THE INFLUENCE OF LOCATION CHARACTERISTICS ON THE INCOME OF AIRBNB'S IN AMSTERDAM

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ABSTRACT

In this paper an explorative research is examined to find some location characteristics that influence the income of Airbnb's in Amsterdam. With use of data from Inside Airbnb, the CBS and from the municipality of Amsterdam several multiple linear regression models are set up. According to a similar industry, the hotel industry, it is expected that the availability of amenities, public transport stops, safety and agglomeration effects in a neighborhood have a positive influence on the income of Airbnb's in Amsterdam. In this research there is found that some location characteristic that are important for hotels are also important for Airbnb's in Amsterdam. However, it seems that the model is still incomplete en that further research is needed.

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Introduction

Nowadays online peer-to-peer marketplaces, also known as the 'sharing economy', are increasing rapidly, especially in the travel and tourism sector (Ert, Fleischer, & Magen, 2016). The rapid growth is driven by technological, economical and societal reasons which will be outlined (van der Borg, Camatti, Bertocchi, & Albarea, 2017). Due to the improvement of information and communication systems people are able to share goods and services more easily and they are able to reach a greater audience. Furthermore, due to the financial crisis in 2008, people pay more attention to their expenses (Gansky, 2010). They are searching for alternative methods to purchase goods and services and online sharing is one of these methods. Due to the direct link between buyers and sellers, online markets can provide competitive prices with lower intermediations costs. Finally, due to the internet it is possible for consumers to leave comments and suggestions which give them the feeling that they are part of a community.

The focus of this research will be at one of these online peer-to-peer marketplaces, namely Airbnb. Airbnb is an online accommodation service that is established in 2008. It allows individuals over the world to rent their accommodations to other individuals via the online platform of Airbnb. In a short period the online accommodation service has rapidly grown. Annually, millions of rooms are shared in more than 191 countries over the world. Just in the city Amsterdam about 1,7 million transactions were done in 2016. This is a growth of 125% relative to 2015.

Since more and more people make use of online peer-to-peer marketplaces such as Airbnb, the goal of this research is to determine which factors are important for people when they are choosing an Airbnb[1]. Furthermore there will be determined what the influence of these factors is on the income of Airbnb's in Amsterdam.

Airbnb is part of the service industry, which is an industry that earns revenue through providing intangible products and services. As mentioned before Airbnb is a new concept and therefore there is almost none empirical literature available about the influence of location characteristics on the attractiveness and income of Airbnb's. However, Airbnb can be compared with another business in the service industry which is expected to be very similar to Airbnb, namely the hotel industry. The advantage of this is that there is a lot of empirical literature available about hotels and their location characteristics. In this research will first be looked which are the most important location characteristics for hotels that influence the attractiveness of hotels and

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[1] In this research *Airbnb* means an accommodation that is rent via the site of Airbnb

therefore the income of hotels. After that there will be explored if these location characteristics also influence the attractiveness and income of Airbnb's. To determine the relationship between location characteristics and the income of an Airbnb in Amsterdam, the following research question is formulated:

What is the influence of location characteristics on the income of Airbnb's in Amsterdam?

The structure of the rest of this paper is as follows. First, in the theoretical framework relevant concepts and theories about the location characteristics of hotels will be explained and the hypotheses will be introduced. Next the data and methodology part will be described. In this research datasets from Inside Airbnb, Centraal Bureau voor de Statistiek (CBS) and from the municipality of Amsterdam will be used. With these data there will be performed an explorative research, because there is not yet empirical evidence available about this topic. After the data and methodology part follow the results where, the outcomes of the multiple linear regressions will be discussed. Finally, this research will be terminated with the conclusion and discussion.

Theoretical Framework

The aim of this research is to find the most important location characteristics which attract tourists or visitors to a destination and which have an influence on the income of Airbnb's in Amsterdam. As mentioned before Airbnb's are part of the service industry and exist only a few years. For this reason there is not much empirical literature available about this topic. Therefore there will be first looked at a similar industry, namely hotels. However, hotels and Airbnb's are not exactly the same. Therefore there might be a chance that location characteristics that influence the attractiveness and income of a hotel not influence the attractiveness and income of an Airbnb. In the next part some existing literature about the importance of the location of a hotel will be outlined. After that some location characteristics that might have an influence on the hotel location are discussed.

In the existing literature there can be made a distinction between factors that determine the choice of a hotel to locate at a specific point and between factors that determine why a certain hotel is so successful and attracts a lot of customers. First, the factors that determine the choice of a hotel at a specific location will be discussed. For service industries, like hotels, an effective location strategy is very important to attract more visitors (Yang, Wong, & Wang, 2012). Hotels have to choose at once a right location to settle, where they can attract enough guests, because it is difficult and very expensive to change their location once they are settled (Urtasun & Gutiérrez, 2006). Several empirical researches proved the importance and consequence of the location on the success of hotels. An example of these researches comes from Newell and Seabrook (2006) who tried to determine the factors that have an influence on the investment decisions of a hotel and they found that location is one of the key factors.

