hosts with 1,2,3 listings (of ALL types) // adjust for the category you need.
+   summarise(no_hosts_EH_listings_1 = length(which(host_group_listings_EH == 1)),
+             no_hosts_EH_listings_2 = length(which(host_group_listings_EH == 2)),
+             no_hosts_EH_listings_3 = length(which(host_group_listings_EH == 3)))
Adding missing grouping variables: `host_id`
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> # X we assume to be bigger before the regulation so we want y to be less than that -> after the regulation the number of two or more hosts went down
> # two sided: are they different at all?
>
> wilcox.test(x = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1]
W = 16, p-value = 0.4762
alternative hypothesis: true location shift is not equal to 0

>
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1]
W = 6, p-value = 0.2571
alternative hypothesis: true location shift is not equal to 0
```

```
>  HOST LOCAL #
Error: unexpected symbol in " HOST LOCAL"
> #Non-Local
>
> df.temp <- CPH2019 %>%
+   select(host_local, last_scraped, regulation) %>% # select the two variables we need for efficiency
+   group_by(last_scraped, regulation) %>% # aggregate data for each month
+   # for each month; hosts with 1,2,3 listings (of ALL types) // adjust for the category you need.
+   summarise(non_local_hosts = length(host_local[which(host_local == 0)]))
Adding missing grouping variables: `host_id`
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$non_local_hosts[df.temp$regulation == 0],
+             y = df.temp$non_local_hosts[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$non_local_hosts[df.temp$regulation == 0] and df.temp$non_local_hosts[df.temp$regulation == 1]
W = 13, p-value = 0.9143
alternative hypothesis: true location shift is not equal to 0

>
```

```
> # ---------------------------------------------------------------------------------------------------------------------------------------- #
> # ANALYSIS PT 2 - STATISTICAL TESTS #
>
> # NUMBER OF LISTINGS #
> df.temp <- CPH2019 %>%
+   group_by(last_scraped, regulation) %>%
+   summarise(no_listings = length(unique(id)),
+             no_listings_shared = length(unique(id[which(room_type_NV_numeric == 1)])),
+             no_listings_entire = length(unique(id[which(room_type_NV_numeric == 0)])))
>
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_entire[df.temp$regulation == 0],
+             y = df.temp$no_listings_entire[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_listings_entire[df.temp$regulation == 0] and df.temp$no_listings_entire[df.temp$regulation == 1]
W = 16, p-value = 0.4762
alternative hypothesis: true location shift is not equal to 0

>
>
> # the one-sided alternative less tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_shared[df.temp$regulation == 0],
+             y = df.temp$no_listings_shared[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_listings_shared[df.temp$regulation == 0] and df.temp$no_listings_shared[df.temp$regulation == 1]
W = 14, p-value = 0.7619
alternative hypothesis: true location shift is not equal to 0
```

London

```
> # NUMBER OF LISTINGS PER HOSTS
> # HOSTS w/ ENTIRE HOMES
> df.temp <- LDN2017 %>%
+   select(host_group_listings_EH, last_scraped, regulation) %>% # select the two variables we need for efficiency
+   group_by(last_scraped, regulation) %>% # aggregate data for each month
+   # for each month; hosts with 1,2,3 listings (of ALL types) // adjust for the category you need.
+   summarise(no_hosts_EH_listings_1 = length(which(host_group_listings_EH == 1)),
+             no_hosts_EH_listings_2 = length(which(host_group_listings_EH == 2)),
+             no_hosts_EH_listings_3 = length(which(host_group_listings_EH == 3)))
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> # X we assume to be bigger before the regulation so we want y to be less than that -> after the regulation the number of two or more hosts went down
> # two sided: are they different at all?
>
> wilcox.test(x = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test with continuity correction

data:  df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1]
W = 18, p-value = NA
alternative hypothesis: true location shift is not equal to 0

Warning message:
In wilcox.test.default(x = df.temp$no_hosts_EH_listings_2[df.temp$regulation ==  :
  kan ikke beregne præcis p-værdi med bindinger
>
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test with continuity correction

data:  df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1]
W = 18, p-value = NA
alternative hypothesis: true location shift is not equal to 0

Warning message:
In wilcox.test.default(x = df.temp$no_hosts_EH_listings_3[df.temp$regulation ==  :
  kan ikke beregne præcis p-værdi med bindinger
>
```

