How Stoners Affect the Price of Stones: Revealing Homeowners' Preferences Against a Cannabis Store Nearby Their House.

Author: Hille G. J. Schouwink
School of Business and Economics, Vrije Universiteit Amsterdam
Student Number: 2545241
Programme: Spatial, Transport, and Environmental Economics (STREEM)
Supervisor: Jos Van Ommeren
Submission Date: 29/06/2020

Abstract

Cannabis stores (coffeeshops) in the Netherlands are often associated with negative phenomena such as crime and nuisances. Thus, it could be the case that a cannabis store nearby is perceived as a dis-amenity by homeowners. Therefore, this paper investigates what the effect of a cannabis store is on nearby transaction house prices in Amsterdam. Making use of two datasets, combining information on 58,159 housing transactions in Amsterdam and cannabis store locations between 2003 and 2017, a hedonic pricing analysis is conducted. The results show that, up to 50 meters away from a cannabis store, a house is economically significantly negatively affected. The price decreases with approximately 2.3% up to 50 meters. The negative effect is stronger when the house is located within 20 meters of a cannabis store and diminishes when the distance increases to further than 50 meters. Hence, a cannabis store is perceived as a dis-amenity by nearby households. Furthermore, the price of a house increases more when the next incumbent of the building of a former cannabis store is not in the retail industry compared to buildings that remain in the retail industry. Quantifying the results, in Amsterdam, each cannabis store causes a welfare loss of approximately €525,000 to €800,000 to surrounding households. By reducing the number of cannabis stores between 2003 and 2017, the municipality of Amsterdam created a welfare gain of at least €43,000,000.

Keywords: cannabis store, coffeeshop, cannabis, dis-amenity, negative externality, house price

Table of Contents

How Stoners Affect the Price of Stones: Revealing Homeowners' Preferences Against a Cannabis Store Nearby Their House.

1. Introduction

The Netherlands, and especially Amsterdam, have long been (in)famous for its liberal 'gedoogbeleid' (toleration policy) surrounding soft drugs such as cannabis. Where around the world cannabis is illegal, and possession and usage are prosecuted severely, in the Netherlands there are stores where one can 'legally' buy consumer quantities of hasj or weed. 'Legally' because it is formally still illegal to possess and sell cannabis, but the sale and possession of fewer than 5 grams of cannabis are 'gedoogd' (tolerated) and not prosecuted (Rijksoverheid, 2020). These cannabis stores are called coffeeshops in the Netherlands. A coffeeshop (from here on referred to as cannabis store) is defined as: "a non-alcoholic catering establishment where trade in cannabis products takes place and where the operator is in possession of a government-issued cannabis toleration permit" (Gemeente Zwolle, 2009). Yet, the production and possession of larger quantities of cannabis is still illegal and prosecuted (Sangers, N.D.). This creates a grey area where crime mixes with the decriminalized world. To get their cannabis, a cannabis store has to trade with criminal cannabis growers. Because they operate in this grey area, cannabis stores are often associated with negative phenomena such as crime and nuisance (Bieleman & Snippe, 2006; Schravezande, 2017).

Following this dubious reputation, one would expect that people prefer not to live in the close proximity of a cannabis store. People would prefer to live in a house that is not near a cannabis store, rather than in the identical house that only differs in the fact that it is located nearby a cannabis store. It has, however, not been investigated whether living in the close proximity of a cannabis store actually matters for homeowners. Often, it is simply assumed that cannabis stores have a negative impact on its neighbors (BCD, 2019).

In economics, one can investigate whether someone prefers not to live in the close proximity of something like a cannabis store. In the economic literature, the valuation of something nearby one his house can be found in the topic of (dis-)amenities. An amenity can be defined as: "A desirable or useful feature or facility of a building or place*"* (Oxford Dictionary, n.d.-a). Things such as nearby parks (Poudyal et al., 2009), transportation access (Levkovich et al., 2016), and good schooling in the neighborhood (Bayer et al., 2007) are often described as amenities. On the other hand, a dis-amenity can be defined as: "The unpleasant quality or character of something*"* (Oxford Dictionary, n.d.-b). For example, pollution (Greenstone & Gallagher, 2008), noise (Theebe, 2004), and crime (Gibbons, 2004) nearby are valued as dis-amenities. Economically, people should be willing to pay less for a house that is

next to a lot of noise pollution compared to the same house that is not affected by noise pollution.

It could be possible that being nearby a cannabis store is also a dis-amenity. If people do not like cannabis stores in their close proximity, for example, because crime happens there, cannabis stores can be seen as a dis-amenity. The cannabis store is a negative attribute of the neighborhood of a house. In that case, all else equal, they would be willing to pay less money for a house that has a cannabis store in the neighborhood compared to the same house when there is not a cannabis store in the neighborhood. Whether people value a cannabis store as a dis-amenity has, however, to the best of my knowledge, never empirically been investigated. Yet, an empirical study into the effects of a cannabis store nearby can add valuable insights both from a theoretical and practical perspective.

This study adds valuable insights to the theoretical knowledge on the topic of (dis-) amenities. Certain kinds of amenities have frequently been studied. For example, crime, pollution, and schooling have frequently been studied. These are often amenities a government can directly impact by changing regulations. Yet, other (dis-)amenities are understudied. For example, the effects of a nearby supermarket, bar, or restaurant on the price of houses remain yet to be investigated. These are (dis-)amenities that a government does have no direct impact on. This study adds the valuable insight into the effect that a commercial (dis-)amenity, a cannabis store in this case, can have on the surrounding house prices. Furthermore, it is important to expand the knowledge base on amenities; if certain phenomena are (dis-)amenities and if so, how big the impact of that (dis-)amenity could be.

From a practical perspective, investigating the effects of cannabis stores on surrounding houses adds valuable insights into the discussion on cannabis and cannabis stores in the Netherlands. In the Netherlands, there is currently a debate on whether the national government should legalize cannabis (Haenen, 2019). Furthermore, in Amsterdam, there is a debate about whether cannabis stores should be relocated away from the city center, mainly in the battle against nuisances and crime (Couzy, 2020). The results of this study can add valuable insights into this debate; whether and to what extent do homeowners actually perceive a cannabis store as a dis-amenity. Also, from a concrete policy perspective, this study adds valuable insights. When a municipality is faced with the decision if and where they should allow cannabis stores to open for business, information on the effect of cannabis stores on surrounding houses should be an important aspect in (not) allowing a cannabis store to open in a certain area. Therefore, this study will investigate what the effect of a cannabis store is on the prices of nearby houses.

The research question that follows is:

*"**To what extent** does a cannabis store have an effect on nearby house prices"?*

This paper combines a highly detailed dataset on house prices in Amsterdam from 2003 until 2019 with a dataset containing information on all the cannabis stores in Amsterdam from 2003 until 2017. Thereby, we can calculate for every house whether there is a cannabis store nearby. The paper uses a hedonic pricing approach to identify the effect of a cannabis store nearby on house prices.

The results of the paper show that a cannabis store has a negative effect of approximately 2.3% on houses up to 50 meters away. The effect is stronger for houses that are located very near a cannabis store and the effect becomes marginal when a house is located further than 50 meters from a cannabis store.

The rest of this paper is structured as follows. The next section discusses the theoretical framework and related literature. Section 3 gives an overview of the history of cannabis stores in the Netherlands and the current situation regarding cannabis stores in the Netherlands. Section four contains a description of the data and definitions. Section five discusses the descriptive statistics of the variables used in this study. Section six contains the methodology used in this study. Further, section seven reports the results. Lastly, section eight discusses the results and concludes.

2. Theory & Literature Review.

a. Theoretical Foundation.

The theoretical reasoning behind the hypotheses and the research question stems from the economic area of amenities. As defined earlier, an amenity is "a desirable or useful feature or facility of a building or a place" (Oxford Dictionary, n.d.-a), where a dis-amenity then follows as an unpleasant characteristic of a building or place (Oxford Dictionary, n.d.-b).

If a feature can be defined as an amenity, it follows that people are willing to pay to have that amenity around their house. After all, their house has a feature that is desirable. Thus, people are willing to pay extra to have that. A nearby park or nearby sports facilities can be examples of amenities (Wen et al., 2014; Chun-Chang, 2010). For dis-amenities, on the other hand, people are only willing to accept that dis-amenity around if they can pay less for the house than when the dis-amenity is not around. Their house is less desirable than a house that does not have that dis-amenity around. Thus, they would be willing to pay less for that house, or they would be willing to pay more for a house that does not have that dis-amenity nearby. Examples

of dis-amenities can be noise pollution from aircraft (Affuso et al., 2019) or high crime rates in the area surrounding a house (Gibbons, 2004).

Generally, there are two different methods one can use to investigate whether something is a (dis-)amenity and how much people are willing to pay (accept) to have that (dis-)amenity in their area. The first method is the stated preference method, where one is asked how much he/or she is willing to pay to (avoid to) live with some characteristic such as a parking place, park nearby, or airport noise. Yet, this method has significant drawbacks as the results can be biased by the hypothetical bias; there is a difference between what people think they want to pay and what they really want to pay (Loomis, 2013). The other branch of methods is the revealed preference method. In this method, the value of a (dis-)amenity is observed using actual choices people have made. The revealed preference method uses real-world data, such as housing transaction prices, to estimate the effect of a (dis-)amenity. Because this method can distill how people valued a (dis-)amenity in the real world, this paper will use a revealed preference method.

The revealed preference methods that will be used in this study to quantify the effect of cannabis stores nearby are based on the hedonic pricing method by Rosen (1974). In the hedonic pricing method, the price of a house is the sum of the different characteristics and features of that house (Rosen, 1974). In other words, the value of a house is composed of internal factors such as the quality of the building and size as well as external factors such as noise, location, and view. Put simply, when one controls for all other characteristics and features, the difference in price between two houses but with or without a cannabis store is a way to reveal the preference to live with a cannabis store nearby. The difference in the price is then the effect of a cannabis store on nearby property. If the price of a house is significantly lower, one can argue that a cannabis store nearby is a dis-amenity; people want to avoid living next to a cannabis store. If the price would be significantly higher, a cannabis store would be an amenity as people pay a premium to live nearby a cannabis store. In the methodology section, we will go more in-depth on the model specification used by this hedonic pricing method.

Amenity or Dis-amenity? A sizeable amount of economic literature has been conducted on the economic effects of various (dis)-amenities on the price of property to quantify the economic effects of certain (dis)-amenities.

Whether something can be defined as an amenity can sometimes be relatively straightforward. For example, it has been found that higher school quality has a positive effect on nearby house prices (Bayer et al., 2007; Figlio & Lucas, 2004). When a house is in a district with better schooling, it provides a premium compared to a similar house but without access to

the better schools. Also, environmental features where people can recreate nearby are generally seen as an amenity. A lake (Wen et al., 2014), a nearby park (Poudyal et al., 2009), or an attractive landscape (Luttik, 2000) all are amenities that increase the price of nearby houses. Even the net effect of living in the proximity of a Wall-Mart is an amenity. Pope & Pope (2015) finds that the sales price of houses within one mile of a new Wall-Mart increases up to 2% compared to homes that are further away. The advantages of the easy access to the Wall-Mart outweigh the disadvantages of more traffic and noise pollution (Pope & Pope, 2015).

Though, whether a feature is an amenity or a dis-amenity is often more complex. For example, the effects of increased transportation availabilities can be both an amenity and a dis-amenity. Better access to different transportation options is an amenity for which people want to pay. Though, the noise pollution caused by transportation is a dis-amenity someone wants to avoid.

Better highway access increases house prices, yet the noise from the highway decreases the price of nearby homes (Levkovich et al., 2016). Combining the positive access effect and the negative noise effect, the total highway amenity effect is positive in the Netherlands (Levkovich et al.,2016). Also, for airports, the proximity to an airport is an amenity (Cohen & Coughlin, 2008). Yet, the nuisances caused by planes flying over are a dis-amenity because the noise they pollute leads to significantly lower house prices (Affuso et al., 2019). In contrast to highways, where the net effect is perceived as an amenity, for Memphis International Airport, the net effect is perceived as a dis-amenity (Affuso et al., 2019). Research into public transportation has shown that access is perceived as an amenity that increases the price of property (Grimes & Young, 2013; Dubé et al., 2013). Yet, the noise that is perceived when one lives nearby train tracks is a dis-amenity, which has a lowering effect on the house prices (Debrezion et al., 2010; Portnov et al., 2009). The net effect of whether different transportation options are perceived as an amenity or a dis-amenity depends on the levels of access that is gained and the nuisance that is created by the transportation option.

Dis-amenities are more than traffic noise pollution. Environmental pollution such as man-induced earthquakes (Koster & van Ommeren, 2015) and waste disposal sites (Greenstone & Gallangher, 2008) also lead to significantly lower housing prices in the surrounding area. Crime is perceived as a dis-amenity too (Gibbons, 2004; Linden & Rockoff, 2008). But also, wind turbines (view pollution) (Sunak & Madlener, 2017) and hog farms nearby (stench) are dis-amenities (Simons et al., 2014). Even building low-income houses in the area is perceived as a dis-amenity by richer households (Funderburg & Macdonald, 2010). Concluding, a lot of

different kinds of locational features can be perceived as an amenity or a dis-amenity by surrounding households.

b. Cannabis (stores).

Commercial Consumer Activities. Cannabis stores can be seen as a form of commercial consumer activity. Economic literature that investigates the effects of commercial consumer activities in general such as sports facilities, bars, or shops in the proximity of a house on the price of that house is scarce. Yet, some research has been conducted. Both sporting facilities where one can do sports (Chun-Chang, 2010) and facilities where one can watch professional sports (Feng & Humphreys, 2016) have been shown to be positive amenities for nearby households. Furthermore, shopping centers are also seen as a positive amenity. In China (Zhang et al., 2018) and Canada (Des Rosiers, 1996) shopping centers have a positive effect on nearby house prices, which becomes lower as the distance increases. Also, in the Netherlands, commercial activity has a positive effect on surrounding house prices. Koster & Rouwendal (2012) find that "Business services, education and healthcare, leisure and retail activities are valued positively by households" (P. 753). Further, they estimate that a good mix of the above activities in an area can increase housing valuation by up to 6%. Thus, a diverse mix of land use for consumer activities is valued as an amenity by consumers.

Cannabis. This study focuses on the external effects of cannabis stores; whether they are perceived as an amenity or a dis-amenity by nearby households. The literature on the spatial effects of things like cannabis and cannabis stores is scarce. However, there is some literature that can shed some insights into the effects. The state of Colorado in the United States fully legalized cannabis in 2014; before 2014, cannabis was only allowed to be used and sold for medical purposes (Conklin et al., 2017). Cheng et al. (2018) studied the effects of cannabis legalization at the municipal level. When a municipality legalized the sales of cannabis, house prices went up approximately 6% compared to municipalities that did not legalize cannabis sale (Cheng et al., 2018). Conklin et al. (2017) investigated the effects of the transformation of medical cannabis dispensaries to legal commercial cannabis stores on nearby property prices in the capital of Colorado. They find that houses within 150 meters of a medical dispensary that switched to a cannabis store increase in value with approximately 8% compared to homes that are between 150 and 400 meters away. Both studies find that homeowners in the United States perceive legal cannabis accessibility as an amenity.