Now the factors are discussed that determine the choice of a hotel to locate at a specific point, there will be discussed due to which factors some hotels are so successful. In several studies is proved that the location of a hotel has a big influence on the choice of guests in choosing a hotel and therefore on the income of a hotel. Rivers, Toh and Alaoui (1991) asked their respondents to rate eight factors they found important in the process of choosing a hotel and the outcome was that a convenient location of a hotel was the most important factor. With a convenient location they mean that the location is easy accessible and that from there other locations easily can be reached. Chan and Wong (2005) also found that, in absence of the factor price, the most important factor that influence the choice of a hotel of guests is a convenient location. And also Lewis and Chambers (1989) and McCleary, Weaver and Hutchinson (1993) found in their research that location is an important factor that influences the selection of a hotel. Chung and

Kalnins (2001) found that people choose for a certain hotel because it is located nearby other locations or events, such as historical landmarks.

From the existing literature that is mentioned above can be derived that it is very important for hotels to choose at once a right location to settle and that location is an important factor for guests in their process of choosing a hotel. In the next part some factors will be discussed that might have an influence on the location and the neighborhoods.

Amenities

Ghose, Ipeirotis and Li (2009) found in their research that external amenities have a positive influence on the demand of hotels. They found that hotels that are located nearby amenities, such as shops and restaurant, can attract more customers which can lead to an increase in demand of hotels and therefore can influence the income of hotels.

Furthermore, consumers find it important that there is a wide-variety of amenities available. Kahn (1995) did a research to try to understand why consumers seek for variety. The first reason that consumers seek variety is that they get saturated by specific products and they want additional products to stimulate their needs. The second reason that people search for other products and want to have a choice between a lot of varieties is due to changes in their external environment. Finally, the last reason for consumers to seek variety is because of uncertainty in the future. If there are a lot of options available in the future, the consumer is able to choose the most favorable option.

Due to these needs for variety it is important that there is enough variety in the amenities. For example, if people go on a holiday and they stay a few days at an Airbnb they want to have the choice to go to different cafés and restaurants such that they do not eat at the same place every day.

Based on this existing literature that amenities in a neighborhood can increase the demand of a hotel and that people love it to have more variety. The following hypothesis is formulated:

H1: An Airbnb which is located in a neighborhood with a lot of amenities, such as cafés and restaurants, has a higher revenue than an Airbnb which is located in a neighborhood with a few amenities.

Public transport

Arbel and Pizam (1977) showed in their research that tourists prefer to travel maximum 15-20 minutes to the city center. The choice of tourists to stay at a hotel further away from the city center, depends on the availability of public transport stops such as railway, bus, subway and tram stops. Only a few tourists can afford it to make use of private transport. However, for most of the tourists, public transport is an essential service and makes it possible to travel between different destinations. If tourists are not able to visit a destination as a result of a inefficient transport system, they may choose another place which is easily accessible with public transport (Prideaux, 2000). Thus a good public transport network is essential, especially in large cities, and makes it possible to benefit of tourism throughout the city (Evans & Shaw, 2002).

Several papers have already found the importance of transport networks. For example, Laws (1995) did a research about which factors are important to attract more visitors and he found that transport is the second most important attribute which makes a location more attractive. Furthermore, transport is also regarded by Gunn (1988) as one of the most important characteristics at a tourist destination. Tourists can use different public transport modes to travel between destinations. Ghose, Ipeirotis and Li (2009) found that hotels which are located close to public transportation can attract more customers. In this research will be examined what the influence is on the income of an Airbnb if it is located nearby a railway station. Furthermore there will be examined what the influence is of the number of public transport stops in a neighborhood on the income of an Airbnb. The reason for this is that it is expected that if there are a lot of different public transport stops in a neighborhood, the accessibility options for tourists will be increased. Therefore the following two hypotheses are formulated:

H2: An Airbnb which is located nearby a railway station has a higher revenue than an Airbnb which is located far away from a railway station

H3: An Airbnb which is located in a neighborhood with a lot of public transport stations has a higher revenue than an Airbnb which is located in a neighborhood with a few public transport stations.

Public safety

In the existing literature about attractive location factors, the factor safety is also mentioned several times as an important characteristic for a destination (Chan & Wong, 2005; Shih, 1986; Mok and Armstrong, 1995). If a destination is recognized as unsafe and with risks, this can influence the destination image of tourists and their choice to visit the destination. Tourists will

avoid these unsafe and risky destinations and rather visit destinations that are safe (Sönmez & Graefe, 1998). Ghose, Ipeirotis and Li (2009) found that a neighborhood with a high crime rate has a negative influence on the demand of hotels. Because tourists are more likely to visit places where they feel safe, it is more likely that Airbnb's have more guests when they are located in a safe neighborhood than when they are located in an unsafe neighborhood. In this research there will be looked at the factor safety per neighborhood of the city Amsterdam. To test if safety of a neighborhood influence the income of an Airbnb, the following hypothesis is formulated:

H4: An Airbnb which is located in a safe neighborhood has a higher revenue than an Airbnb which is located in an unsafe neighborhood.