```
> # NUMBER OF LISTINGS PER HOSTS
> # HOSTS w/ ENTIRE HOMES
> df.temp <- LDN2017 %>%
+   select(host_group_listings_EH, last_scraped, regulation) %>% # select the two variables we need for efficiency
+   group_by(last_scraped, regulation) %>% # aggregate data for each month
+   # for each month; hosts with 1,2,3 listings (of ALL types) // adjust for the category you need.
+   summarise(no_hosts_EH_listings_1 = length(which(host_group_listings_EH == 1)),
+             no_hosts_EH_listings_2 = length(which(host_group_listings_EH == 2)),
+             no_hosts_EH_listings_3 = length(which(host_group_listings_EH == 3)))
Adding missing grouping variables: `host_id`
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> # X we assume to be bigger before the regulation so we want y to be less than that -> after the regulation the number of two or more hosts went down
> # two sided: are they different at all?
>
> wilcox.test(x = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1]
W = 12, p-value = 0.3939
alternative hypothesis: true location shift is not equal to 0

>
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1]
W = 8, p-value = 0.132
alternative hypothesis: true location shift is not equal to 0

>
```

Paris

```
> # NUMBER OF LISTINGS PER HOSTS
> # HOSTS w/ ENTIRE HOMES
> df.temp <- PRI2017 %>%
+   select(host_group_listings_EH, last_scraped, regulation) %>% # select the two variables we need for efficiency
+   group_by(last_scraped, regulation) %>% # aggregate data for each month
+   # for each month; hosts with 1,2,3 listings (of ALL types) // adjust for the category you need.
+   summarise(no_hosts_EH_listings_1 = length(which(host_group_listings_EH == 1)),
+             no_hosts_EH_listings_2 = length(which(host_group_listings_EH == 2)),
+             no_hosts_EH_listings_3 = length(which(host_group_listings_EH == 3)))
Adding missing grouping variables: `host_id`
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> # X we assume to be bigger before the regulation so we want y to be less than that -> after the regulation the number of two or more hosts went down
> # two sided: are they different at all?
>
> wilcox.test(x = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1]
W = 35, p-value = 0.002525
alternative hypothesis: true location shift is not equal to 0

>
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1]
W = 35, p-value = 0.002525
alternative hypothesis: true location shift is not equal to 0

>
> wilcox.test(x = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1],
+             alternative = 'greater')

        Wilcoxon rank sum test

data:  df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1]
W = 35, p-value = 0.001263
alternative hypothesis: true location shift is greater than 0

>
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0],
+             y = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1],
+             alternative = 'greater')

        Wilcoxon rank sum test

data:  df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0] and df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1]
W = 35, p-value = 0.001263
alternative hypothesis: true location shift is greater than 0

>
```

```
> # HOST LOCAL #
> #Non-Local
>
> df.temp <- PRI2017 %>%
+   select(host_local, last_scraped, regulation) %>% # select the two variables we need for efficiency
+   group_by(last_scraped, regulation) %>% # aggregate data for each month
+   # for each month; hosts with 1,2,3 listings (of ALL types) // adjust for the category you need.
+   summarise(non_local_hosts = length(host_local[which(host_local == 0)]))
Adding missing grouping variables: `host_id`
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$non_local_hosts[df.temp$regulation == 0],
+             y = df.temp$non_local_hosts[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test with continuity correction

data:  df.temp$non_local_hosts[df.temp$regulation == 0] and df.temp$non_local_hosts[df.temp$regulation == 1]
W = 26.5, p-value = 0.1667
alternative hypothesis: true location shift is not equal to 0

Warning message:
In wilcox.test.default(x = df.temp$non_local_hosts[df.temp$regulation ==  :
  kan ikke beregne præcis p-værdi med bindinger
>
```

```
> # ------------------------------------------------------------------------------------------------------------------------
> # ANALYSIS PT 2 - STATISTICAL TESTS #
>
> # NUMBER OF LISTINGS #
> df.temp <- PRI2017 %>%
+   group_by(last_scraped, regulation) %>%
+   summarise(no_listings = length(unique(id)),
+             no_listings_shared = length(unique(id[which(room_type_NV_numeric == 1)])),
+             no_listings_entire = length(unique(id[which(room_type_NV_numeric == 0)])))
>
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_entire[df.temp$regulation == 0],
+             y = df.temp$no_listings_entire[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_listings_entire[df.temp$regulation == 0] and df.temp$no_listings_entire[df.temp$regulation == 1]
W = 34, p-value = 0.005051
alternative hypothesis: true location shift is not equal to 0