A difference, however, between cannabis stores in Colorado and the cannabis stores in the Netherlands, which are investigated in this paper, is that cannabis is, from production to retail, completely legalized in the state of Colorado. In contrast, in the Netherlands only selling

cannabis to consumers and possessing consumer quantities of cannabis is tolerated. Formally, it is still illegal. The production side is even still illegal and prosecuted. The next section of this paper goes more in-depth on the current cannabis situation in the Netherlands.

Also, between 2001 and 2002, the London borough of Lambeth experimented with depenalizing the possession of small amounts of cannabis. Adda et al. (2014) studied the effect of the depenalization on property prices. They document that the depenalization of cannabis in Lambeth led to a 5% reduction in property prices in the years after. This effect continued to be present even years after the experiment ended and cannabis was penalized again (Adda et al., 2014). The study attributes the effect to an increase in both consumers and dealers of cannabis into the borough. It became more attractive for consumers to buy and smoke cannabis in Lambeth as opposed to other boroughs in London because the penalties were reduced, which increased the number of dealers serving the market (Adda et al., 2014). Thus, the borough saw a form of drug-tourism arise. 'Tourists' from within the London area came to Lambeth to buy and smoke cannabis. Consequently, the nuisance of the cannabis consumers and dealers increased. The argument was further supported by an investigation into drug 'hotspots' in Lambeth. These areas saw a steep increase in substance sales and usage around these hotspots after the depenalization in Lambeth. Consequently, the house prices dropped, with 13.8%, harder around the hotspots than in the rest of Lambeth (Adda et al., 2014).

The results of Adda et al. (2014) can be interpreted in two ways. First, the effect of illegal, though depenalized, cannabis sales and consumption in a neighborhood are perceived as a dis-amenity by nearby households because the price of property dropped in Lambeth after the depenalization of small amounts of cannabis possession. Second, the nuisance of cannabis sales and consumption is likely spatially concentrated. It is not only the fact and dislike that small amounts of cannabis are depenalized that lowers the house price, it is the nuisance from illegal sales and consumption of cannabis that affect nearby houses that seems to be the main driver of the reduction in the prices.

Cannabis Stores in the Netherlands. Research on the effects of cannabis stores on nearby house prices in the Netherlands, or in Amsterdam specific, is, to my knowledge not existing. Though, whilst the author was drafting this paper, Bruijn & Ribas (2020) published a draft of their research into the effects of cannabis stores on nearby house prices. They tentatively find that households in the Netherlands are willing to pay a premium of 2-7% to be more than 0.3 miles away from a cannabis store (Bruijn & Ribas, 2020).

Research into adjacent topics, however, can shed some light on the possible effects that a cannabis store has on nearby properties. In the Netherlands, cannabis stores are frequently

linked to crime (Bieleman & Snippe, 2006; Van der Boom & Van Eijk, 2017) and nuisances (Beelen et al., 2009; Couzy, 2020). Furthermore, cannabis stores could also be considered a disamenity because homeowners find (recreational) cannabis consumption obscene. A lot of people think that drugs, including cannabis, are generally bad and should be prosecuted (Eggink, 2014; Stichting Maatschappij & Cannabis, 2019). It could be that homeowners do not want to be associated with cannabis and therefore perceive a cannabis store nearby as a disamenity. Research into the effects of crime, nuisances, and obscenity on the price of a house has been conducted and gives more insight into how homeowners in Amsterdam could value a cannabis store nearby their house.

Crime. The effect that crime nearby has on property prices has been studied quite frequently. Generally, studies find that crime in an area lowers the price of houses in the area (Gibbons, 2004; Adda et al., 2004; Linden & Rockoff, 2008). There, however, is a difference in how different kinds of crimes affect nearby house prices. Crimes that are violent in nature, such as robberies and assault have a much bigger negative effect on nearby house prices than non-violent crimes such as burglaries and petty theft (Ihlanfeldt & Mayock, 2010; Lynch & Rasmussen, 2001).

Furthermore, the association with violent crime and subsequently the fear of being affected by that violent crime seems to be a big influence the house prices. Gautier et al. (2008) find that, after a Muslim-terror attack in the Netherlands, house prices in neighborhoods with a high percentage of Muslims dropped compared to the rest of the sample. Fear of being affected by a future terror attack affected the house prices. Also, in London, a study on domestic property crimes show that criminal damage crimes such as graffiti vandalism have a negative effect on the price of nearby houses whilst burglaries do not affect the price of nearby property (Gibbons, 2004). They explain these differences in that the price of houses is mainly affected by the fear of crimes rather than crimes themselves. Also, in the United States, where sex offenders are forced to publicly register their address, house prices drop when a sexual offender is registered nearby (Pope, 2008; Caudill et al., 2014). Again, the fear of being affected by a violent crime, sexual in nature this time, is something that people are willing to pay to avoid.

For cannabis stores in the Netherlands, a similar mechanism can be in play. As will be explained in the next section, cannabis stores cannot legally buy the cannabis they sell, they are criminal in nature. Therefore, cannabis stores are attractive to criminal people, they have the infrastructure and the knowledge to deal with criminals. A study into the entrepreneurs behind cannabis stores in Amsterdam confirms this image. 79% of the cannabis store owners in Amsterdam are known by the police for felonies (Bieleman & Snippe, 2006). Also, cannabis

stores are frequently affected by visible, violent crimes such as extortion (AT5, 2018; Van den Heuvel & Van Wely, 2016), shootings (Knura, 2018; Van Weezel, 2016) and grenades in front of the door (Parool, 2019). It could be that homeowners associate cannabis stores with these violent crimes. Fear of being affected by these crimes by living in the area of a cannabis store can be a reason to avoid living nearby a cannabis store. Hence, they are willing only to pay less for a house that is nearby a cannabis store compared to houses that do not have a cannabis store nearby.

Nuisances. Bieleman et al. (2009) find that cannabis stores also are a cause of nuisances to nearby residents. The most prevalent nuisances are nuisances caused by traffic, where customers of cannabis stores cause congestions or park their vehicles wrong (Bieleman et al., 2009). The other related nuisance is caused by the visitors of a cannabis store lingering around the cannabis store. They linger in the vicinity of a cannabis store or consume their cannabis in the vicinity of a cannabis store, causing nuisances to local residents and leave litter behind (Bieleman et al., 2009; Benschop et al., 2015). Furthermore, many tourists visit Amsterdam with the main purpose of consuming cannabis (Couzy, 2020). They frequently cause nuisances around the cannabis stores in the city center of Amsterdam (Couzy, 2020).

Nuisances are also a form of a dis-amenity that lead to lower house prices (Sunak & Madler, 2017; Affuso et al., 2019). It could be the case that the nuisances caused by customers of cannabis stores are perceived as a dis-amenity. People then are only to be willing to pay less for a house that is nearby a cannabis store compared to houses that do not have a cannabis store nearby.

Obscenity. An ‘obscenity’ effect can also be present surrounding the preferability to live around a cannabis store. The obscenity effect is the effect that people prefer not to live next to phenomena they find obscene.

In the Netherlands, Giambona & Ribas (2018) studied the effect of prostitution on house prices. Although prostitution has been legal in the Netherlands since 2000, the authors argue that it is a ‘sinful business’ and is ‘obscene’. Many people are against prostitution and adultery is seen as immoral in many cultures and religions. In Amsterdam, the prostitution area is concentrated in the red-light district. Compared to similar houses on the other side of the canal, and thus not in the red-light district, houses in the red-light district are sold for 10% less. When the houses are located next to a prostitution window, the price of the houses drops even further, they are sold for 30% less. The authors argue that people are against the visibility of a sinful, obscene business around their home. They prefer to live in areas that are not associated with prostitution.

Another example study can be found in the United States, investigating the effect of methamphetamine labs on house prices. They find that discovering a clandestine methamphetamine lab causes nearby house prices to drop with 6.5% (Dealy et al., 2017). This is in line with previous findings that people avoid living next to crime. However, even after decontaminating the methamphetamine lab, the price of nearby houses was still 1.5% lower compared to houses that never had an illegal methamphetamine lab next to them (Dealy et al., 2017). The authors of the paper argue that the decrease in the price is caused by a stigma effect that is present in the area around a former methamphetamine lab.

The obscenity or stigma effect can also be present for cannabis stores. Whilst cannabis stores are tolerated in the Netherlands, they are still formally illegal. Further, the 'back-door' of the cannabis store, where they get their cannabis from producers, is both formally and practically illegal. Also, a lot of Dutch citizens think that drugs, including cannabis, are generally bad and should be prosecuted (Eggink, 2014; Stichting Maatschappij & Cannabis, 2019). In 2014, a 2/3rd majority of the respondents to a poll from a Dutch right-wing newspaper were in favor of closing all cannabis stores (Eggink, 2014). Furthermore, 47 of the 150 seats in the Dutch parliament are in the hand of political parties that explicitly want to close all cannabis stores (Stichting Maatschappij & Cannabis, 2019). People are, also politically, vocal about their dislike of cannabis. This makes cannabis 'obscene'; it goes against the morality of the time. It could be the case that homeowners do not want to be associated with this obscene behavior. Thus, they would prefer not to live next to a cannabis store for this reason. They are only willing to pay less for a house that is nearby a cannabis store compared to a house that is not nearby a cannabis store.

Hypothesis. To conclude, many local features of a house can be described as amenities or dis-amenity that have a significant effect on surrounding house prices. In the literature, commercial consumer activities, which a cannabis store also is, are generally perceived as an amenity in an area. However, for cannabis stores, the situation is more complicated. Cannabis stores are associated with crime and nuisances in the area around the cannabis store. Furthermore, a cannabis store can also be perceived as an obscene feature of an area.

From both a crime, nuisance, and obscenity perspective, the literature indicates that cannabis stores are perceived as dis-amenities. People want to avoid living in areas where those features are present. Hence, they are only willing to pay less for a house that has those features. As a cannabis store is linked to these features, people also want to avoid living next to a cannabis store. Thus, they are only willing to pay less for a house that is nearby a cannabis store compared to a house that is not located nearby a cannabis store.

Therefore, the following hypothesis is formulated:

> **Hypothesis 1:** The transaction price of a house is lower when a house is located nearby a cannabis store compared to a house that is not located nearby a cannabis store.

3. An Overview of Cannabis (Stores) and the Netherlands.

In this section, an overview of the history behind tolerating cannabis and the current situation of cannabis and cannabis stores in the Netherlands and in Amsterdam specific are discussed.

a. A Brief History of Cannabis (Stores) in the Netherlands.

In 1928, cannabis became officially illegal in the Netherlands as the Netherlands formalized the Geneva Opium Convention of 1925 into Dutch law (Informatiecentrum Cannabis, n.d.). Until the 1960s, cannabis in the Netherlands was not really an issue; there were barely any users. However, with the rise of the hippie movement, the usage of cannabis was rising amongst youngsters in the Netherlands (Jellinek, 2015). Initially, cannabis was prosecuted the same way as much more harmful drugs such as cocaine and heroin. This led to increasing criticism from experts and the public (Meeus, 2014).

After small-scale, successful, experiments with tolerating cannabis on festivals, prosecution of cannabis became less of a priority for the police, and legalizing cannabis became an item on the political agenda (Jellinek, 2015). In 1972, the first cannabis store like the one we have today opened. This cannabis store was not officially tolerated like current cannabis stores are, but it was not actively prosecuted by the government either (Jellinek, 2015). Between 1972 and 1976 more cannabis stores arose. Also, the government tolerated night clubs appointing their own house-dealers, who were only allowed to sell cannabis, to minimize nuisances outside (Jellinek, 2015). Yet, legally, there was no distinction between the penalties on cannabis and hard drugs such as cocaine and heroin.

In 1976, the laws regarding drugs changed in the Netherlands. Cannabis was now labeled as a ‘soft-drug’, whilst other drugs such as heroin and cocaine were labeled as ‘hard-drugs’. These ‘hard-drugs’ are considered as completely unacceptable. From this moment, cannabis, as a ‘soft-drug’ was prosecuted less harsh than ‘hard-drugs’. House-dealers were officially tolerated by municipalities if they did not have hard drugs on them, made no advertisements, and did not have too much cannabis in their possession (Jellinek, 2015).

In 1979, the Dutch government came with a written directive to tolerate house-dealers in night clubs (Meeus, 2014). This formalized the toleration of cannabis usage and cannabis sales to consumers. Furthermore, it allowed municipalities to make arrangements with cannabis stores and house-dealers. This de-facto, but not de-jure, legalized the existence of cannabis

stores in the Netherlands; local governments made formalized arrangements with cannabis stores and house dealers on which premises they were allowed. Yet, the production side of cannabis to the cannabis stores was, and still is, illegal and prosecuted (Meeus, 2014).

Because cannabis stores led to nuisances, the Dutch government tightened the directive for cannabis stores in 1996. Since 1996 the cannabis stores have to formally adhere to the following criteria (the AHOJG-criteria) to ensure that the nuisances remain low: No advertisements, no hard-drugs, no sale to persons below 18, no sale of more than 5 grams of cannabis per person per day, and no nuisances in and around the cannabis stores (Meeus, 2014). Furthermore, cannabis stores were not allowed to have more than 500 grams of cannabis in their store. Following the national tolerating criteria, since 1997, Amsterdam gives each cannabis store an operating license (Informatiecentrum cannabis, n.d.). When a cannabis store fails to adhere to the national toleration criteria or violates agreements with the municipality, the municipality revokes the license and the cannabis store must shut down.

The rules since 1996 have been put in place with the aim of reducing the number of cannabis stores in the Netherlands (Meeus, 2014). This led to the number of cannabis stores in the Netherlands to decrease from 846 in 1999 to 519 in 2014 (Jellinek, 2015). After a quiet hiatus in the early 2000s, the Dutch national government put again more stringent tolerance rules in place in 2013. To reduce the number of cannabis tourists, only Dutch citizens are formally allowed to enter a cannabis store. Though, most municipalities do not enforce this rule; Amsterdam even explicitly ignores this rule (Jellinek, 2015).

A last tightening of the Dutch cannabis rules was in 2014 when the Dutch national government decided that all cannabis stores within 250 meters of a high school or intermediate vocational education had to shut down (AT5, 2013). This is a noteworthy event because it was an exogenous shock that led to the closure of cannabis stores. Only the distance to a school was a factor in deciding whether a cannabis store had to shut down, not the potential nuisances caused by the cannabis store or violations of agreements.