Agglomeration effects

In this part the location characteristic of agglomeration effects will be discussed. In the past few years, the interest in agglomeration effects is intensively increased and therefore there is a lot of extensive research performed on this topic. Agglomeration effects are the benefits that firms obtain when they are located in close geographic proximity to other firms (Rosenthal & Strange, 2004). Agglomeration economies seems contradictory with the traditional economic point of view, because more competition usually leads to lower prices and lower sales. However, agglomeration of firms sometimes leads to external benefits which can increase the income of companies (Canina, Enz, & Harrison, 2005). Companies can, for example, benefit from each other's advertisements (Shankar, 1999).

Marshall (1920) was one of the first persons who considered that firms can obtain benefits when they agglomerate. He made a distinction between two types of benefits that can be obtained by firms which are located in close geographic proximity. The first one is *production economies*. Production economies can arise in three ways: (1) access to specialized labor, (2) access to specialized inputs and (3) access to technology spillovers. These types of agglomeration externalities arise through efficient use of *supply* resources and occur mostly in manufacturing and high-technology industries (McCann & Vroom, 2010). In the next part there will be looked if it is possible for these types of externalities to occur in the service industry, like hotels.

Supply-side agglomerations

The first type of agglomeration effects can arise due to access to specialized labor. Companies that are located near each other have access to specialized local labor pools. Therefore companies can reduce their searching costs when they are looking for new personnel.

Furthermore, the new personnel must be able to carry out tasks correctly. Therefore they must be follow trainings, which are very expensive. The employees in the specialized labor pool have already the knowledge to carry out tasks correctly, therefore the costs to acquire their knowledge will be lower (McCann, 2013). This phenomenon can also occur in the hotel industry. If hotels are located close to each other, they can obtain employees who already have knowledge about some tasks and about the hotel industry, which can reduce costs. This type of externality can occur at city level, but also at the level of a neighborhood. An employee that lives on the other side of the city Amsterdam can still easily be contacted by the hotel.

The second reason why agglomeration effects arise is due to industries that need specialized inputs, such as research tools or suppliers. Sellers are at risk when they have only one buyer. If the same companies agglomerate with each other, the seller can reach more people and can deliver services to companies (McCann and Folta, 2008). However, this type of externality is irrelevant for the hotel industry. There are no special inputs that they need, which are difficult to get if they are located on their own.

The third reason why agglomerations can arise is due to technological spillovers. If companies are located close to each other the employees of one company can easily contact employees of another company. This contact can imply formal contact, such as business meetings, or informal contact, such as lunch or sport activities. During this formal or informal meetings tacit information can be exchanged. Tacit information is incomplete information, for example, about new products, personnel, technology and market trends (McCann, 2013). In the hotel industry this form of agglomeration are not very likely to occur.

From the above there can be seen that some of these types of externalities not only arise in the manufacturing and high-technology industries but that they also can arise in the service industry, like the hotel sector. The impact of these supply sources of externalities are only not as high as in the manufacturing and high-technology industries.

The second type of benefits, that firms can obtain is *increased demand* for products or services. These *demand externalities* are more common in retail and consumer services industries. Because the focus of this research is on Airbnb's and hotels, which are part of the service industry, the demand-side agglomerations will be outlined more extensive.

Demand-side agglomerations

The second type of external benefits that Marshall (1920) mentions is *increased demand*. If firms are located nearby other firms the convenience of customers increases (Marshall, 1920). The reason for this is that it becomes easier for customers to compare firms and the different options that they offer, which can lead to lower searching costs for customers (Stahl, 1982; Stuart, 1979). Lower searching costs can increase the probability to buy something, which cause an increased demand for firms that clump together (McCann & Vroom, 2010). This type of agglomeration effect is the most clear when firms offer heterogeneous products (Fisher & Harrington, 1996), which consumers find important to evaluate before they purchase the product (Stahl, 1982). For this type of externality it is more important that it will be measured on level of the neighborhood, than on city level.

In previous research there is found some evidence that hotels gain profits when they agglomerate. Chung and Kalnins (2001) did research about increased demand in the lodging industry in Texas. They proved that agglomeration leads to an increase in demand. This happens especially in rural markets, where lower search costs are very effective to increase demand. A hotel that is located in a market with a high amount of chain or large establishments obtain higher revenues per room. A reason for this is that larger hotels are more likely to advertise which also have a positive benefit on other hotels. Canina, Enz and Harrison (2005) found that hotels which are located nearby each other obtain higher income.