>
>
> # the one-sided alternative less tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_shared[df.temp$regulation == 0],
+             y = df.temp$no_listings_shared[df.temp$regulation == 1],
+             alternative = 'two.sided')

        Wilcoxon rank sum test

data:  df.temp$no_listings_shared[df.temp$regulation == 0] and df.temp$no_listings_shared[df.temp$regulation == 1]
W = 33, p-value = 0.0101
alternative hypothesis: true location shift is not equal to 0

>
>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_entire[df.temp$regulation == 0],
+             y = df.temp$no_listings_entire[df.temp$regulation == 1],
+             alternative = 'greater')

        Wilcoxon rank sum test

data:  df.temp$no_listings_entire[df.temp$regulation == 0] and df.temp$no_listings_entire[df.temp$regulation == 1]
W = 34, p-value = 0.002525
alternative hypothesis: true location shift is greater than 0

>
> # the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
> wilcox.test(x = df.temp$no_listings_shared[df.temp$regulation == 0],
+             y = df.temp$no_listings_shared[df.temp$regulation == 1],
+             alternative = 'greater')

        Wilcoxon rank sum test

data:  df.temp$no_listings_shared[df.temp$regulation == 0] and df.temp$no_listings_shared[df.temp$regulation == 1]
W = 33, p-value = 0.005051
alternative hypothesis: true location shift is greater than 0
```

Appendix M - Sample Script for Data Proccessing

```
library(dplyr)
library(tidyverse)
library(lubridate)

# ---------------------------------------------------------------------------------------------------------------------------------------------------------------------- #

# DATA CLEANING PROCESS #

# Read the raw data
AMS2017 <- read.csv("amsterdam_2017-01-01.csv")

# Delete the irrelevant columns CHANGE TO EXCLUDE THE RETS
AMS2017 <- AMS2017[-c(2:3,5:19,21:23,25:37,38:39,40:52,55:60,62:67,70:85,87:93,96:106)]

# Convert blanks and NULL to NA
AMS2017[AMS2017 == ""] <- NA
AMS2017[AMS2017 == "NULL"] <- NA

# Convert variables to character or numeric form
AMS2017$last_scraped <- as.character(AMS2017$last_scraped)
AMS2017$host_location <- as.character(AMS2017$host_location)
AMS2017$room_type <- as.character(AMS2017$room_type)
AMS2017$price <- as.character(AMS2017$price)
AMS2017$last_review <- as.character(AMS2017$last_review)
AMS2017$requires_license <- as.character(AMS2017$requires_license)
AMS2017$license <- as.numeric(AMS2017$license)

# Convert the date columns to date form. Format YY-MM-DD.
AMS2017$last_scraped <- as.Date(AMS2017$last_scraped, format = "%Y-%m-%d")
AMS2017$last_review <- as.Date(AMS2017$last_review, format = "%Y-%m-%d")

# Remove non-numeric symbols in price, i.e. currency sign and commas, from the price columns and convert to numeric format.
AMS2017$price <- parse_number(AMS2017$price)

# Caulculate difference between last_scrape and last_review. If over 6 months, considered inactive listings.
AMS2017$date_diff <- as.Date(strptime(AMS2017$last_scraped, "%Y-%m-%d"))-as.Date(strptime(AMS2017$last_review, "%Y-%m-
%d"))
AMS2017$date_diff <- as.numeric(AMS2017$date_diff)

# Delete the inactive listings
AMS2017 <- filter(AMS2017, AMS2017$date_diff <= 182)

# Set last_scraped to first of each month since the scraping for each month runs over multiple days. Moved to here since otherwise the the
date diff will be incorrect
AMS2017$last_scraped <- floor_date(AMS2017$last_scraped, "month")