For Amsterdam, this meant that 20 cannabis stores had to close between the first of January 2014 and the first of January 2017 (AT5, 2013). Amsterdam started to close cannabis stores within 250 meters from a school in three waves (Bieleman et al., 2015). The first wave consisted of 8 cannabis stores that had to close before the first of July 2014. These were cannabis stores that were directly visible from a school. The other cannabis stores within 250 meters of a school could remain open, but they were only allowed to remain open from 18:00 to 01:00. The second wave was on the first of January 2015, the four stores that were within 150 meters walking distance of a school had to shut down. The last phase of closings was on

the first of January 2017. The 8 stores that were between 150- and 250-meters walking distance of a school had to close. This resulted in a total of 20 cannabis stores that had to shut down due to an arbitrary exogenous governmental restriction.

Another noteworthy event is Project 1012. In 2009, the municipality of Amsterdam decided to improve the area of the red-light district of Amsterdam, named project 1012 after the postal code of the area (Rekenkamer Amsterdam, 2018). The area has been notorious for its many prostitution windows and cannabis stores which led to much crime, human trafficking, and nuisance in the area. The goal of the project was to both undermine the criminal infrastructure in that area and to increase the economic value of that area. The municipality did so by stricter enforcements of local rules, closing 48 cannabis stores, and closing 112 prostitution windows (Rekenkamer Amsterdam, 2018). Even though it closed a lot of cannabis stores and prostitution windows, the evaluation of the project indicated that it failed. The criminal infrastructure has not been broken (Rekenkamer Amsterdam, 2018). However, the economic upgrade was a success. Relatively to the other areas in Amsterdam, the price of houses in the 1012 area increased during Project 1012 (Rekenkamer Amsterdam, 2018).

b. The 'Coffeeshopparadox'.

Whilst the sales towards consumers is formally tolerated, and with the toleration sales to consumers de-facto legal, the production and 'business to business' trade of cannabis has always been and still is illegal and prosecuted (Meeus, 2014). This creates a paradox between the illegal 'backdoor' of the cannabis store and the semi-legal tolerated sale of cannabis at the front of the store. Cannabis stores are forced to operate within the illegal domain of society to obtain their merchandise. Even for cannabis stores, it is illegal to buy cannabis (Meeus, 2014). To be able to serve their customers, cannabis stores are forced to buy large quantities of cannabis from large illegal distributors (Panhuysen & Maalsté, 2015). Furthermore, because they are only allowed to have 500 grams of cannabis in their store, and most stores sell more than 500 grams of cannabis in a day, store owners have to keep secret stashes of cannabis around their cannabis store (Meeus, 2014).

This makes cannabis stores attractive to persons that do not feel like adhering to the law. A study that has investigated criminal behavior around cannabis store owners concludes that 79% of the investigated cannabis store owners in Amsterdam are known by the police for felonies and more than 50% have been convicted of a felony (Bieleman & Snippe, 2006). Furthermore, the illegality of the 'backdoor' of cannabis stores makes the stores also attractive to extortion and theft. Owners of cannabis stores cannot go to the police to report their too large quantity of cannabis as stolen. It happens often that the illegal stash of cannabis gets stolen (De

Kruijff, 2015) or that cannabis stores are extorted by criminals via bullets or grenades in front of the door (Van Den Heuvel & Van Wely, 2016). Because a cannabis store owner is likely to lose his tolerance statement and has to close when he admits that he has too much cannabis in his possession (De Kruijff, 2015), he cannot go to the police when he is extorted or robbed. Furthermore, because Dutch municipalities close every cannabis store that gets publicly extorted due to public safety concerns, it is a viable method to lower the competition (Van Den Heuvel & Van Wely, 2016).

Cannabis stores in the Netherlands are very profitable. It is virtually nonexistent that a cannabis store must close due to market forces. Bieleman & Snippe (2006) argue that because the number of cannabis stores declined since 2000 whilst the demand for cannabis was stable, profits for other cannabis stores must have gone up during the observation period. Furthermore, For the years 2014 and 2016 it was investigated why cannabis stores in the Netherlands, thus also in Amsterdam, had to shut down (Mennes et al., 2019; Benschop et al., 2015). All cannabis stores had to shut down because of a negative BIBOB advice[1] or because they violated the AHOJG-criteria and had to shut down for that reason. Hence, one can argue that the cannabis stores that had to close are the worst cannabis stores – they had the most associations with crime or caused the most nuisance.

To conclude, although cannabis stores have never been legalized in the Netherlands, the possession of small quantities and sales to consumers in cannabis stores has been officially tolerated since the end of the 1970s. Yet, as nuisances from cannabis stores increased, since 1996, the Dutch national government tightened the control which led to a reduction in cannabis stores since that period. Also, the municipality of Amsterdam has tightened the control of cannabis stores, and the amount of cannabis stores has gradually been declining. Further, the 'back-door' of the cannabis store is still illegal and heavily prosecuted. This makes the cannabis store business attractive to people with a criminal mindset. Furthermore, cannabis stores are frequently linked to nuisances and crimes.

4. Data & Definitions

This section discusses the data and definitions used in this study. Data sources used in this study are threefold.

[1] The BIBOB law allows municipalities to withdraw or deny permits because there is an indication that criminality facilitates the permit (Justis, N.D.).

a. Data

Housing Data. The main data source used in this study comes from the Dutch Association of realtors and valuators (De Nederlandse Coöperatieve Vereniging van Makelaars en Taxateurs in onroerende goederen, NVM). With over 4400 members the NVM is the largest branch organization of realtors in the Netherlands (NVM, n.d.). In cities such as Amsterdam, the members of the NVM handle more than 75% of all housing transactions (De Wit et al.,2013). Furthermore, De Wit et al. (2013) establish that the database from the NVM is unbiased and reliable.

Members of the NVM must report on all houses that are sold through an NVM realtor (De Wit et al., 2013). The database used in this study consists of all houses sold in the municipality of Amsterdam through an NVM realtor from 2003 to 2019. Information in the database consists of the sales-price, sales-date, time the house was offered on the market, asking price, address, location, and an extensive list of physical characteristics of the house (such as size, type of dwelling, and whether the house has a garden). Also, the maintenance state of the house is reported in the NVM database.

Retail Data. The data for cannabis stores and other stores comes from Locatus. Locatus is a private company that gathers data on all stores and consumer-oriented service providers in the Netherlands (Locatus, n.d.). For example, supermarkets and clothing stores, but also restaurants, bars, and repair services are in the database. Every year, they record, for every building with a retail function, the address, geographical location, whether the building is empty or not, the name of incumbent, the branch, industry, and sector the incumbent operates in. Hence, they also have extensive information on all cannabis stores that operated in Amsterdam. Because the Locatus database consists of the retail buildings rather than the retailers, the database also contains information on what happened to the retail building after a cannabis store had to shut down. The locates database ranges from 2003 until 2017.

250m Distance Criterion Stores Data. A last combination of sources is the third source of data. As mentioned in section three, 20 cannabis stores in Amsterdam had to close between 2014 and 2017 because they were located too close to a high school or intermediate vocational education (AT5, 2013). The data on the location and closing date of these cannabis stores comes from three sources. The main source is an English news website focusing on Amsterdam (DutchAmsterdam, 2016). They have an updated list of what cannabis store had to shut down when. The list was verified in the database of Amsterdam Coffeeshop Directory. The Amsterdam Coffeeshop Directory has a complete list of all cannabis stores in the Netherlands and information on whether they are still open or had to shut down (ACD, n.d.) The cannabis

stores on the list matched the status of the cannabis store on the directory of the Amsterdam Coffeeshop Directory website and a thorough Google search indicated that none of the cannabis stores were still operating.

After having verified which cannabis stores had to close and when that cannabis store had to shut down, the stores were marked in the Locatus database. The observations on the stores that had to close were marked in the Locatus database as a cannabis store that had to close due to the 250m-distance criterion as well as that their actual closing date was added to the observations of those cannabis stores.

b. Definitions

In this section, the definitions and specifications used in the empirical study will be elaborated on.

Postal Codes: PC4, PC5, & PC6. In the Netherlands, all addresses are given a 6-digit postal code. Four numbers and two letters. For example, 1012 AB is the postal code of the main train station of Amsterdam. The four numbers stand for the neighborhood an address is in. The two letters stand for the smaller neighborhood and (part of a) street and address is in. For this study, location fixed effects based on different levels of the postal code specification are used in the regressions.

The PC4 is the four-digit postal code of a neighborhood, for example, 1012. In Amsterdam, there are 81 PC4s, with approximately 5250 houses in each PC4 (De Haan, 2019). Calculating to size, it is approximately 0.875 km^2. Each PC4 has approximately 16 PC5s and 225 PC6s.

The PC5 is the five-digit postal code of a smaller neighborhood, for example, 1012A. This five-digit postal code is calculated from the PC6 by removing the last letter of the postal code. For example, 1012A. The PC5 is between the PC4 and the PC6 in size and number of houses. There are 1172 PC5 areas in Amsterdam (De Haan, 2019). Each PC5 contains approximately 380 houses. It has a size of approximately 0.063 km^2 or a circle with a radius of 141 meters. Per PC5, there are, on average, 16 PC6s per PC5.

The PC6 is the six-digit postal code. The postal code refers to one side of a street. In urban areas, such as Amsterdam, a postal code is usually only a part of a street. In Amsterdam, a PC6 consists of approximately 23 houses (De Haan, 2019). In Amsterdam, there are 18,280 PC6s (De Haan, 2019).

Cannabis Store. As has been defined earlier, a cannabis store is a store that is legally tolerated to sell cannabis to consumers. These stores are identified by the Locatus database. By year, there is information on their name, address, and geographical information. In Amsterdam,

there were 254 cannabis stores at the start of the observation period in 2003, and at the end of the observation period, in 2017, 172 remain.

250m Distance Criterion Store. As discussed in section three, some cannabis stores had to shut down because of changing arbitrary governmental regulations. In Amsterdam, all cannabis stores that are located within 250 meters walking distance of a high school or intermediate vocational education had to shut down between 2014 and 2017. Because these stores had to shut down more or less arbitrarily, it could be that the effect that these stores had on the price of nearby houses is different than for the other cannabis stores that had to shut down. As argued before, cannabis stores are all very profitable. They only shut down when their license gets revoked or because they failed to adhere to national rules. It could be argued that the effect of cannabis stores on the house prices, in general, is overestimated because the closing cannabis stores are the worst cannabis stores. Thus, it will also be analyzed whether the 250m distance criterion stores have a different effect on the price of a house than the other cannabis stores. The stores that had to shut down due to the 250m distance criterion are defined as the 250m distance criterion stores ("250m-stores" onwards).

No-250m Distance Criterion Store. The 250m-stores are compared against all other cannabis stores. All the cannabis stores in Amsterdam that did not have to shut down due to the 250m distance criterion are defined as "no-250m-stores".

The Function of the Building After the Cannabis Store had to Shut Down. The Locatus database contains information on the retail buildings rather than on the retail stores in the Netherlands. Therefore, there is also information on what happened with a retail building after the cannabis store had to shut down. In total, 169 cannabis stores had to shut down between 2003 and 2017. 63 (37%) of the buildings lost their retail function after the cannabis store had to shut down. A Google and Google Maps search on 10 of those addresses indicates that approximately 50% of those buildings end up being residential buildings and another 50% into office spaces.

Furthermore, 77 (45%) of the buildings remained in the hospitality industry after the cannabis store had to shut down. Especially cafés (33) and restaurants (27) are frequent functions for the building after the cannabis store has left. The other 29 retail buildings end up as stores (such as clothing) or in the consumer service industry (such as barbers).

It could be the case that it matters for the price of a house what happens with a retail building after the incumbent cannabis store had to shut down. It could be that, for example, other retail establishments, such as establishments in the hospitality industry, also have a

negative effect on the price of a house. Therefore, this study also investigates whether it matters for the price of nearby houses what happens with the building after a cannabis store had to shut down.

The paper analyzes two different situations with what happens after a cannabis store had to shut down. The first is to analyze whether it matters if the building of a cannabis store remains in the hospitality industry or not. The second is to analyze whether it matters if the building of a cannabis store loses its retail function or not.

Hospitality-Store. This is a store that remains in the hospitality industry throughout the observation period. This store either remains as a cannabis store throughout the observation period, or it becomes a different establishment within the hospitality industry (for example, a bar) if the cannabis store had to shut down.

Leaves-hospitality-Store. This is a cannabis store that is in a building that leaves the hospitality industry after the store had to shut down. After the cannabis store had to shut down, the building of the cannabis store either loses its retail function or another retail establishment, that is not in the hospitality industry (For example, a clothing store), enters this building.

Retail-Store. This is a cannabis store that remains in the retail industry throughout the observation period. It either remains a cannabis store or, after the cannabis store had to shut down, the building kept its retail function.

Leaves-Retail-Store. This is a cannabis store of which the building loses its retail function after the cannabis store had to shut down. When the building loses its retail function after the cannabis store had to shut down, approximately half turn into residential buildings. The other half turns into an office building.

Cannabis Store Nearby. Combining the information on the cannabis stores from the Locatus database and houses from the NVM housing database, one can calculate whether a house has a cannabis store nearby. The observations from the Locatus database are yearly. By year, each house is linked to the nearest cannabis store and the distance to that cannabis store is calculated as the Euclidean distance to that nearest cannabis store. Furthermore, the houses are linked to a cannabis store when they are in the same PC6 or on the same street.

To investigate up until what distance the effect of a cannabis store on nearby property has an effect, this paper uses multiple definitions of what a cannabis store ‘nearby’ is. In total, this paper tests 8 different definitions of nearby. The 8 definitions of a cannabis store nearby are:

In a given year, when a transacted house is ..

1) In the same PC6 as a cannabis store
2) In the same street as a cannabis store
3) within 50 meters of a cannabis store
4) In the same street and within 50 meters of a cannabis store
5) In the same street and within 100 meters of a cannabis store
6) Within 20 meters of a cannabis store
7) Within 20 to 50 meters of a cannabis store
8) Within 50 to 100 meters of a cannabis store

.. the house has a cannabis store nearby.

Three fictional housing transactions are described here as examples. When a house is, for example, sold in 2005 and located on Churchstreet 1 1011AB and the nearest cannabis store is located 19 meters away on Churchstreet 3 1011AB, the house is marked as having a cannabis store nearby when the definition is a cannabis store in the PC6, in the street, within 50 meters, within the same street and 50 meters, within the same street and 100 meters and within 20 meters. Thus, for definitions 1, 2, 3, 4, 5, and 6, this house is nearby a cannabis store.