Following the existing literature, agglomeration effects can have a influence on the income of hotels and the expectation is that this also holds for Airbnb's, therefore the following hypothesis is formulated:

H5: the revenue of Airbnb's which are clustered together is higher than the revenue of Airbnb's which are not clustered together.

City center

In 1968 Yokeno proposed a model of locations of hotels, which was based on the agricultural land-use model of von Thunen (1826). Yokeno suggested that in a mono-centric center, hotels choose to locate close to the Central Business District (CBD) which is part of the city center (see Figure 1). In the city center and the CBD there are a lot of people and tourists and the demand for accommodations is high (Yokeno, 1968). Shoval (2006) has shown in his paper that individual tourists prefer a hotel in the heart of the city and they are willing to pay more such that they can easy access the city center.

The city center or CBD is normally seen as the most accessible place, where transport, labor and retail markets are located. However, due to adjustments in transport systems nowadays it is often difficult to enter the city center or the CBD. Therefore it cannot be noticed as the most accessible place for transport, labor and retail markets. But for some industries, such as the hotel industry, it is still most attractive to locate at the city center (Egan & Nield, 2000). The reason for this is that the city center often contains historical buildings, shops, museums and other amenities that attract customers to the city, which increases the demand for hotels. Because of the many visitors and the higher prices they want to pay to stay at a hotel next to the city center to have easy access to the city center, the following hypothesis is formulated:

H6: An Airbnb that is located inside the city center has a higher revenue than an Airbnb that is located outside the city center.

Figure 1. Yokeno's model of locations of hotels[2]

Data and Methodology

Data

In this research several databases will be used. The first database that will be used is Inside Airbnb. Inside Airbnb is an independent organization that provides a data tool that can be used to examine how people make use of Airbnb (Inside Airbnb, 2017). The database of Inside Airbnb contains information about listings in several cities. For this research information about listings in Amsterdam will be collected. The listings in Amsterdam are classified by Airbnb in 22 neighborhoods and this makes it possible to compare the Airbnb listings in different neighborhoods. Furthermore the number of reviews per listing are available from several years. However, in the other databases that will be used for this research there is no information available about 2016. To compare the different neighborhoods with each other it is important that all the data that will be used is derived from the same year. Therefore in this research only data from 2015 will be used, because this is the most recent year of which all data is available.

The second database that will be used is called *"Nabijheid voorzieningen; afstand locatie, wijk- en buurtcijfers 2015"* and is part of the database StatLine from the Centraal Bureau voor de Statistiek (CBS) (CBS, 2017). The CBS publishes reliable, statistical information that addresses the needs of the society. This database provides among others information about the proximity of facilities, such as cafés, restaurants and railway stations classified by 99 neighborhoods. Furthermore it provides information about the average number of cafés and restaurants within one, three and five kilometer in the neighborhoods of Amsterdam. As can be seen in the theoretical framework, people love it to have more variety. Therefore the average number of cafés and restaurants within one kilometer will be used. For the railway stations the average kilometers to the nearest railway station will be used, because this is the only data available of railways.

The last data that will be used is part of the database Onderzoek, Informatie en Statistiek (OIS) from the municipality of Amsterdam. This database contains a lot of statistical information about Amsterdam, such as information about the population, employment opportunities and safety. OIS has its own business register and uses sources from building and population registers of Amsterdam. Besides that, OIS receive data from organizations like the CBS and UWV. This data will be processed by OIS and published. In this research data about the safety in the neighborhoods will be used and is called "Veiligheidsindex 22 gebieden en stadsdelen (deel 1 en 2), 2015" (OIS Amsterdam, 2017). Furthermore, information about the number of public

transport stops (metro, bus, tram and ferry) in the neighborhoods will be used. This data is called "OV-haltes" and is derived from *Open Geo Data*, which is part of OIS Amsterdam (2017).

Variables

The variables that will be used in this research will be outlined in this section. The dependent variable in the model will be the income of Airbnb's in 2015 (*income2015)*. This variable is chosen as dependent variable because the aim of this research is to determine if location characteristics have an influence on the income of Airbnb's. The number of reviews of an Airbnb is an approach to determine the number of guests of an Airbnb. In this research there will be assumed that all the Airbnb listings have the same chance to receive a review and that one review means a booking for one night at an Airbnb. However, it can be possible that one review means a booking for more nights at an Airbnb and this can cause a bias. The assumption makes it possible to generate the independent variable *income2015*, which can be calculated through multiply the price of an Airbnb with the number of reviews in 2015 of an Airbnb. The dependent variable will be expressed in euro's.