# Add new colum with new categorisation of room type
AMS2017$room_type_NV <- NA
AMS2017$room_type_NV <- as.character(AMS2017$room_type_NV)
AMS2017 <- AMS2017 %>%
  mutate(room_type_NV = case_when(str_detect(room_type, "Entire") ~ 'Entire home', is.na(room_type) ~ NA_character_, TRUE ~ "Shared
home"))

# CLEANED

# ---------------------------------------------------------------------------------------------------------------------------------------------------------------------- #

# HOST LOCAL #

# Checks if the host is local or not by checking for the city name in host_location. Categorise as 0 for non local, 1 for local.
AMS2017$host_local = as.numeric(str_detect(AMS2017$host_location, 'amsterdam|Amsterdam|AMSTERDAM'))
count(AMS2017, vars=c("last_scraped", "host_local"))
```

```
count(is.na(AMS2017$host_local))
# ---------------------------------------------------------------------------------------------------------------------------------------------------------------- #
# NUMBER OF LISTINGS #
# Number of listings by listing type
count(AMS2017, vars=c("last_scraped","room_type_NV"))

# NUMBER OF LISTINGS PER HOST #
# 1. Calculate number of listings per host by total and by listing type
AMS2017 <- AMS2017 %>%
  group_by(host_id, last_scraped) %>% # group data by host and month
  mutate(count_listings_in_data = length(unique(id)), # for each host/month combination; count the number of unique listing IDs
        count_shared_homes = length(unique(id[which(room_type_NV == "Shared home")])), # for each host/month combination; count the
number of unique listing IDs for which the room type is "shared"
        count_entire_homes = length(unique(id[which(room_type_NV == "Entire home")]))) # for each host/month combination; count the
number of unique listing IDs for which the room type is "entire"

# 2. Make listing type to numerical based on categorisation: 1, 2, 3 or more

# set all hosts to group == 0
AMS2017$host_group_listings_ALL <- 0
AMS2017$host_group_listings_ALL[AMS2017$count_listings_in_data == 1] <- 1 # all hosts that have exactly one listing
AMS2017$host_group_listings_ALL[AMS2017$count_listings_in_data == 2] <- 2 # all hosts that have exactly two listings
AMS2017$host_group_listings_ALL[AMS2017$count_listings_in_data >= 3] <- 3 # all hosts that have more than two listings

table(AMS2017$host_group_listings_ALL)
table(AMS2017$host_group_listings_ALL[AMS2017$last_scraped == '2016-07-01'])

# 3. Make listing type for Entire homes only to numerical based on categorisation: 1, 2, 3, 4 or more

# this sets all hosts to group == 0 (including those that have SHARED home listings)
AMS2017$host_group_listings_EH <- 0
AMS2017$host_group_listings_EH[AMS2017$count_listings_in_data == 1 & AMS2017$room_type_NV == 'Entire home'] <- 1 # exactly
one ENTIRE listing
AMS2017$host_group_listings_EH[AMS2017$count_listings_in_data == 2 & AMS2017$room_type_NV == 'Entire home'] <- 2 # exactly
two ENTIRE listing
AMS2017$host_group_listings_EH[AMS2017$count_listings_in_data >= 3 & AMS2017$room_type_NV == 'Entire home'] <- 3 # more
than two ENTIRE listings


# 4. Make listing type for Shared homes only to numerical based on categorisation: 1, 2, 3, 4 or more

# this sets all hosts to group == 0 (including those that have ENTIRE home listings)
AMS2017$host_group_listings_SH <- 0
AMS2017$host_group_listings_SH[AMS2017$count_listings_in_data == 1 & AMS2017$room_type_NV == 'Shared home'] <- 1 # exactly
one SHARED listing
AMS2017$host_group_listings_SH[AMS2017$count_listings_in_data == 2 & AMS2017$room_type_NV == 'Shared home'] <- 2 # exactly
two SHARED listings
AMS2017$host_group_listings_SH[AMS2017$count_listings_in_data >= 3 & AMS2017$room_type_NV == 'Shared home'] <- 3 # more
than two SHARED listings


# Calculate number of listings per host and month for Entire Homes

HLCG_072016_EH <- as.data.frame(table(AMS2017$host_id[AMS2017$last_scraped == '2016-07-01'],
AMS2017$host_group_listings_EH[AMS2017$last_scraped == '2016-07-01']))
HLCG_072016_EH <- HLCG_072016_EH[HLCG_072016_EH$Freq > 0, ]
HLCG_072016_EH$last_scraped <- '2016-07-01'