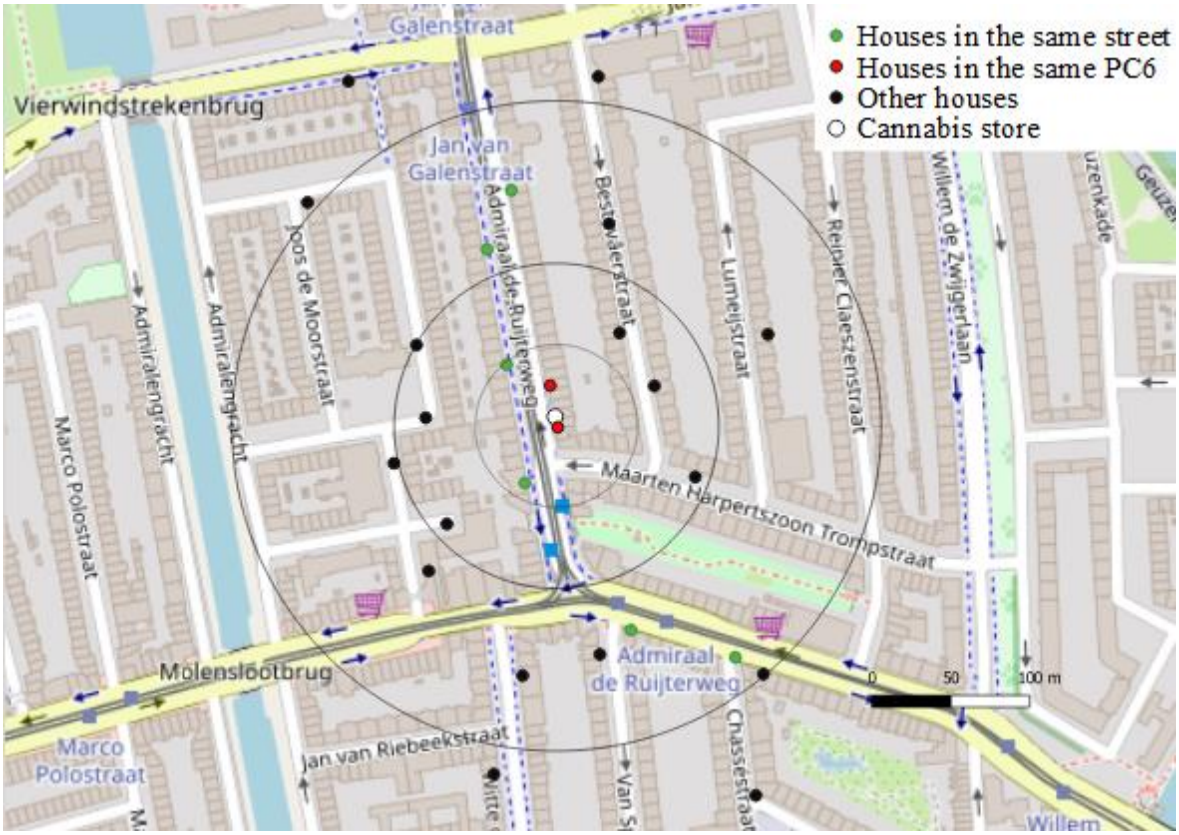
Furthermore, when a house is sold in 2007 and is located on Churchstreet 29 1011AE and the nearest cannabis store is located 60 meters away on Churchstreet 3 1011AB, the house is marked as having a cannabis store nearby when the definition is a cannabis store in the same street, when the definition is a cannabis store in the same street and within 100 meters, and when the definition is a cannabis store between 50 and 100 meters. The house does not have a cannabis store nearby when the definition of a cannabis store nearby entails in the same PC6, within 50 meters, or within the same street and 50 meters of a cannabis store. Thus, for definitions 2, 5, and 8, this house is nearby a cannabis store.

Lastly, when the house on Churchstreet 1 1011AB is sold again in 2010, and the cannabis store on Churchstreet 3 1011AB had to close in 2007, the house will be linked to a different cannabis store that is still in business. The house is now linked to the cannabis store on Market Street 5 1012AE, this cannabis store is 40 meters away from Churchstreet 1. Now, the house has a cannabis store nearby when the definition of nearby is within 50 meters. It does not have a cannabis store nearby when the definition is in the same PC6, street, or street and 50m. Thus, for definitions 3 and 7, this house is nearby a cannabis store.

By using different definitions with different distances to a cannabis store, we investigate whether there is an effect. Furthermore, if there is an effect, we can investigate whether the

effect diminishes as the distance increases and until what distance a cannabis store has a relevant effect. Figure 1 illustrates the different definitions of cannabis store nearby.

Figure 1 – Illustration of defining cannabis stores nearby.



Notes: The smallest circle has a radius of 50 meters around the cannabis store, the middle circle has a radius of 100 meters around the cannabis store and the largest circle has a radius of 400 meters. The green dots that fit inside the smallest circle are the houses that are in the same street and within 50 meters. The green dots that fit inside the middle circle are the houses that are in the same street and within 100 meters. Created with the use of QGIS and OpenStreetMap.

Other Cannabis Store Nearby Variables. The same calculations for whether there is a cannabis store nearby has also been done when the cannabis stores are differentiated by whether they are a 250m-store or not, a retail-store or not, and a hospitality-store or not. For example, for the 250m-stores, by doing these calculations separately, we link each house to the nearest 250m-store and the nearest non-250m-store. Then, for each definition of cannabis store nearby, we calculate as explained in the previous paragraph, if a house is nearby a 250m-store or a non-250m-store.

We can then regress both variables in the same regression to investigate what the effect of a 250m-store is on the price of the house and what the effect of a non-250m-store nearby is on the price of a house.

Distance to the City Center. Lastly, three distances were calculated. The city center is being defined as the Dam Square. This is one of the biggest and most important squares of Amsterdam which is in the middle of the city center of Amsterdam. The distance to the Dam Square is calculated as the Euclidean distance between a house and the middle of the Dam Square.

Distance to the Nearest Train Station and Distance to the Nearest Highway Ramp. The distances to the nearest train station and the nearest highway ramp are also used in the analysis. The distance is calculated as the Euclidean distance between a house and the nearest train station. Furthermore, the distance to the nearest highway ramp is also calculated as the Euclidean distance between a house and the nearest highway ramp.

5. Descriptive Statistics.

The number of cannabis stores in Amsterdam gradually declined throughout the observation period, from 254 in 2003 to 172 in 2017. In line with the more stringent cannabis policies of the Dutch national government and the municipality of Amsterdam, the decline has been increasing from 2013 onwards. Between 2013 and 2017 the number of cannabis stores in Amsterdam went down from 210 to 172. This is approximately the same decline as in the 10 years before that when the number of stores dropped from 254 to 210. Figure 2 gives an overview of the number of cannabis stores that were yearly present in Amsterdam between 2003 and 2017.

Figure 2 – Number of cannabis stores in Amsterdam by year.

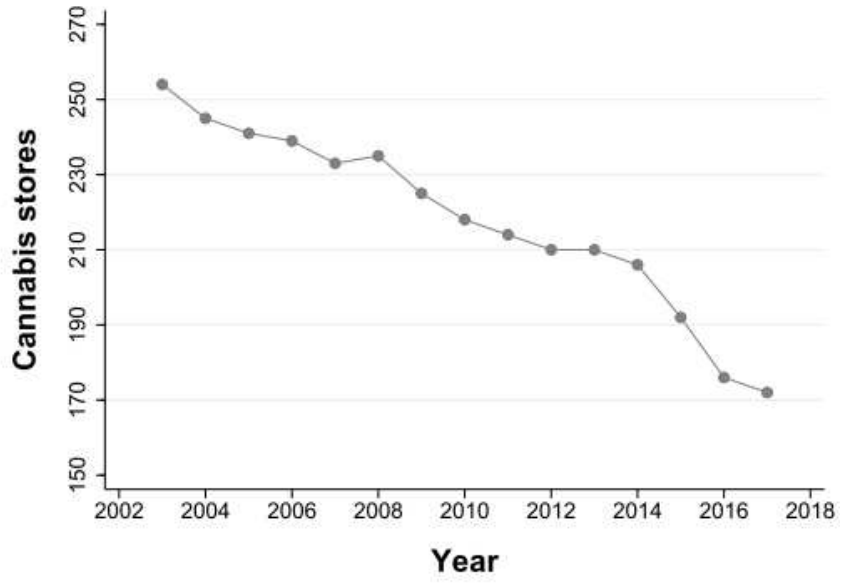


Table 1 contains the descriptive statistics of the dependent variable, cannabis store nearby variables, and most control variables. We exclude transactions with prices that are below 50.000 and above 2.5 million. The excluded houses comprise less than 0.01% of the sample data.[2] As will be explained in the methodology section, only houses that are located within 400 meters of a cannabis store are taken into the main analyses. Therefore, only the descriptive statistics for those houses are shown in Table 1. The descriptive statistics for 250m-stores, no-250m-stores, retail-stores, leaves-retail-stores, hospitality-stores, and leaves-hospitality-stores nearby can be found in appendix A.

A couple of interesting observations can be made from the descriptive statistics. There are 58,159 houses in Amsterdam within 400 meters of a cannabis store, this is 48% of all transactions in Amsterdam[3]. Virtually all the houses that are within 400 meters of a cannabis store in Amsterdam consist of apartments (96%). Only, 0.7% of the sample (407 houses) are detached or semi-detached. The average distance to the city center is 3.1 kilometers, whilst the average distance to the nearest train station (2.0 km) or highway ramp (2.5 km) is slightly lower. The average size of a house is 80m^2. With an average maintenance state of 0.791 out of 1 (inside) and 0.789 (outside), the maintenance state of the houses is generally good. 68.9% (40,319) of the houses is built before 1945.

Figure 3 shows the distribution of the distance to a cannabis store. There are relatively few houses very close to a cannabis store. Furthermore, the average distance to a cannabis store is 199 meters in the sample data. Only 2.5%, or 1,454 houses have a cannabis store in their PC6 at the time of a sale. Compared to houses that have a cannabis store in their street, there are relatively many houses (15,072 (25.8%)) that have a cannabis store in their street at the time of a sale. This could be because there are some large streets that both have a lot of houses attached to it as well as one or more cannabis stores. Furthermore, there are 3,780 (6.5%) houses located within 50 meters of a cannabis store, 11,515 (19.9%) houses located within 100 meters of a cannabis store. There are 2,442 (4.2%) observed transactions within the same street and within 50 meters of a cannabis store. Lastly, there are 5,757 (9.9%) observed transactions of houses that are located within 100 meters and on the same street as a cannabis store.

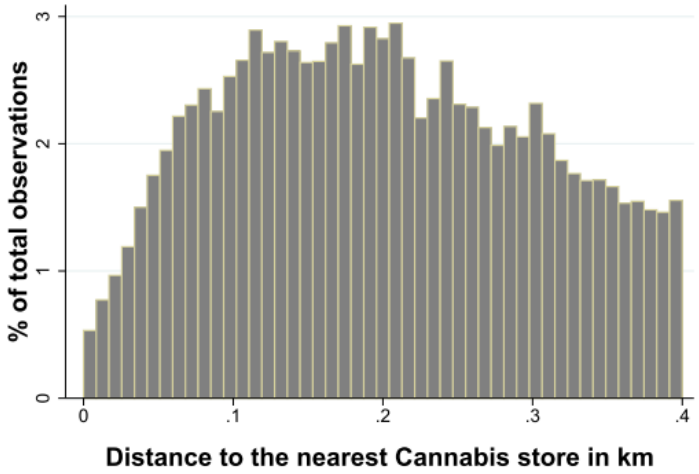
[2] 148 of a total of 121,615 transactions. For transactions that occur only within 400 meters of a cannabis store, 52 have been outside the price range.
[3] There are 121,651 housing transactions in Amsterdam between 2003 and 2017.

Table 1 - Descriptive statistics

	Mean	St.Dev	min	max
Price	311000	200000	63000	2495000
Cannabis store in the pc6	.025	.156	0	1
Cannabis store within 50m	.065	.246	0	1
Cannabis store in street within 50m	.042	.2	0	1
Cannabis store in street within 100m	.099	.298	0	1
Cannabis store in street	.249	.433	0	1
Cannabis store within 20m	.016	.126	0	1
Cannabis store 20 to 50m	.049	.216	0	1
Cannabis store 50 to 100m	.133	.339	0	1
km to Dam Square	3.159	1.567	.062	11.145
km to highway ramp	2.548	1.025	.271	4.845
km to train station	2.041	.818	.218	4.586
Size	79.321	40.79	26	475
Leasehold	.383	.486	0	1
VON	.045	.206	0	1
Number of rooms	3.016	1.34	1	22
Apartment	.96	.197	0	1
Terraced house	.034	.181	0	1
Semi detached	.004	.062	0	1
Detached	.003	.051	0	1
Parking	.034	.181	0	1
Garage	.026	.158	0	1
Garden	.987	.115	0	1
Number of bathrooms	.924	.464	0	7
Number of kitchens	.764	.489	0	5
Number of balconies	.552	.539	0	5
Number of rooftop terraces	.147	.367	0	3
Number of floors	1.381	.772	1	8
Number of dormer windows	.018	.133	0	2
Office	0	.012	0	1
Maintenance state inside	.791	.113	0	1
Maintenance state outside	.787	.152	0	1
Number of types of insulation	1.458	1.656	0	5
Central heating	.877	.329	0	1
Monumental building	.047	.212	0	1
Constructed Before 1906	.286	.452	0	1
Constructed 1906-30	.403	.491	0	1
Constructed 1931-1944	.095	.293	0	1
Constructed 1945 - 1959	.012	.11	0	1
Constructed 1960 - 1970	.018	.131	0	1
Constructed 1971-1980	.017	.13	0	1
Constructed 1981 – 1990	.062	.241	0	1
Constructed 1991 – 2000	.057	.231	0	1
Constructed after 2000	.049	.216	0	1
Auction	.001	.038	0	1
Occupied	.994	.079	0	1
Partly rent	.003	.051	0	1

Note The number of observations is 58,159.

Figure 3 – Distribution of distance to a cannabis store.



6. Empirical Methodology

This section delves deeper into the methodology that was used in this paper. All the models used in the study are discussed one by one.

Sample Restriction. This paper investigates the effect that a cannabis store has on the price of a house in the municipality of Amsterdam. To limit the bias that can occur because different kinds of neighborhoods are compared instead of similar houses with or without a cannabis store nearby, only houses that are within 400 meters of a cannabis store are taken into the regression analyses. By employing this method, the sample is restricted to be more homogenous. Neighborhood effects are more likely to be similar for houses that are located near each other than that they are for houses that are located further from each other. Yet, the distance to a cannabis store can still vary within the neighborhood. The 400-meter distance cut-off value is taken as the Euclidean distance.