The dependent variable is influenced by several explanatory variables. In this research different location characteristics will be used as explanatory variables. The first variable that will be outlined is called *amenities.* From the theoretical framework can be derived that amenities have an influence on the demand of hotels and with this variable there will be tested if amenities also influence the income of an Airbnb. The database from the CBS contains information about the proximity to cafés and restaurants and about the absolute number of cafés and restaurants within one, three and five kilometer per neighborhood. However, as mentioned before, people love to have more variety. Therefore in the model the absolute number of cafés and restaurants will be included instead of the proximity. Furthermore, there is chosen for the number of cafés and restaurants within one kilometer, because this shows the number of cafés and restaurant relatively nearby.

The data about the absolute numbers of cafés and restaurants from the CBS within 1 kilometer is divided in 99 neighborhoods. However, the data of Inside Airbnb (see Figure 1 and 2) is divided into 22 neighborhoods. Therefore, some of the neighborhoods must taken together to create the same neighborhoods of Inside Airbnb. With use of a map of Amsterdam, the neighborhoods from the CBS were taken together to create the same neighborhoods as the neighborhoods of Inside Airbnb. As can be seen, cafés and restaurants will be not measured as two variables, but as one called *amenities*. The reason for this is that the correlation between cafés and restaurants is 0.9850 (see Table 1) and will be explained in the next part.
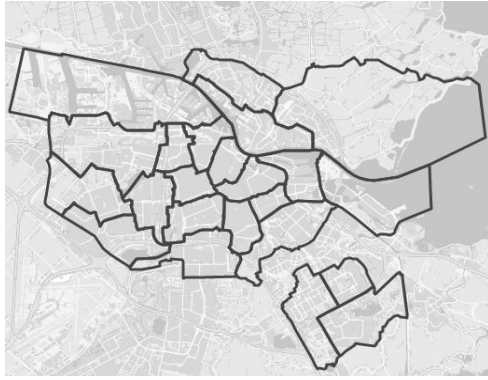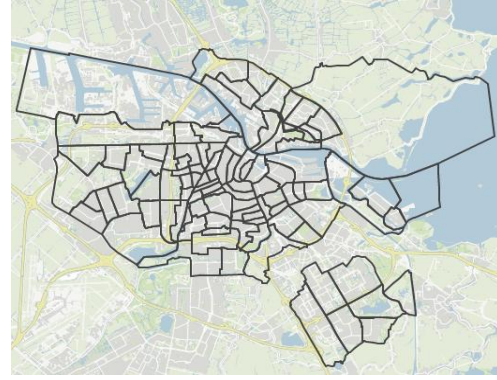
Figure 1. neighborhoods according to Airbnb	Figure 2. neighborhoods according to CBS

The second and third variable are respectively the mean distance to the railway station (*distance_rs)* and the number of public transport stops (*ptstops)*. From the existing literature can namely be derived that people find accessibility important when they are choosing a hotel or destination. The data of the railways stations retrieved from the CBS were also divided into different neighborhoods than the neighborhoods from Inside Airbnb. At the same way as described above the different neighborhoods from the CBS were taken together to create the same neighborhoods as from Inside Airbnb. The average distances to the railway stations are added together and created the variable *distance_rs.* The variable *ptstops* shows the absolute number of public transport stops in the different neighborhoods classified by Airbnb. The public transport stops include the stops of the subway, tram, bus and ferry.

According to the theoretical framework it seems that safety has also an influence on the demand of hotels, therefore the fourth variable will be called *safety*. From the database OIS of Amsterdam the safety index per neighborhood is retrieved. The safety index shows the safety per neighborhood. The lower the safety index, the more safe the neighborhood. The safety index is drawn up via two sources, namely via numbers of the police and via survey data. And it is the average of three other indexes, namely crime, nuisance and insecurity. The crime-index consists of police numbers and data of victims. In this index there is an distinction between High Impact Crime (HIC) and High Volume Crime (HVC). The crime-index is the average of the HIC- and the HVC-index. The nuisance-index consist also of police numbers and survey data. In this context means nuisance if people behave annoying against other people, objects of goods in public spaces. Examples are, loitering teen, street litter and vandalism. Within the nuisance-index there is a distinction between nuisance by people or against people and harm of the neighborhood. The nuisance-index is the average of these two indexes. The insecurity-index consist only of survey data and represents therefore only the opinion of the inhabitants. This index is divided into three elements: risk perception, insecurity experience and avoidance behavior. Risk

perception shows the chance to be victim of crime or nuisance. Insecurity experience shows how often people are feeling unsafe and avoidance behavior shows how often people avoid places because they feel there unsafe. The insecurity-index is the average of these three elements.

According to the existing literature it seems that the income of a hotel is influenced by other hotels in the neighborhood, due to agglomeration effects. To measure if agglomeration effects also influence the income of an Airbnb, the explanatory variable is *listings_nhood* is created. This variable shows the total number of Airbnb listings per neighborhood and will be used to determine if the number of listings in a neighborhood have an influence on the revenue of an Airbnb.