HLCG_082016_EH <- as.data.frame(table(AMS2017$host_id[AMS2017$last_scraped == '2016-08-01'],
AMS2017$host_group_listings_EH[AMS2017$last_scraped == '2016-08-01']))
HLCG_082016_EH <- HLCG_082016_EH[HLCG_082016_EH$Freq > 0, ]
HLCG_082016_EH$last_scraped <- '2016-08-01'

HLCG_092016_EH <- as.data.frame(table(AMS2017$host_id[AMS2017$last_scraped == '2016-09-01'],
AMS2017$host_group_listings_EH[AMS2017$last_scraped == '2016-09-01']))
HLCG_092016_EH <- HLCG_092016_EH[HLCG_092016_EH$Freq > 0, ]
```

```
HLCG_092016_EH$last_scraped <- '2016-09-01'


HLCG_112016_EH <- as.data.frame(table(AMS2017$host_id[AMS2017$last_scraped == '2016-11-01'],
AMS2017$host_group_listings_EH[AMS2017$last_scraped == '2016-11-01']))
HLCG_112016_EH <- HLCG_112016_EH[HLCG_112016_EH$Freq > 0, ]
HLCG_112016_EH$last_scraped <- '2016-11-01'

HLCG_122016_EH <- as.data.frame(table(AMS2017$host_id[AMS2017$last_scraped == '2016-12-01'],
fAMS2017$host_group_listings_EH[AMS2017$last_scraped == '2016-12-01']))
HLCG_122016_EH <- HLCG_122016_EH[HLCG_122016_EH$Freq > 0, ]
HLCG_122016_EH$last_scraped <- '2016-12-01'

HLCG_012017_EH <- as.data.frame(table(AMS2017$host_id[AMS2017$last_scraped == '2017-01-01'],
AMS2017$host_group_listings_EH[AMS2017$last_scraped == '2017-01-01']))
HLCG_012017_EH <- HLCG_012017_EH[HLCG_012017_EH$Freq > 0, ]
HLCG_012017_EH$last_scraped <- '2017-01-01'


HLCG_022017_EH <- as.data.frame(table(AMS2017$host_id[AMS2017$last_scraped == '2017-02-01'],
AMS2017$host_group_listings_EH[AMS2017$last_scraped == '2017-02-01']))
HLCG_022017_EH <- HLCG_022017_EH[HLCG_022017_EH$Freq > 0, ]
HLCG_022017_EH$last_scraped <- '2017-02-01'

HLCG_032017_EH <- as.data.frame(table(AMS2017$host_id[AMS2017$last_scraped == '2017-03-01'],
AMS2017$host_group_listings_EH[AMS2017$last_scraped == '2017-03-01']))
HLCG_032017_EH <- HLCG_032017_EH[HLCG_032017_EH$Freq > 0, ]
HLCG_032017_EH$last_scraped <- '2017-03-01'


HLCG_042017_EH <- as.data.frame(table(AMS2017$host_id[AMS2017$last_scraped == '2017-04-01'],
AMS2017$host_group_listings_EH[AMS2017$last_scraped == '2017-04-01']))
HLCG_042017_EH <- HLCG_042017_EH[HLCG_042017_EH$Freq > 0, ]
HLCG_042017_EH$last_scraped <- '2017-04-01'


HLCG_052017_EH <- as.data.frame(table(AMS2017$host_id[AMS2017$last_scraped == '2017-05-01'],
AMS2017$host_group_listings_EH[AMS2017$last_scraped == '2017-05-01']))
HLCG_052017_EH <- HLCG_052017_EH[HLCG_052017_EH$Freq > 0, ]
HLCG_052017_EH$last_scraped <- '2017-05-01'


HLCG_062017_EH <- as.data.frame(table(AMS2017$host_id[AMS2017$last_scraped == '2017-06-01'],
AMS2017$host_group_listings_EH[AMS2017$last_scraped == '2017-06-01']))
HLCG_062017_EH <- HLCG_062017_EH[HLCG_062017_EH$Freq > 0, ]
HLCG_062017_EH$last_scraped <- '2017-06-01'