Externality effect of a cannabis store nearby. The empirical methodology of this paper is centered around the hedonic pricing model by Rosen (1974). For different analyses, the standard model will be modified to investigate different effects. This model is expanded with dummy variables indicating cannabis stores nearby in the subsequent models. The basic hedonic pricing model used in this study is specified in equation (1) as follows:

$$Ln(price)_{it} = \beta 0 + \beta 1 X_{it} + \beta 2 T_t + \beta 3 L_i + \beta 4 N_j + \epsilon_{it} \quad (1)$$

Where $Ln(price)_{it}$ is the natural logarithm of the sales price of house ***i*** at time ***t***. $\boldsymbol{X_{it}}$ is a set of physical housing attributes of house ***i*** at time ***t***. For example, size, number of rooms,

maintenance state, and construction period. T_t is the time fixed effect at time t. It controls for time fixed effects at the quarterly level. Because the transactions occur over 15 years, the model controls for time effects that are equal amongst the observations (For example, inflation or housing market trends). L_i represents the distance to the city center, the nearest train station, and the nearest highway ramp of house i. N_j denotes time-invariant location-specific fixed effects for location j. It could be the case that cannabis stores are in areas where the property prices are generally lower. If these location characteristics are time-invariant, location-specific fixed effects can control for this. The location-specific fixed effects are added with different levels of preciseness of location for robustness. They are tested on the PC4, PC5, PC6, and house levels. ϵ_{it} is an identically and independently distributed error term.

The basic hedonic model (1) is expanded with a dummy variable indicating whether there is a cannabis store nearby or not. Equation (2) contains the model including a dummy variable indicating a cannabis store nearby house i at transaction time j.

$$Ln(price)_{it} = \beta 0 + \beta 1 X_{it} + \beta 2 T_t + \beta 3 L_i + \beta 4 N_j + \beta 5 C_{it} + \epsilon_{it} \qquad (2)$$

Where C_{it} is a dummy variable that is 1 when house i has a cannabis store nearby at transaction time t.

There are 6 different regressions run with equation (2). Each regression uses a different definition of the C_{it} dummy variable indicating a cannabis store nearby. A cannabis store nearby is:

1) In the same PC6 as a cannabis store
2) In the same street as a cannabis store
3) within 50 meters of a cannabis store
4) In the same street and within 50 meters of a cannabis store
5) In the same street and within 100 meters of a cannabis store
6) Within 20 meters of a cannabis store, or within 20 to 50 meters of a cannabis store, or within 50 to 100 meters of a cannabis store

These six regressions are repeated four for different Fixed Effects levels; namely: PC4, PC5, PC6, and House Fixed Effects. In total 24 regressions are conducted and analyzed.

Changing the Sample Restriction. Furthermore, it is possible that the sample selection still biases the estimator as we compare different kinds of neighborhoods rather than whether a house has a cannabis store nearby or not. To account for this possibility, we estimate equation

(2) again with different sample selections. We estimate equation (2) with sample selections of 500m, 400m, 300m, 200m, 100m, and 50m distance to a cannabis store. We estimate these regressions for two definitions of a cannabis store nearby. Namely, when a house is located in the same PC6 as a cannabis store and when a house is located within 50 meters of a cannabis store. In total, 12 regressions are estimated.

Without the 1012 Area. Also, there were and are a lot of cannabis stores in the 1012 PC4 area in Amsterdam. This area is notorious for the high levels of crime, drugs, prostitution, and nuisance from tourists (Rekenkamer Amsterdam, 2018). During the observation period (starting in 2009), the municipality of Amsterdam tried to increase the economic value of the 1012 postal code area and break the criminal infrastructure in a project named after the PC4 of the area, Project 1012. The municipality did so by stricter enforcement of rules, closing 48 cannabis stores, and closing 112 prostitution windows. Relative to the other areas in Amsterdam, the house prices in the 1012 PC4 increased during Project 1012. As elaborated on in the literature section, prostitution windows generally lead to a relatively large devaluation of house prices (Giambona & Ribas, 2018). As the closure of many cannabis stores in the 1012 PC4 area correlated highly with the closure of prostitution windows and enforcements of rules around the cannabis stores, it could be that the effect of a cannabis store nearby is overestimated in equation (2). Therefore, equation (2) is estimated again, this time all observations that are in the 1012 PC4 area are removed from the sample to mitigate the bias occurring from observations from that area.

Search Frictions It could also be that, instead of the price adapting to a cannabis store nearby, the effect of a cannabis store nearby ends up into higher search frictions. It takes longer for a house that is nearby a cannabis store to sell rather than that the full effect of the externality goes into the price. This study also examines whether this is the case by regressing the effect of a cannabis store with the time on the market as the dependent variable instead of the price of a house as the dependent variable. Equation (3) contains the hedonic model.

$$Ln(daysonmarket)_{it} = \beta 0 + \beta 1 X_{it} + \beta 2 T_t + \beta 3 L_i + \beta 4 N_j + \beta 5 C_{it} + \epsilon_{it} \qquad (3)$$

Where $\boldsymbol{Ln(daysonmarket)_{it}}$ is the log of the time in days a piece of property $\boldsymbol{i}$ had been on sale before it was sold at time $\boldsymbol{t}$.

Cannabis Stores that had to Close due to the 250m Distance to School Criterion. Also, virtually all cannabis stores that had to close in Amsterdam were closed because of

changing rules or violations of agreements with the government rather than because of market forces. It could be that those closing cannabis stores are the most criminal or nuisance causing cannabis stores. If that is the case, the results in equation (2) could be overestimated as the closing cannabis stores are worse than a regular cannabis store. On the other hand, the 20 cannabis stores that had to close due to the 250m-distance to school criterion were closed for the reason that they were within 250m of a school rather than that they caused too much nuisance. Thus, it could be that the cannabis stores that had to close due to the exogenous 250m distance criterion are perceived differently by homeowners than the stores that did not have to close due to the 250m distance criterion. Therefore, another analysis will be conducted. Equation (4) contains the hedonic model used in this analysis.

$$Ln(price)_{it} = \beta 0 + \beta 1 X_{it} + \beta T2_t + \beta 3 L_i + \beta 4 N_j + \beta 5 CD_{it} + \beta 6 CND_{it} + \epsilon_{it} \quad (4)$$

Where $\boldsymbol{CD_{it}}$ is a dummy variable that is 1 when house $\boldsymbol{i}$ has a cannabis store that had to close due to the distance criterion store nearby at transaction time $\boldsymbol{t}$. $\boldsymbol{CND_{it}}$ is a dummy variable that is 1 when house $\boldsymbol{i}$ has a cannabis store that did not have to close due to the distance criterion store nearby at transaction time $\boldsymbol{t}$.

Using the Lincom Estimator[4] it will be tested whether the coefficients of $\boldsymbol{CD_{it}}$ and $\boldsymbol{CND_{it}}$ are statistically significantly different from each other.

Moreover, there is more data on housing transactions (2003-2019) than on retail establishments (2003-2017). However, there is full information on the cannabis stores that had to shut down due to the 250m distance criterion. Therefore, another hedonic regression will be conducted. This time, the observation period runs from 2003 until 2019, and only cannabis stores that had to shut down due to the 250m distance to school criterion are taken into the regression. Equation (5) specifies the model that will be estimated.

$$Ln(price)_{it} = \beta 0 + \beta 1 X_{it} + \beta T2_t + \beta 3 L_i + \beta 4 N_j + \beta 5 CD_{it} + \epsilon_{it} \quad (5)$$

Where $\boldsymbol{CD_{it}}$ is a dummy variable that is 1 when house $\boldsymbol{i}$ has a cannabis store that had to close due to the distance criterion store nearby at transaction time $\boldsymbol{t}$.

[4] The Lincom estimator tests whether H0: $\beta CD_{it} - \beta LCND_{it} = 0$ will be rejected.

Effects of the New Incumbent of a Former Cannabis Store Building. Furthermore, to investigate whether it matters for the price of a nearby house what kind of incumbent goes into a building after a cannabis store had to shut down, two extra regressions are analyzed.

Hospitality Industry or not. It will be also analyzed whether it matters for nearby house prices if the new incumbent of a former cannabis store is in the hospitality industry or not. Equation (6) specifies the model that will be estimated for this test.

$$Ln(price)_{it} = \beta 0 + \beta 1 X_{it} + \beta T2_t + \beta 3 L_i + \beta 4 N_j + \beta 5 H_{it} + \beta 6 LH_{it} + \epsilon_{it} \qquad (6)$$

Where $\boldsymbol{H_{it}}$ is a dummy variable that is 1 when house $\boldsymbol{i}$ is nearby a cannabis store that either remains open throughout the observation period or when the cannabis store does have to shut down, the building remains in the hospitality industry at sales time $\boldsymbol{t}$. $\boldsymbol{LH_{it}}$ is a dummy variable that is 1 when house $\boldsymbol{i}$ is nearby a cannabis store that is located in a building that, after it had to shut down, leaves the hospitality industry at sales time $\boldsymbol{t}$.

After the model is constructed, with the Lincom estimator it will be tested if the coefficients $\boldsymbol{H_{it}}$ and $\boldsymbol{LH_{it}}$ are statistically different from each other.

Retail Industry or not. Furthermore, it is also analyzed whether it matters for the price of a house whether the building of a cannabis store loses its retail function after the cannabis store had to shut down. Equation (7) specifies the model that will be estimated for this test.

$$Ln(price)_{it} = \beta 0 + \beta 1 X_{it} + \beta T2_t + \beta 3 L_i + \beta 4 N_{j_i} + \beta 5 R_{it} + \beta 6 LR_{it} + \epsilon_{it} \qquad (7)$$

Where $\boldsymbol{R_{it}}$ is a dummy variable that is 1 when house $\boldsymbol{i}$ is nearby a cannabis store that either remains in business throughout the observation period or when it does have to shut down, the building keeps its retail function at transaction time $\boldsymbol{t}$. $\boldsymbol{LR_{it}}$ is a dummy variable that is 1 when house $\boldsymbol{i}$ is nearby a cannabis store that is located in a building that, after the cannabis store had to shut down, loses its retail function at transaction time $\boldsymbol{t}$.

Similar to the analysis on the hospitality industry, the Lincom function will be used to test whether the coefficients $\boldsymbol{R_{it}}$ and $\boldsymbol{LR_{it}}$ are statistically significantly different from each other.

7. Results

In this section, the results of this paper are presented. The results are presented and discussed per model.

The externality of a cannabis store nearby. Table 2 contains the results for the cannabis store nearby coefficients of the main analysis as specified in equation (2). Coefficients for the other estimators are not shown in Table 2, but a table containing all the coefficients and standard errors for the control variables with PC5 fixed effects and being within 50 meters of a cannabis store as the cannabis nearby estimator can be found in Appendix B. The coefficients for the control variables are as what would be expected. For example, when a cannabis store nearby is being defined as within 50 meters and one controls for location fixed effects at the PC5 level, the following coefficients for housing characteristics are found. The coefficients for housing characteristics are as expected, where bigger houses sell for more (the logsize coefficient is 0.77 (***SE*** = 0.006)) and houses with a better maintenance state sell for more (coefficient for maintenance state inside is 0.22 (***SE*** = 0.008), the coefficient for maintenance state outside is 0.11 (***SE*** = 0.10)). Furthermore, houses that are located one kilometer further away from the city center (β = 0.086 ***SE*** = 0.13)) and the nearest highway ramp (β = 0.037. ***SE*** = 0.014) sell for less.

Table 2 reads as follows: the rows (a-d) indicate the level of fixed effects used in the regressions. The columns indicate the independent variable(s) of interest that are regressed as in equation (2) on the log of the price of a house. Per fixed effect level, there are 6 regressions conducted, indicated by the number (1-6) in front of the independent variable. The results in the table are the results for the independent variable(s) of interest for each fixed effect regression. For example, b-2 (β= -.0228, ***SE*** = 0.008) is the effect found for a cannabis store within 50 meters of a house when one controls for location-specific fixed effects at the PC5 level.

Table 2 presents us with some interesting results. When we analyze the coefficients with PC5 fixed effects, the results indicate that a cannabis store has a negative effect on the price of a house that is nearby. The effect is strongest when a cannabis store is located very close to a house. Being within 20 meters of a cannabis store is associated with a 3.9% decrease in the price of a house. The results indicate that the effect decreases when a house is located further away from a cannabis store. When a house is within 50 meters of a cannabis store the effect is already only -2.3%. When a cannabis store is located within the same street as a house but can be up to 100 meters of a cannabis store, the effect drops further until a 1.4% decrease in the house price. The results imply that the negative effect of a cannabis store nearby diminishes rapidly when the distance increases. When a house is further than 50 meters away, but less than 100 meters, the results already indicate that the effect drops to only -0.7%.

Table 2 – Baseline Results
(Dependent Variable: The Logarithm of the House price)

Variable	(a) PC4 FE Regressions	(b) PC5 FE Regressions	(c) PC6 FE Regressions	(d) House FE Regressions
(1) Cannabis Store in PC6	-0.0354***	-0.0263***	-0.00947	-0.0292
	(0.00868)	(0.00802)	(0.0117)	(0.0191)
(2) Cannabis Store 50m	-0.0318***	-0.0228***	-0.00759	0.000737
	(0.00497)	(0.00474)	(0.00538)	(0.0127)
(3) Cannabis Store in street and 50m	-0.0332***	-0.0256***	-0.00824	-0.00343
	(0.00617)	(0.00630)	(0.00627)	(0.0162)
(4) Cannabis Store in street and 100m	-0.0177***	-0.0137***	-0.00368	0.0122
	(0.00559)	(0.00477)	(0.00559)	(0.0123)
(5) Cannabis store in the Street	-0.00719	-0.00843	0.000694	-0.00593
	(0.00503)	(0.00571)	(0.00634)	(0.00984)
(6) Cannabis store within 20m	-0.0494***	-0.0391***	-0.0128	-0.0211
	(0.00868)	(0.00850)	(0.00936)	(0.0203)
(6) Cannabis store within 20to50m	-0.0290***	-0.0209***	-0.0103*	0.00668
	(0.00543)	(0.00516)	(0.00605)	(0.0149)
(6) Cannabis store within 50 to 100m	-0.00918*	-0.00727**	-0.00442	-0.00330
	(0.00531)	(0.00342)	(0.00389)	(0.00805)
Location FE	YES	YES	YES	YES
Number of:	PC4: 50	PC5: 558	PC6: 5,380	houses: 53,268
Quarter FE [60]	YES	YES	YES	YES
Housing Characteristics	YES	YES	YES	YES
Observations	58,159	58,159	58,159	58,159
R-squared	0.880	0.872	0.858	0.818

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Another interesting observation can be made from the cannabis store in the same street coefficient, which is not significant. Apparently, merely being in the same street as a cannabis store is not what matters to homeowners; the distance to the cannabis store is more important. From the houses that have a cannabis store in their street, 64% of them are located further than 100 meters away from a cannabis store. The results indicate that it does not matter for the price of a house when there is a cannabis store in the same street, but also relatively far away.