The last explanatory variable that will be discussed is called *citycenter*. As mentioned before is the data of the Airbnb listings divided into 22 neighborhoods. The variable *citycenter* is a dummy variable that gets the value 1 if the Airbnb listing is located in a neighborhood that is part of the city center of Amsterdam. If the Airbnb listing is located outside the city center the variable gets the value 0. This variable measures actually some other factors that are not included as other explanatory variables in the multiple regression models. For example, the city center contains often a historical part that attracts a lot of people. This variable is not a separate variable that included in the multiple regression models, but it can have an influence on the income of an Airbnb. This fact will therefore be taken in the variable *citycenter.* Table 1 shows the descriptive statistics about all the mentioned variables.

Table 1. Descriptive Statistics					
	Observations	Mean	Std. Dev	Min	Max
income2015	5668	1439.06	1967.43	27	34020
amenities	5668	910.84	700.91	3.1	2018.4
distance_rs	5668	2.05	1.03	0.975	6.40
ptstops	5668	62.44	17.03	28	118
safety	5668	102.29	20.02	73	142
listings_nhood	5668	570.69	312.44	10	1058
citycenter	5668	0.23	0.42	0	1

Methodology

The first step is to measure the correlation between the variables (see Table 1). The correlation indicates the cohesion between variables. As mentioned above is the correlation between cafés and restaurants 0.9850. This means that they are almost perfect positive correlated and that they explain the same in the model. Therefore it is better to take this two variables together. Also the correlation between safety and citycenter, listings_nhood and cafés and restaurants are high, respectively 0.8015, 0.8180, 0.8624. However, due to the large sample size (n=5668) may this not cause a problem in the tests.

Now the correlation between the variables is measured, the hypotheses can be tested. Therefore all the variables that are mentioned above will be used to built multiple linear regression models, using ordinary least squares (OLS). A multiple linear regression is an expansion of a simple linear regression model. With a multiple linear regression model it is possible to estimate the relation between a dependent variable and two or more independent variables. A multiple linear regression model looks like this:

$$\hat{Y} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n + \varepsilon$$

In this equation is $\hat{Y}$ is the value that will be predicted (also called the expected value or the dependent variable). The independent variables are X_1 till X_n. The intercept, β_0, gives the value Y when all the independent variables (X_1 till X_n) are equal to zero. The error term (ε) include all the other factors that determine Y, but which are not included in the model. Each coefficient shows the change in Y if one of the explanatory variables change with one unit. For example, β_1 shows the change in Y if X_1 changes with one unit, assuming that all other explanatory variables stay constant.

The first model that will be drawn is a simple regression model with one variable. As mentioned in the theoretical framework it seems that amenities, which will be measured in this research as the absolute number of cafés and restaurants, attract people. The expectation is that if more people are attracted to a city due to amenities, this can lead to a higher income for Airbnb's. Therefore in the first model will be tested what the influence of the variable *amenities* is on the income of an Airbnb. The model will look as follows:

$$income2015 = \beta_0 + \beta_1\, amenities + \varepsilon \qquad\qquad (1)$$

	income 2015	reviews 2015	citycenter	cafés	restaurants	distance_rs	ptstops	safety	listings_nhood
income 2015	1.0000								
reviews 2015	0.8082	1.0000							
citycenter	0.1954	0.1013	1.0000						
cafés	0.1436	0.0667	0.6548	1.0000					
restaurants	0.1390	0.0597	0.6075	0.9850	1.0000				
distance_rs	-0.0479	0.0069	-0.3341	-0.2656	-0.2753	1.0000			
ptstops	0.1209	0.0748	0.6911	0.3273	0.2905	-0.2309	1.0000		
safety	0.1516	0.0976	0.8015	0.4915	0.4097	-0.1796	0.5373	1.0000	
listings_nhood	0.0575	0.0075	0.1768	0.8180	0.8624	-0.1925	-0.1071	-0.0256	1.0000

Table 2. Correlation between variables

Beside amenities, it also seems that tourists appreciate it when there are public transport stops in the neighborhood of their hotel. Therefore the expectation is that Airbnb's that are located nearby public transport stops will probably be more attractive and obtain a higher income. To test this hypothesis two explanatory variables (*ptstops* and *distance_rs*) will be added to model 1 and this will give the following equation:

$$income2015 = \beta_0 + \beta_1\,amenities + \beta_2\,ptstops + \beta_3\,distance\_rs + \varepsilon \qquad (2)$$

People choose destinations where they feel safe. Therefore it is more likely that Airbnb's which are located in a safe neighborhood attract more customers. To measure if safety actually affects the income of an Airbnb, the following the model is set up:

$$income2015 = \beta_0 + \beta_1\,amenities + \beta_2\,ptstops + \beta_3\,distance\_rs + \beta_4\,safety + \varepsilon$$

$$(3)$$

Agglomeration effects have a positive influence on the income of hotels. With the following model will be tested if agglomeration effects also have a positive influence on the income of Airbnb's. Model 4 will looks as follows:

$$income2015 = \beta_0 + \beta_1\, amenities + \beta_2\, ptstops + \beta_3\, distance\_rs + \beta_4\, safety$$
$$+\beta_5\, listings\_nhood + \varepsilon \qquad (4)$$