AMS2017HLCG_EH <-
rbind(HLCG_072016_EH,HLCG_082016_EH,HLCG_092016_EH,HLCG_112016_EH,HLCG_122016_EH,HLCG_012017_EH,HLCG_0
22017_EH,HLCG_032017_EH,
                   HLCG_042017_EH,HLCG_052017_EH,HLCG_062017_EH)

count(AMS2017HLCG_EH, vars = c("last_scraped", "Var2"))

# ------------------------------------------------------------------------------------------------------------------------------------------------------------ #

# PRICE #

# Avg price per night per listing listing type per month
aggregate(price ~ room_type_NV + last_scraped, data = AMS2017, mean)

# ------------------------------------------------------------------------------------------------------------------------------------------------------------ #

# ANALYSIS PT 2 - STATISTICAL TESTS #
```

```
# NUMBER OF LISTINGS #
df.temp <- AMS2017 %>%
  group_by(last_scraped, regulation) %>%
  summarise(no_listings = length(unique(id)),
            no_listings_shared = length(unique(id[which(room_type_NV_numeric == 1)])),
            no_listings_entire = length(unique(id[which(room_type_NV_numeric == 0)])))


# the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
wilcox.test(x = df.temp$no_listings_entire[df.temp$regulation == 0],
            y = df.temp$no_listings_entire[df.temp$regulation == 1],
            alternative = 'two.sided')


# the one-sided alternative less tests if  x is shifted to the left of y (i.e. is smaller on average)
wilcox.test(x = df.temp$no_listings_shared[df.temp$regulation == 0],
            y = df.temp$no_listings_shared[df.temp$regulation == 1],
            alternative = 'two.sided')


# the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
wilcox.test(x = df.temp$no_listings_entire[df.temp$regulation == 0],
            y = df.temp$no_listings_entire[df.temp$regulation == 1],
            alternative = 'greater')

# the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
wilcox.test(x = df.temp$no_listings_shared[df.temp$regulation == 0],
            y = df.temp$no_listings_shared[df.temp$regulation == 1],
            alternative = 'greater')




# NUMBER OF LISTINGS PER HOSTS
# HOSTS w/ ENTIRE HOMES
df.temp <- AMS2017 %>%
  select(host_group_listings_EH, last_scraped, regulation) %>% # select the two variables we need for efficiency
  group_by(last_scraped, regulation) %>% # aggregate data for each month
  # for each month; hosts with 1,2,3 listings (of ALL types) // adjust for the category you need.
  summarise(no_hosts_EH_listings_1 = length(which(host_group_listings_EH == 1)),
            no_hosts_EH_listings_2 = length(which(host_group_listings_EH == 2)),
            no_hosts_EH_listings_3 = length(which(host_group_listings_EH == 3)))

# the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
# X we assume to be bigger before the regulation so we want y to be less than that -> after the regulation the number of two or more hosts
went down
# two sided: are they different at all?

wilcox.test(x = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0],
            y = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1],
            alternative = 'two.sided')


# the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
wilcox.test(x = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0],
            y = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1],
            alternative = 'two.sided')

wilcox.test(x = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 0],
            y = df.temp$no_hosts_EH_listings_2[df.temp$regulation == 1],
            alternative = 'greater')


# the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
wilcox.test(x = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 0],
            y = df.temp$no_hosts_EH_listings_3[df.temp$regulation == 1],
```

```
        alternative = 'greater')



# HOST LOCAL #
#Non-Local

df.temp <- AMS2017 %>%
  select(host_local, last_scraped, regulation) %>% # select the two variables we need for efficiency
  group_by(last_scraped, regulation) %>% # aggregate data for each month
  # for each month; hosts with 1,2,3 listings (of ALL types) // adjust for the category you need.
  summarise(non_local_hosts = length(host_local[which(host_local == 0)]))

# the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
wilcox.test(x = df.temp$non_local_hosts[df.temp$regulation == 0],
        y = df.temp$non_local_hosts[df.temp$regulation == 1],
        alternative = 'two.sided')

# the one-sided alternative "less" tests if  x is shifted to the left of y (i.e. is smaller on average)
# 'two.sided' test if the two groups  are different at all
wilcox.test(x = df.temp$non_local_hosts[df.temp$regulation == 0],
        y = df.temp$non_local_hosts[df.temp$regulation == 1],
        alternative = 'greater')
```