The results are similar when location-specific effects are controlled for at the PC4 level instead of the PC5 level. Though, the results imply that the effect of a cannabis store nearby is

a bit higher with location fixed effects at the PC4 level (4.9% within 20 meters, 3.2% within 50 meters). Probably, not all the location-specific effects are controlled for by the PC4 fixed effects. When we only control for location-specific fixed effects at the PC4 level, it seems that houses that are close to a cannabis store are also in areas of PC4s that are lower in price. Hence, some of the location-specific effects end up in the cannabis store nearby coefficient. Thus, the effect of a cannabis store nearby is overestimated when location fixed effects are only fixed at the PC4 level.

When we control for location fixed effects at the PC6 level, the coefficients for the effect of a cannabis store nearby turn insignificant for all definitions of what is nearby a cannabis store. Yet, because the PC6 is a very small area in Amsterdam (it is only a part of one side of a street), there is little variation in cannabis stores nearby within the same PC6. It is probable that the effect of a cannabis store nearby is captured by the PC6 fixed effect rather than in the cannabis store nearby dummy variable. The signs are, however, as expected, all negative.

The regression was also run with house fixed effects. However, the number of observations is reduced severely (there are only 4,974 houses that are sold more than once during the observation period). Yet again, there is probably very little variation in cannabis stores nearby when one fixes the effects at the house level. Probably, most of the effects, if any, end up in the house fixed effect variable. Therefore, as the PC5 fixed effects do control for detailed location-specific fixed effects, and it allows for more variation within cannabis stores nearby a house than PC6 fixed effects, the rest of the analyses will be conducted using PC5 fixed effects.

Changing the sample restriction. In the main analysis the sample was restricted to houses within 400 meters of a cannabis store to make the sample more homogenous. This time, the sample on which the regressions as specified in equation (2) were run was changed for each regression ranging from 500 meters to only 50 meters from a cannabis store. Two sets of regressions were run. In the first set, a cannabis store nearby is when a cannabis store is in the same PC6 as a transacted house. In the second set, a cannabis store nearby is when a cannabis store is within 50 meters of a transacted house. The results can be found in Table 3. The table reads as follows. The numbers 1-6 indicate the different sample selections on which regression one and two were run.

The results of the two analyses are similar. The results do not change significantly when the sample is restricted from 500m to 200m for both the cannabis store in the PC6 estimator and the cannabis store within 50 meters estimator. The results are robust to the changes and are

Table 3 – Changing the Sample Restriction
(Dependent variable: The logarithm of the price)

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	500M	400M	300M	200M	100M	50M
Regression 1:	-0.0283***	-0.0263***	-0.0261***	-0.0295***	-0.0260***	-0.0269***
Cannabis Store in the PC6	(0.00802)	(0.00802)	(0.00769)	(0.00747)	(0.00762)	(0.00949)
Regression2:	-0.0241***	-0.0228***	-0.0229***	-0.0240***	-0.0157***	
Cannabis Store Within 50m	(0.00483)	(0.00474)	(0.00474)	(0.00495)	(0.00544)	
Number of PC5	610	558	490	429	325	228
PC5 FE	YES	YES	YES	YES	YES	YES
Quarter FE (60)	YES	YES	YES	YES	YES	YES
Housing Characteristics	YES	YES	YES	YES	YES	YES
Observations	66,082	58,159	46,458	30,396	11,487	3,773

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

approximately -2.6% when a cannabis store is in the same PC6 and -2.3% when a cannabis store is within 50 meters of a house. As the coefficient for a cannabis store in the PC6 is a bit larger, the results suggest that a cannabis store in the PC6 has a bit higher effect than a cannabis store that is a bit further away, but still within 50 meters of a cannabis store. This also indicates that the negative effect of a cannabis store on nearby house prices decreases when the distance to a cannabis store increases.

Only when the sample is restricted to houses within 100m of a cannabis store, the coefficient for cannabis store within 50m becomes a bit lower. Possibly, this is because the effect of a cannabis store nearby is non-zero between 50 and 100 meters of a cannabis store. Hence, some of this non-zero effect ends up in the coefficient and the effect of a cannabis store nearby is underestimated. This is also indicated in the results in Table 2, where a cannabis store between 50 meters and 100 meters of a house has a negative effect of 0.7%.

Search Frictions. It could also be that the effect of a cannabis store nearby goes into larger search frictions rather than into the price of a house. Therefore, Table 4 contains the results of the regression as specified in equation (3), with the log of the days that a house was offered on the market before it was sold as the dependent variable. The table reads as follows. The numbers 1-5 indicate regression run and the definition of a cannabis store nearby corresponding to that regression.

From Table 4, one can see that for all specifications of a cannabis store nearby, there is no effect on the time a house is on the market up for sale. Hence, the results indicate that the full effect of a cannabis store nearby goes into the price of a house rather than that a part of the effect leads to a house to be for a longer time on sale on the market.

Table 4 - estimating the effect of a cannabis store nearby on the time on the market
(Dependent variable: The logarithm of the days a house is offered on the market.)

	(1)	(2)	(3)	(4)	(5)
VARIABLES	PC6	50m	Street 50m	street 100m	Street
Cannabis Store in ( )	0.0280	0.00926	0.0309	0.0137	0.0261
	(0.0324)	(0.0243)	(0.0320)	(0.0223)	(0.0233)
PC5 FE (558)	YES	YES	YES	YES	YES
Quarter FE (60)	YES	YES	YES	YES	YES
Housing Characteristics	YES	YES	YES	YES	YES
Observations	56,774	56,774	56,774	56,774	56,774
R-squared	0.164	0.164	0.164	0.164	0.164

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Interestingly, when we change the fixed effects from PC5 level fixed effects to PC4 level fixed effects, some coefficients are significant[5]. When a cannabis store is located within the same PC6 (β = 0.5; ***SE*** = 0.23), there is a significant effect on the time that a house is on the market. It seems that a cannabis store nearby makes it more difficult for a house to sell. Yet, it seems that this is a location-specific effect that is not necessarily due to the cannabis store as the effect disappears when one controls for PC5 and PC6 level fixed effects.

Project 1012. Observations in the 1012 PC4 area could bias the results; the municipality of Amsterdam both closed cannabis stores and economically upgraded the 1012 PC4 area during the observation period. Table 5 contains the regression as specified in equation (2) but without the observations for houses that are in the 1012 postcode. The table reads as follows. The numbers 1-6 indicate the regression run and the corresponding definition(s) of a cannabis store nearby.

[5] Appendix C contains the regression results for the regression with log(daysonmarket) as the dependent variable with PC4 fixed effects.

Table 5 – the effect of a cannabis store nearby without the 1012 area
(Dependent Variable: The logarithm of the price.)

VARIABLES	(1) PC6	(2) 50m	(3) Street 50m	(4) Street 100m	(5) Street	(6) Multiple cut-off values
Cannabis store in the ( )	-0.0203***	-0.0191***	-0.0214***	-0.0129***	-0.00727	
	(0.00745)	(0.00447)	(0.00588)	(0.00467)	(0.00574)	
Cannabis store within 20m						-0.0373***
						(0.00747)
Cannabis store 20 to 50m						-0.0167***
						(0.00521)
Cannabis store 50 to 100m						-0.00803**
						(0.00340)
PC5 FE (538)	YES	YES	YES	YES	YES	YES
Quarter FE (60)	YES	YES	YES	YES	YES	YES
Housing Characteristics	YES	YES	YES	YES	YES	YES
Observations	56,819	56,819	56,819	56,819	56,819	56,819
R-squared	0.872	0.872	0.872	0.872	0.872	0.872

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

What one can see from Table 5 is that the coefficients for a cannabis store nearby are a bit smaller when the observations from the 1012 PC4 are removed from the regression. The results indicate that some of the effects for the cannabis store nearby coefficient are caused by the 1012 PC4 area and the 1012 development project rather than by a cannabis store nearby. However, the coefficients are similar to the coefficients of the general analysis from Table 2 and still are statistically significant. Up to 50 meters away from a cannabis store, a house is affected. The effect is a bit smaller (-1.9% instead of -2.3%) but still substantial. Most of the negative effects found for a cannabis store nearby a house are still present when the 1012 PC4 area is removed from the analysis. The results of this analysis also indicate that the results from the main analysis are valid. It is a cannabis store that causes the negative coefficients on nearby house prices instead of omitted variables.

Comparing 250m-stores with non-250m stores. In total, 20 cannabis stores had to shut down due to the 250m distance criterion, starting in 2014 and ending in 2017. It has been investigated whether the effects of these 250m stores, that had to close arbitrarily due to government restrictions, are different from cannabis stores that do not have to close due to that restriction. Table 6 presents the results of the model as specified in equation (4).

As there are only 20 cannabis stores that had to close due to the 250m distance criterion, there are few observations of houses and little variation in houses that are located nearby a 250m-store. Whilst the coefficients for 250m-stores nearby are approximately the same as the coefficients for the other cannabis stores, the standard errors are much higher for 250m-stores. Hence, the effect of a 250m-store nearby is mostly not statistically significant.

Table 6 – Comparing 250m-stores with non-250m stores
(Dependent Variable: The logarithm of the price)

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	PC6	50m	Street 50m	Street 100m	Street	Multiple cut-off values
No 250m-store in the ( )	-0.0278***	-0.0268***	-0.0268***	-0.0141***	-0.00655	
	(0.00908)	(0.00687)	(0.00687)	(0.00497)	(0.00570)	
250m-store in the ( )	-0.0167**	-0.0191	-0.0191	-0.0162	-0.0128	
	(0.00806)	(0.0122)	(0.0122)	(0.0103)	(0.0154)	
no250m-store within 20m						-0.0424***
						(0.00888)
no250m-store 20 to 50 m						-0.0192***
						(0.00556)
no250m-store 50 to 100m						-0.00814**
						(0.00364)
250m-store within 20m						-0.0146
						(0.0216)
250m-store 20 to 50 m						-0.0274**
						(0.0117)
250m-store 50 to 100m						-0.00265
						(0.00846)
pc5 FE (558)	YES	YES	YES	YES	YES	YES
Quarter FE (60)	YES	YES	YES	YES	YES	YES
Housing Characteristics	YES	YES	YES	YES	YES	YES
Observations	58,159	58,159	58,159	58,159	58,159	58,159
R-squared	0.872	0.872	0.872	0.872	0.872	0.872

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Yet, when we estimate whether the coefficients differ statistically significant from each other[6], none of the coefficients differed statistically significantly from each other. From this analysis, it cannot be concluded that stores that had to close due to the 250m distance criterion have a significantly different effect on house prices than stores that do not have to close due to the 250m-distance criterion.

Further, even with the limited observations, a 250m-store in the same PC6 or within 20 to 50 meters of a house has a statistically significant negative effect on the house price. Thus, these results indicate that cannabis stores that had to close arbitrarily and exogenously also have a negative effect on the prices of nearby houses of approximately 2%. The results indicate that the coefficients in the general analysis on cannabis sores as in Table 2 are not overestimated. It could have been the case that the coefficients in the general analysis on cannabis stores as presented in Table 2 are overestimated because most variation was due to the cannabis stores that caused the most nuisances. However, these results provide evidence that it is a general dislike for cannabis stores that causes the negative coefficients for the cannabis store nearby estimators.

2003-2019 distance criterion stores. Moreover, the analysis as specified in equation (5) was run, this time with housing observations from 2003 until 2019 instead of 2003 until 2017. Though, there is only data on 250m-stores for the years 2018 and 2019. There is no data for the other cannabis stores in 2018 and 2019. Therefore, only the 250m-stores nearby are included in this analysis. The results can be found in Table 7.

These results indicate that the results from the main analysis are valid. Up to 50 meters away, also only cannabis stores that had to close due to the 250m-distance criterion have a significant, negative, effect on nearby house prices. The effect is, with approximately 2.4%, similar to the effect found in the general analysis where all cannabis stores were included. These results also indicate that the coefficients found in Table 2 are not overestimated. It could have been argued that equation (2) overestimates the coefficients because it was mainly the most nuisance causing cannabis stores that had to close. These results indicate that also the cannabis stores that had to close arbitrarily had a negative effect on the price of nearby property. Even further, the effect of the 250m-stores nearby within 50 meters is of the same size as in the general analysis including all cannabis stores. Thus, the results from equation (5) indicate that the effects found in Table 2 are not overestimated.

[6] The Lincom estimator was used to test the hypothesis whether the null hypothesis: β non-250mstore – β 250m-store = 0 would be rejected. This was repeated for each regression.

Table 7 – Analyzing the effect of 250m-store from 2003 until 2019
(Dependent Variable: The logarithm of the price)

VARIABLES	(1) PC6	(2) 50m	(3) Street 50m	(4) Street 100m	(5) Street	(6) Multiple cut-off values
250m-store in (..)	-0.0154*	-0.0235**	-0.0180**	-0.0108	-0.00859	
	(0.00842)	(0.0107)	(0.00849)	(0.00935)	(0.0145)	
250m-store within 20 m						-0.0239
						(0.0165)
250m-store 20 to 50m						-0.0226**
						(0.0115)
250m-store 50to100m						0.00363
						(0.00878)
PC5 FE (576)	YES	YES	YES	YES	YES	YES
Quarter FE (66)	YES	YES	YES	YES	YES	YES
Housing Characteristics	YES	YES	YES	YES	YES	YES
Observations	69,215	69,215	69,215	69,215	69,215	69,215
R-squared	0.884	0.884	0.884	0.884	0.884	0.884

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Effects after the Cannabis Stores. The data allows us to investigate what happens with a retail building after a cannabis store had to shut down. It could be that the effect of a closing cannabis store is different depending on what happens with the cannabis store after it had to shut down. It could be the case that people prefer to live next to a non-hospitality establishment rather than a hospitality establishment (including a cannabis store). Also, it could be the case that people prefer to live next to a building that is not in the retail industry rather than a building that remains in the retail industry (including a cannabis store).

Hospitality-store or not. Table 8 presents the results for the analysis as specified in equation (6), differentiating on stores that are in buildings that leave the hospitality industry after the cannabis store had shut down or not.

As one can see from Table 8, the coefficients are similar for cannabis stores that remain in the hospitality industry and for cannabis stores that are in a building that leaves the hospitality industry. The buildings that leave the hospitality industry show a marginally higher coefficient. It seems that, when a cannabis store leaves a building and when the next inhabitant of the

Table 8 – Buildings that remain in the hospitality industry versus buildings that leave after the cannabis store left
(Dependent Variable: The logarithm of the price.)

	(1)	(2)	(3)	(4)	(5)
VARIABLES	PC6	50m	Street 50m	Street 100m	Street
Hospitality Store in (...)	-0.0274***	-0.0224***	-0.0255***	-0.0128**	-0.00453
	(0.00932)	(0.00511)	(0.00702)	(0.00511)	(0.00633)
Leaves-Hospitality Store in (…)	-0.0284**	-0.0255***	-0.0314***	-0.0175**	-0.00970
	(0.0134)	(0.00878)	(0.0112)	(0.00834)	(0.00735)
pc5 FE (558)	YES	YES	YES	YES	YES
Quarter FE	YES	YES	YES	YES	YES
Housing Characteristics	YES	YES	YES	YES	YES
Observations	58,159	58,159	58,159	58,159	58,159
R-squared	0.872	0.872	0.872	0.872	0.872

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

building is not in the hospitality industry (but in, for example, fashion or non-retail), the priceof a nearby house increases a bit more.