Finally the explanatory variable *citycenter* will be included in the model. As mentioned in the theory, most activities take place in the central business center and therefore this industry attracts a lot of people, which creates a good potential market for Airbnb's. With the following model will be tested of Airbnb's that are located inside the city center obtain a higher income:

$$income2015 = \beta_0 + \beta_1\, amenities + \beta_2\, ptstops + \beta_3\, distance\_rs + \beta_4\, safety$$
$$+\beta_5\, listings\_nhood + \beta_6\, citycenter + \varepsilon \qquad (5)$$

For all the tests in this study will be looked at a significance level of 10, 5 and 1 percent. The significance level indicates how likely it is that a pattern in the data has arisen due to change. The most common significance level that is being used is 5 percent. This is also an appropriate significance level given the sample size. It means that the finding has a chance of 95% to be true.

Results

To research if location characteristics have an influence on the income of Airbnb's, several multiple linear regression models are set up. In this section the outcomes of the multiple linear regression models will be discussed. The results will be discussed in order of the models that are mentioned in the previous part.

The first model is a simple regression model. The only explanatory variable in the model is *amenities*, which indicates in this research the absolute number of cafés and restaurants. The results are being showed in Table 3. There can be seen that the explanatory variable *amenities* is significant at a significance level of 1%. Furthermore can be seen that *amenities* have a positive effect of 0.42 on the income of an Airbnb. This means that if there is one more amenity in the neighborhood, thus one more café or one more restaurant, this leads to an increase of €0,42 on the income of an Airbnb.

Table 3. Outcomes multiple regression models					
	Model 1	Model 2	Model 3	Model 4	Model 5
constant	1068.55***	771.31***	282.80	1734.33***	1417.20***
amenities	0.42***	0.34***	0.29***	1.07***	0.27
ptstops		9.09***	6.61***	-0.21	-0.42
distance_rs		-16.92***	-9.96**	0.93	7.75
safety			6.03***	-2.97	-2.30
listings_nhood				-1.62***	-0.40
citycenter					814.28***
N	5668	5668	5668	5668	5668
R-squared	0.0222	0.0318	0.0337	0.0364	0.0394

*, ** and *** indicate respectively that a variable is significant at 0.10, 0.05 and 0.01

To create the second model the explanatory variables *ptstops* and *distance_rs* are added to the first model. As can be seen in Table 3, all the explanatory variables are significant at a significance level of 1%. In model 2 the explanatory variable *amenities* changes a little bit, namely from 0.42 in the first model to 0.34 in the second model. Furthermore there can be seen that there is a positive relationship between the explanatory variable *ptstops* and the income of an Airbnb. The number 9.09 indicates that when there is one more public transport stop (subway, tram, bus or ferry stop) in a neighborhood, this increases the income of an Airbnb with €9.09, if all the other variable stay constant. From model 2 can also be seen that between the distance to a railway station and the income of an Airbnb there is a negative relationship. It

shows that if the mean distance to a railway station increases with one kilometer, the income of an Airbnb decreases with €16.91, when all the other variables stay constant.

In model 3 another location characteristic is added to model 2, namely the explanatory variable *safety*. Through this addition the coefficients change relative to model 2. The coefficients from *amenities, ptstops* and *distance_rs* change respectively to 0.29, 6.61 and -9.96. As can be seen in Table 3, the explanatory variable *distance_rs* is only significant at a significance level of 5%. However, the explanatory variables *amenities, ptstops* and *safety* are significant at a significance level of 1%. Furthermore there can be seen from Table 3 that there is a positive relationship between the safety of a neighborhood and the income of an Airbnb. Model 3 shows that the income of an Airbnb increases with €6.03 when the safety index increases with one and all the other variables stay constant.

In model 4 the location characteristic *listings_nhood* is added to the previous model. This addition causes that all the coefficients changes relative to model 3. The coefficients from *amenities, ptstops*, *distance_rs* and *safety* change respectively to 1.07, -0.21, 0.93, -2.97. Due to the addition of the explanatory variable *listings_nhood* the variables *ptstops, distance_rs* and *safety* are not significant anymore. The explanatory variables *amenities* and *listings_nhood* are both significant at a significance level of 1%. Furthermore can be seen from model 4 that the variable *listings_nhood* has a negative relationship with the income of an Airbnb. The coefficient shows that if there is one more Airbnb listing in the neighborhood, the income of an Airbnb decreases with €1.62, all the other variables held constant.