However, when we test (again with the Lincom estimator) whether the coefficients for the hospitality cannabis stores and the non-hospitality cannabis stores differ significantly from each other, none of the coefficients do.[7] Hence, the results indicate that the price of surrounding houses is not differently affected by whether the building of the cannabis store remains in the hospitality industry or not.

Retail Industry or not. For retail versus non-retail however, the results are different. Table 9 presents the results for the analysis as specified in equation (7), investigating the difference between cannabis stores that are located in buildings that lose their retail function after the cannabis store shuts down and cannabis stores that are in buildings that remain in the retail industry.

The results shown in Table 9 suggest that the price of a house increases stronger when a house is nearby a building that leaves the retail industry after the cannabis store has left than when the building does not leave the retail industry. The results suggest that it is approximately 2% stronger. When, again with the Lincom estimator, it is tested whether the coefficients are statistically different from each other, the coefficient for retail-store within 50 meters and

[7]The result for the Lincom estimator for the coefficients that differ the most (nearby = street and 50m) is: β = 0.006, ***SE*** = 0.11

leaves-retail-store within 50 meters are statistically significantly different from each other (β= 0.025, ***SE*** = 0.0.012). The other coefficients do not differ significantly from each other. Hence, the results indicate that it matters for the price of nearby property what happens with a building after the cannabis store shuts down. The price of a house increased more when, after a cannabis store had to close, the building of the cannabis store loses its retail function. The results indicate that people prefer to live in houses that are not located in the proximity of retail buildings.

Table 9 – Buildings that leave the retail industry versus buildings that remain after the cannabis store left
Dependent Variable: The logarithm of the price.

	(1)	(2)	(3)	(4)	(5)
VARIABLES	PC6	50m	Street 50m	Street 100m	Street
Retail-Store in the (..)	-0.0261*** (0.00868)	-0.0207*** (0.00503)	-0.0243*** (0.00664)	-0.0123** (0.00494)	-0.00299 (0.00593)
Leaves-Retail-Store in the (..)	-0.0348* (0.0186)	-0.0459*** (0.0111)	-0.0457*** (0.0148)	-0.0276*** (0.0102)	-0.0241** (0.0102)
PC5 FE (558)	YES	YES	YES	YES	YES
Quarter FE (60)	YES	YES	YES	YES	YES
Housing Characteristics	YES	YES	YES	YES	YES
Observations	58,159	58,159	58,159	58,159	58,159
R-squared	0.872	0.872	0.872	0.872	0.872

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

DID & repeat sale with a DID estimator. For this paper also a difference-in-difference analysis and a repeat-sale with difference-in-difference analysis were conducted. Put simply, houses in areas that did see a cannabis store nearby leaving were compared with houses in areas that did not see a cannabis store nearby leaving. Controlling for other variables, if the houses that did see a cannabis store leaving sell for significantly more than the houses that did not see a cannabis store leaving, a cannabis store nearby is perceived as a dis-amenity. Although the results of the analyses are excluded from the final version of this paper, they are briefly discussed.

For both the DID and the repeat sales with a DID estimator, none of the coefficients for the leaving cannabis store estimators are statistically significant. There are few observations of houses nearby a cannabis store and there is little variation in houses that see a cannabis store leaving. Thus, the standard errors are high. On the other hand, the coefficients are as what would

be expected. They are all positive; the price of a house goes up when a cannabis store nearby leaves. Furthermore, they are around 2% within 50 meters of a cannabis store and decrease as the houses are located further away from a cannabis store. Hence, also the results for this analysis, although not statistically significant, suggest that there could be a negative effect of a cannabis store on the transaction price of nearby houses. The full results are available upon request.

8. Discussion

The results provide evidence to support the hypothesis that was tested in this paper. Namely, ***Hypothesis 1: The transaction price of a house is lower when a house is located nearby a cannabis store compared to a house that is not located nearby a cannabis store.*** The results indicate that up to 50 meters away from a cannabis store, a house is economically and statistically significantly negatively affected by a cannabis store. House prices reduce by approximately 2.3% when a cannabis store is within 50 meters of a house. Hence, the cannabis store is perceived as a dis-amenity for surrounding homeowners.

The negative effect of a cannabis store diminishes with the distance. A cannabis store very close to a house has a negative effect up to 3.9%. Though, when the distance is increased the effect becomes smaller. The effect decreases to a decrease of 2.1% when a house is between 20 and 50 meters of a house and the effect becomes very small when the distance is between 50 and 100 meters of a cannabis store. These results indicate that a cannabis store nearby is perceived as a dis-amenity that diminishes quickly when the distance to a cannabis store goes up. As the negative effect marginalizes when the distance is further than 50 meters away from a cannabis store, this paper concludes that a cannabis store is an economically significant dis-amenity of a house up to within 50 meters of a cannabis store. The results are robust to various model specifications. This study adds to the current literature into externalities that cannabis stores in Amsterdam are perceived as a dis-amenity by nearby households. The study suggests that people do not want to live nearby a feature associated with crime, nuisance, and obscenity.

The why, however, is something that is not answered by this paper. The results are somewhat in line with the current literature. Although in the United States there is evidence that legal cannabis sales lead to higher house prices nearby (Conklin et al., 2017; Cheng, et al., 2018), other research finds that tolerated cannabis sales lead to lower house prices nearby (Adda et al., 2014; Bruijn & Ribas, 2020). The main difference between the studies in the United States and Europe is, however, that cannabis is, from production to consumption, a completely legal

business in parts of the United States whilst in the two studies in Europe cannabis only was partially tolerated.

There are various mechanisms through which the cannabis stores can lead to lower house prices on property surrounding cannabis stores. Being associated with crime, nuisances from cannabis stores, and an 'obscenity' effect are mechanisms that could be causing cannabis stores to be a dis-amenity for nearby houses.

Cannabis stores in the Netherlands are frequently linked to crime (Bieleman & Snippe, 2006; Parool, 2019; Van Weezel, 2016). The literature has established that fear of being affected by crimes leads to lower house prices in the vicinity of criminal activities (Gibbons, 2004; Gautier, 2008). It could be that the fear of being affected by criminal activities is what drives the reduction in the price for cannabis stores in the Netherlands.

However, also the 'obscenity' effect can be into play (Giambona & Ribas, 2018). It could be that a general aversion regarding the illegality and morality of cannabis leads to people preferring to not be associated with a cannabis store and thus avoid living in the proximity of a cannabis store. Related, but not equal, to obscenity effect, is the not-in-my-backyard (NIMBY) effect, where people are not in general against something, but they want the something to stay away from 'their backyard' (Oxford Dictionary, n.d.-c). The difference between the NIMBY effect and the obscenity effect is that in the obscenity effect people do not want something at all at all, whereas with the NIMBY effect people are in favor of the land use, just not where it bothers them. In the literature, NIMBY examples can be found on psychiatric housing (Borell & Westermark, 2018), nuclear waste sites (Benford, et al., 1993) and on legal cannabis stores in the United States (Németh & Ross, 2013).

It could be that this behavior is the driver behind the negative externality of a cannabis store nearby. Rather than a general aversion of cannabis stores, people just do not want a cannabis store located near their house. In the Netherlands, often protests from local residents arise when a cannabis store relocates to a new location (Van Dun, 2014; Weltevreden, 2019; Van der Hooft, 2018). The protests focus on the effect of the cannabis stores in their neighborhoods rather than a general dislike of cannabis stores. It could be that this behavior is also present in Amsterdam, a city whose citizens possibly do not think that cannabis is obscene (explained in a subsequent section), but maybe also a city whose citizens do not want to live with a cannabis store in their backyard.

A third mechanism that comes into play is a nuisance mechanism. Like other retail establishments, cannabis stores attract traffic and other nuisances such as noise and increased traffic to an area. It could be that people prefer to live in an area where there is less concourse

from strangers. The results of this study also indicate that this mechanism might be in play. When the building of a cannabis store loses its retail function after the cannabis store had to shut down, the price of houses within 50 meters of that cannabis store goes up stronger than for houses that are nearby a cannabis store that did not lose the retail function. This indicates that, partially, some of the negative effects found for cannabis stores nearby could be caused by a general retail effect where people prefer not to live in the very close proximity of retail businesses. Yet, as also buildings that did not lose their retail function after the cannabis store had to shut down have a significant negative effect, this mechanism cannot fully describe the negative externality of a cannabis store on nearby house prices. Future research could investigate through which mechanisms cannabis stores have an effect on nearby property prices.

Moreover, it would be interesting to compare the effect of a cannabis store nearby to the effect of other retail establishments such as bars and supermarkets nearby. In the literature, research on commercial consumer activities on nearby house prices is scarce. It would be interesting to compare the effects found in this study on cannabis stores to the effects of other retail establishments such as bars or supermarkets. Those are also commercial activities that could generate a negative externality for houses that are located in the proximity of those establishments. For example, a supermarket might cause higher traffic nuisances and a bar can lead to noise pollution in the vicinity. Yet, their effects are, to the best of my knowledge, not studied. Then, a better conclusion can be drawn on the importance and size of the effect of a cannabis store nearby. If the effect is similar for other retail establishments nearby, it could be the case that a retail establishment in the close proximity as a house is perceived as a dis-amenity rather than that people perceive cannabis stores as such as a dis-amenity.

As discussed in the section on cannabis stores, cannabis stores are a highly profitable business. Therefore, we can assume that none of the cannabis stores had to close due to market forces. Virtually all the cannabis stores in the Netherlands that had to close had to close because of governmental interference, usually through violating governmental rules or other governmental policies aimed at reducing crime like Project 1012 (Mennes et al., 2019). This could bias the results as the variance in cannabis stores is caused by the cannabis stores that were causing the most nuisances and criminal activity in the neighborhood. This could imply that the negative results for cannabis stores found are overestimated and that the true effect is smaller. Hence, the results should be interpreted with caution.

However, the results also provide evidence that the coefficients are not overestimated. The results on the estimation that analyzes cannabis stores that had to close due to the arbitrary decision of the Dutch government that all cannabis stores within 250 meters of a high school or

intermediate vocational education had to close also show a significant, negative, effect up to 50 meters away from a cannabis store of approximately 2.4%. This is, approximately, the same effect as was found in the general analysis on cannabis stores. Hence, the results provide evidence that the coefficient on which the conclusions are drawn are not overestimated and, thus, the results are not biased because the most nuisance causing cannabis stores had to shut down.

A limitation stems from the empirical methodology of this paper. This study employs the hedonic pricing method (HPM) to estimate the effects of a cannabis store on nearby house prices. The main limitation of the HPM is that it is likely for omitted variable bias to occur. When there is a variable that is both correlated with the price of a house and the likeliness of a cannabis store nearby, the model does not correctly specify the effect that a cannabis store has on the price of a house. For example, if cannabis stores tend to be located on busy intersections of roads and the price of a house is lower nearby that intersection because of a dislike for much traffic nearby one his house, the coefficient for a cannabis store nearby has been overestimated. Although the paper controls for location-specific effects at the PC5 level, it could be that the effects are more location specific and, thus, the coefficients are over (or under) estimated. Future research could use a different methodology that is better able to account for the omitted variable bias to verify the results found in this study.

Furthermore, it could be that the closure of a lot of cannabis stores was caused by a general upgrade of an area. Like Project 1012 by the municipality of Amsterdam, it could be that the government decided that an area was in a bad state and decided to upgrade the area (i.e. upgrading public space and more police interventions to reduce crime) and also close many cannabis stores. If that is the case, the negative effects of a cannabis store nearby are overestimated because the increase in the price in an area was not merely caused by the cannabis store shutting down. Though, even when the area affected by Project 1012 was excluded from the analysis the effect of a cannabis store nearby (within 50 meters) was still significant with a 1.9% decrease in the price of a house. However, it could be the case that also other cannabis store closures were centered around redevelopment projects of areas. The paper does not have information on whether this is the case. Therefore, it could be possible that the coefficient of a cannabis store nearby is overestimated. Future research could investigate why cannabis stores had to close and control for this.

Generalization of the results of this paper to the rest of the Netherlands should be done with caution. Amsterdam is not representative for the rest of the Netherlands. Amsterdam is notorious for its reputation as the cannabis capital of the world (Couzy, 2020). This reputation

attracts a lot of extra 'cannabis tourists' to Amsterdam whose cause severe nuisances in the area around cannabis stores (Couzy, 2020). This could make the negative effect of a cannabis store nearby stronger in Amsterdam than in other municipalities in the Netherlands.

On the other hand, the municipal policy regarding cannabis is vastly different in Amsterdam than in other municipalities in the Netherlands. There are a lot more cannabis stores per inhabitant in Amsterdam than in the other municipalities that contain cannabis stores (Mennes et al., 2019). Furthermore, for the municipal elections of 2018, only two of the 45 seats were voted towards parties that were against cannabis stores in Amsterdam (Stichting Maatschappij en Cannabis, 2018). Even though the national branches of some parties are against cannabis stores, in Amsterdam they are in favor of legal sales and regulation of cannabis distribution via cannabis stores (Stichting Maatschappij en Cannabis, 2018). This is indicative of the view on cannabis in Amsterdam. The city tends to be a lot more progressive and liberal than the rest of the Netherlands (Gemeente Amsterdam, 2018). It is possible that the negative effects of cannabis stores nearby are stronger in more conservative municipalities where the aversion against (soft-)drugs is stronger.

a. Counterfactual Analysis.

A back-of-the-envelope counterfactual analysis is conducted to quantify the economic impact cannabis stores have because they are nearby houses in Amsterdam. The results of the counterfactual analysis should be interpreted with caution as it is a simple back-of-the-envelope calculation with simplifying assumptions. However, the calculation sheds some light on the scope of the size of the negative external effects that a cannabis store has.

First, based on the results of this study, we assume that the full external effect of a cannabis store is felt within 50 meters of a cannabis store. After that distance, the negative externality becomes very small. From the NVM data, we know that 3.12% of all the transacted houses are located within 50 meters of a cannabis store [8]. Furthermore, in total, there were 427,858 houses in Amsterdam in 2017 (Gemeente Amsterdam, 2020). Hence, if we assume that the distribution is the same, in 2017, there were 13,342 houses within the negative externality range of a cannabis store. From the NVM-database, we also know that the average sales price of houses in Amsterdam in 2017 was €448,000 for properties that were sold through the NVM.