The final model consist of all the variables that are mentioned before and there is added a last variable called *citycenter*. This variable is the only variable that is significant at a significance level of 1%. All the other explanatory variables from the previous models are not significant anymore. The explanatory variable *citycenter* has a positive influence on the income of an Airbnb. From Table 2 can be seen that if an Airbnb is located at the city center the income of the Airbnb increases with €814.28, if all the other variables stay constant.

Conclusion and Discussion

In the existing literature there is not much known about the influence of location characteristics on the income of Airbnb's. The goal of this research was therefore an explorative research to gain more insight of the influence of location characteristics on the income of Airbnb's in Amsterdam. To examine this several multiple linear regression models were tested, using OLS.

From the results can be concluded that the variable *amenities* in model 1 till 4 has a positive significance influence on the income of an Airbnb. In previous research Ghose, Ipeirotis and Li (2009) found that amenities such as shops and restaurants have a positive on the demand of hotels. From this research can therefore be concluded that *amenities* also have a positive significant influence on Airbnb's and this is in line with hypothesis 1. It seems that Airbnb's which are located in a neighborhood with a lot of cafés and restaurants, earn a higher income than Airbnb's that are located in a neighborhood with only a few of these amenities. However, there are a lot more external amenities that can have an influence on the income of Airbnb. For example, the number of shops, historical buildings, museums etc. For further examination about the influence of location characteristics on the income of an Airbnb all these other amenities could taken into account. Furthermore, to create the same 22 neighborhoods from Inside Airbnb, some of the neighborhoods of the CBS were taken together. It is possible that a mistake is made while this was done, which also can cause a bias in the model. A possible bias can be that a big neighborhood and a small neighborhood, with almost the same number of cafés and restaurants, were taken together to create the neighborhood of Inside Airbnb. This created neighborhood will have about the same average number of cafés and restaurants as the big and small neighborhood, but the model does not show about which area it is measured.

In earlier research there is proved that the demand of hotels can be increased if they are located nearby public transport stops (Laws, 1995; Ghose, Ipeirotis and Li, 2009). In this research is examined if this also holds for Airbnb's that are located in a neighborhood with a lot of public transport stops (stops from the subway, tram, bus or ferry) or close to a railway station. From the results can be concluded that the number of public transport stops has a positive significant influence on the income of an Airbnb and that the distance to a railway station this has a negative influence on the income of an Airbnb according to model 2 and 3. These outcomes correspond with the expectations of hypotheses 2 and 3. In model 4 and 5 other location characteristics are added that may influence the income of an Airbnb, through this addition the variables *ptstops* and *distance_rs* are not significant anymore. This indicates that these other variables have also an influence on the explanatory variables and this causes a bias in the model.

For further research it is important that the distance to the railway station will be measured more accurate. It can be possible that the accessibility and agglomeration effects are confounded. Furthermore, in this research the distance to the closest railway stations from the 99 neighborhoods were added together, to create the 22 neighborhoods of Inside Airbnb. However because the neighborhoods were taken together this can display the wrong mean distance to the railway stations.

According to model 3 there can be concluded that *safety* has a positive significance influence on the income of an Airbnb. However, a higher safety index shows that a neighborhood is relatively unsafe. Thus this is not in line with the findings from the previous mentioned literature, which found that an unsafe destination is less attractive than a safe destination. According to model 4 and model 5 the coefficients change to negative values, but these values are not significant. A reason for this is that is it possible that safety is measured at different levels. If people visit a city most of the time they look at the overall safety of the city and not at the safety per neighborhood. Therefore it can be that safety does affect the demand for an Airbnb, not on level of the neighborhood but on level of the city. This can be taken into account in further research.

From the theoretical framework can also be seen that hotels can profit from the proximity of other hotels. In this research is tried to find if the other Airbnb listings have an influence on the income of an Airbnb. From the results can be concluded that if there are a lot of other Airbnb listings in a neighborhood the income of an Airbnb decreases. This result does not correspond with hypothesis 5. A reason for this can be that an Airbnb is not the same as a hotel and therefore there are no external benefits to profit. In further research the influence of agglomeration effects on an Airbnb can be researched more extensively.

The last location characteristic that is tested and may have an influence on the income of Airbnb's is the variable city center. From the results can be concluded that when this variable is added to the existing model all the other variable change to insignificant variables. This can mean that within this variable there are more location characteristics that influence both the other explanatory variables and the dependent variable. In further research there must be tried to identify this other explanatory variables and add them separately to the model.

Finally, based on the hypothesis can be concluded that location characteristics such as amenities and public transport stops do have a positive influence on the income of Airbnb's. However, the more variables that are included in the model the more insignificant the models are. It is possible that there are more variables, such as shops, museums and historical buildings,

influence the dependent and independent variables, which are not included in the model and therefore cause a bias in the model. With this research there is made a start to find location characteristics that can influence the income of an Airbnb in Amsterdam. In further research the model can be expanded and measured more accurate.

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