The results indicate that when a house is located within 50 meters of a cannabis store, the house price decreases by 2.3%. This would mean that on average, a cannabis store leads to

[8] There are 3,798 observations within 50 meters of a cannabis store in Amsterdam. In total there are 121,763 houses sold through the NVM in Amsterdam between 2003 and 2017. 3,798/121,763 = 0.0312.

a decrease of €10,304 per house that is within 50 meters of a cannabis store. As there are approximately on average 77 [9] houses that are affected per cannabis store, each cannabis store leads to a welfare loss of approximately €800,000. In total, the 172 cannabis stores in Amsterdam lead to a welfare loss of approximately €137,000,000.

However, in this calculation, it is assumed that the effect on welfare is the same for owner-occupied houses as it is for social rental houses and regular rental houses. This is an assumption not likely to hold, renters can more easily move away if they find the nuisances too much and, as homeowners tend to be of a different age category and tend to be richer than renters, the effect might be stronger for homeowners than for renters. Also, in this calculation it is assumed that homeowner occupied houses are of the same value as rental properties and the effect of a cannabis store nearby is the same for homeowners as for renters. This assumption is not likely to hold. Social houses could be less valuable than owner-occupied houses.

In Amsterdam, in 2017, the housing market consists of 32% owner-occupied houses, 24% is private rental houses, and the other 44% is social rental housing (Gemeente Amsterdam, 2020). Let us, conservatively, assume that rental houses are worth half of an owner-occupied house (€224,000) to control for the lower effect a cannabis store can have on rental houses. The weighted average effect of a cannabis store nearby then becomes a loss of €6,800[10] per house. Per cannabis store, the welfare loss becomes approximately €525,000. The total welfare loss due to cannabis stores within 50 meters of a house is approximately €90,000,000.

Hence, depending on the assumptions, the welfare loss per cannabis store is between €525,000 and €800,000. Moreover, by reducing the number of cannabis stores in Amsterdam between 2003 and 2017 from 254 to 172, the welfare gain in Amsterdam was at least €43,000,000. In sum, the welfare lost by cannabis stores in Amsterdam is substantial. By reducing the number of cannabis stores, the municipality created a significant welfare gain.

Though, with 172 cannabis stores, there are still relatively many cannabis stores in Amsterdam. As Amsterdam had 845,000 inhabitants in 2017 (CBS, 2019), there was approximately 1 cannabis store per 5,000 inhabitants in Amsterdam. Comparing that statistic to the second and third largest cities in the Netherlands, Rotterdam and The Hague, gives more insight into the meaning of that number. In Rotterdam, there was 1 cannabis store per 15,000 inhabitants (635,000 inhabitants (CBS, 2019), 41 cannabis stores) and in The Hague, there was

[9] 13,345 (houses) / 172 (the number of cannabis stores in Amsterdam in 2017)
[10] €10,304 loss for an owner-occupied house and €5,152 loss for a rental house. Weighing the losses over the occurrences of the houses leads to an average effect of €6,800.

1 cannabis store per 13,800 inhabitants (525,000 inhabitants (CBS, 2019), 38 cannabis stores). One can see that Amsterdam relatively has a lot of cannabis stores.

As the other two large cities in the Netherlands manage with fewer cannabis stores per inhabitant, one can argue that Amsterdam could reduce the number of cannabis stores further down towards the level of the other big cities in the Netherlands, without having a distortion effect that is too large (i.e. more illegal street sales of cannabis, the reason cannabis stores were initially tolerated). Because the negative externality per cannabis store is substantial, reducing the number of cannabis stores in Amsterdam could lead to substantial welfare gains of €500,000 to €800,000 per cannabis store shut down.

Furthermore, the economic effect of a cannabis store is rather large because of the number of houses that are affected per cannabis store in a radius of 50 meters (approximately 77 houses are affected per cannabis store). This indicates that cannabis stores are often located inside or near blocks of residential buildings. A way to reduce the negative externalities of cannabis stores would be to move the cannabis stores to less crowded areas. This way, the municipality of Amsterdam can further reduce the negative consequences of cannabis stores in Amsterdam.

To conclude, using detailed housing data from the NVM and retail data from Locatus, this paper used the hedonic pricing method to establish a relationship between a cannabis store and the transaction price of nearby houses. Testing different definitions of what being nearby a cannabis store is, this paper concludes that, up to 50 meters from a house, a cannabis store has an economically significant negative effect of approximately 2.3% on the price of a house. The effect is greater when the distance is closer and diminishes quickly when the distance is greater than 50 meters. Hence, a cannabis store is valued as a dis-amenity by nearby homeowners. The results are robust to various model specifications. Furthermore, the price of a house increases more when the next incumbent of a closing cannabis store is not active in the retail industry. Hence, the results also indicate that people prefer not to live near a retail establishment. Quantifying the economic impact of cannabis stores suggests that each cannabis store has a negative effect of €525,000 to €800,000. By reducing the number of cannabis stores with 82 between 2003 and 2017, the municipality of Amsterdam created a welfare gain of at least €43,000,000.

9. References

ACD. (n.d.). Amsterdam Coffeeshop Directory. https://www.coffeeshopdirect.com/

Adda, J., McConnell, B., & Rasul, I. (2014). Crime and the depenalization of cannabis possession: Evidence from a policing experiment. ***Journal of Political Economy***, ***122***(5), 1130-1202. https://doi.org/10.1086/676932

Affuso, E., Caudill, S. B., Mixon, F. G., & Starnes, K. W. (2019). Is airport proximity an amenity or disamenity? An empirical investigation based on house prices. ***Land Economics***, ***95***(3), 391-408. https://doi.org/10.3368/le.95.3.391

AT5. (2013, December 17). The Grasshopper in 2014 dicht, Bulldog in 2016. ***AT5***. https://www.at5.nl/artikelen/115601/

AT5. (2018, November 1). Ondernemers afgeperst met dreigmail: 'betaal 50K aan bitcoins anders handgranaat'. ***AT5***. https://www.at5.nl/artikelen/187856/ondernemers-afgeperst-met-dreigmail-betaal-50k-aan-bitcoins-anders-handgranaat

Bayer, P., Ferreira, F., & McMillan, R. (2007). A unified framework for measuring preferences for schools and neighborhoods. ***Journal of Political Economy***, ***115***(4), 588-638. https://doi.org/10.1086/522381

BCD. (2019, September 10). ***Negatieve beeldvorming coffeeshops***. Bond van Cannabis Detaillisten. https://coffeeshopbond.nl/blog/negatieve-beeldvorming-coffeeshops

Benford, R. D., Moore, H. A., & Williams, J. A. (1993). In whose backyard?: Concern about siting a nuclear waste facility. ***Sociological Inquiry***, ***63***(1), 30-48. https://doi.org/10.1111/j.1475-682x.1993.tb00200.x

Benschop, A., Wouters, M., & Korf, D. (2015). ***Coffeeshops, toerisme, overlast en illegale verkoop van softdrugs, 2014*** (2538). WODC. https://www.wodc.nl/onderzoeksdatabase/2538-landelijke-rapportage-over-effecten-coffeeshopbeleid.aspx

Bieleman, B., Biesma, S., Snippe, S., & Beelen, A. (2009). ***Lokale drugsproblematiek - Overlast en criminaliteit*** (1790A). WODC. https://www.wodc.nl/onderzoeksdatabase/1790a-lokale-drugsproblematiek-overlast-en-criminaliteit.aspx

Bieleman, B., Mennes, R., & Sijtstra, M. (2015, July 2). ***Monitor afstandscriterium coffeeshops Amsterdam***. Het CCV. https://hetccv.nl/onderwerpen/drugsbeleid/documenten/monitor-afstandscriterium-coffeeshops-amsterdam/

Bieleman, B., & Snippe, J. (2006). Coffeeshops en criminaliteit. ***Justitiële Verkenningen***, ***32***(1), 46-60.

Borell, K., & Westermark, Å. (2016). Siting of human services facilities and the not in my back yard phenomenon: A critical research review. ***Community Development Journal***, ***53***(2), 246-262. https://doi.org/10.1093/cdj/bsw039

Bruijn, L. M., & Ribas, R. P. (2020). 'No drugs in my back yard:' the ambivalent reception of cannabis retailers. ***SSRN Electronic Journal***. https://doi.org/10.2139/ssrn.3461820

Caudill, S. B., Affuso, E., & Yang, M. (2014). Registered sex offenders and house prices: An hedonic analysis. ***Urban Studies***, ***52***(13), 2425-2440. https://doi.org/10.1177/0042098014547368

CBS. (2019). ***CBS Statline***. https://opendata.cbs.nl/#/CBS/nl/dataset/37259ned/table

Cheng, C., Mayer, W. J., & Mayer, Y. (2018). The effect of legalizing retail marijuana on housing values: Evidence from Colorado. ***Economic Inquiry***, ***56***(3), 1585-1601. https://doi.org/10.1111/ecin.12556

Chun-Chang, L. (2010). The impact of facilities of leisure and sports on housing prices in Taiwan: An application of hierarchical linear modeling. ***Journal of Real Estate Practice and Education***, ***13***(2), 159-175.

Cohen, J. P., & Coughlin, C. C. (2008). Spatial hedonic models of airport noise, proximity, and housing prices. ***Journal of Regional Science***, ***48***(5), 859-878. https://doi.org/10.1111/j.1467-9787.2008.00569.x

Conklin, J., Diop, M., & Li, H. (2017). Contact high: The external effects of retail marijuana establishments on house prices. ***Real Estate Economics***, ***48***(1), 135-173. https://doi.org/10.1111/1540-6229.12220

Couzy, M. (2020, February 7). Halsema pakt coffeeshops aan in strijd tegen overlast hasjtoeristen. ***Het Parool***. https://www.parool.nl/amsterdam/halsema-pakt-coffeeshops-aan-in-strijd-tegen-overlast-hasjtoeristen~b6be094d/

De Haan, K. (2019). ***Postcode6-vlakken op basis van Basisregistratie Adressen en Gebouwen***. Gemeente Amsterdam. https://maps.amsterdam.nl/open_geodata/?k=191

De Kruijff, N. (2015, September 2). 'Alle coffeeshops doen het zo'. ***AD***. https://www.ad.nl/utrecht/alle-coffeeshops-doen-het-zo~a5413d58/

De Wit, E. R., Englund, P., & Francke, M. K. (2013). Price and transaction volume in the Dutch housing market. ***Regional Science and Urban Economics***, ***43***(2), 220-241. https://doi.org/10.1016/j.regsciurbeco.2012.07.002

Dealy, B. C., Horn, B. P., & Berrens, R. P. (2017). The impact of clandestine methamphetamine labs on property values: Discovery, decontamination and stigma. ***Journal of Urban Economics***, ***99***, 161-172. https://doi.org/10.1016/j.jue.2017.03.002

Debrezion, G., Pels, E., & Rietveld, P. (2010). The impact of rail transport on real estate prices. ***Urban Studies***, ***48***(5), 997-1015. https://doi.org/10.1177/0042098010371395

Des Rosiers, F., Lagana, A., Thériault, M., & Beaudoin, M. (1996). Shopping centres and house values: An empirical investigation. ***Journal of Property Valuation and Investment***, ***14***(4), 41-62. https://doi.org/10.1108/14635789610153461

Dubé, J., Thériault, M., & Des Rosiers, F. (2013). Commuter rail accessibility and house values: The case of the Montreal south shore, Canada, 1992–2009. ***Transportation Research Part A: Policy and Practice***, ***54***, 49-66. https://doi.org/10.1016/j.tra.2013.07.015

DutchAmsterdam. (2016, December 26). ***Amsterdam phases out 28 (No. 31) cannabis 'coffeeshops'***. https://www.dutchamsterdam.nl/3485-amsterdam-coffeeshops-phased-out#phase3new

Eggink, I. (2014, October 20). Uitslag stelling: Alle coffeeshops sluiten. ***De Telegraaf***. https://www.telegraaf.nl/nieuws/894488/uitslag-stelling-alle-coffeeshops-sluiten

Feng, X., & Humphreys, B. (2016). Assessing the economic impact of sports facilities on residential property values. ***Journal of Sports Economics***, ***19***(2), 188-210. https://doi.org/10.1177/1527002515622318

Figlio, D. N., & Lucas, M. E. (2004). What's in a grade? School report cards and the housing market. ***American Economic Review***, ***94***(3), 591-604. https://doi.org/10.1257/0002828041464489

Funderburg, R., & MacDonald, H. (2010). Neighbourhood valuation effects from new construction of low-income housing tax credit projects in Iowa: A natural experiment. ***Urban Studies***, ***47***(8), 1745-1771. https://doi.org/10.1177/0042098009356122

Gautier, P. A., Siegmann, A., & Van Vuuren, A. (2009). Terrorism and attitudes towards minorities: The effect of the Theo van Gogh murder on house prices in Amsterdam. ***Journal of Urban Economics***, ***65***(2), 113-126. https://doi.org/10.1016/j.jue.2008.10.004

Gemeente Amsterdam. (2018). ***Raadsleden en fracties***. Retrieved June 1, 2020, from https://www.amsterdam.nl/bestuur-organisatie/gemeenteraad/raadsleden-fracties/

Gemeente Amsterdam. (2020). ***Wonen in Amsterdam 2019 - Woningmarkt***. https://assets.amsterdam.nl/publish/pages/410516/190000_factsheet_woningmarkt_web.pdf

Gemeente Zwolle. (2009). ***Coffeeshop beleid***. https://decentrale.regelgeving.overheid.nl/cvdr/xhtmloutput/Actueel/Zwolle/CVDR34626.html

Giambona, E., & Ribas, R. P. (2018). Unveiling the price of obscenity: Evidence from closing prostitution Windows in The Netherlands. ***SSRN Electronic Journal***. https://doi.org/10.2139/ssrn.2994037

Gibbons, S. (2004). The costs of urban property crime. ***The Economic Journal***, ***114***(499), F441-F463. https://doi.org/10.1111/j.1468-0297.2004.00254.x

Greenstone, M., & Gallagher, J. (2008). Does hazardous waste matter? Evidence from the housing market and the Superfund program. ***Quarterly Journal of Economics***, ***123***(3), 951-1003. https://doi.org/10.1162/qjec.2008.123.3.951

Grimes, A., & Young, C. (2013). Spatial effects of urban rail upgrades. ***Journal of Transport Geography***, ***30***, 1-6. https://doi.org/10.1016/j.jtrangeo.2013.02.003

Haenen, P. (2019, August 29). Proef met legale wiet, van Breda tot Groningen. https://www.nrc.nl/nieuws/2019/08/29/proef-met-legale-wiet-van-breda-tot-groningen-a3971542

Het Parool. (2019, April 28). Handgranaat aangetroffen bij coffeeshop op Brouwersgracht. ***Het Parool***. https://www.parool.nl/nieuws/handgranaat-aangetroffen-bij-coffeeshop-op-brouwersgracht~baee2f65/

Ihlanfeldt, K., & Mayock, T. (2010). Panel data estimates of the effects of different types of crime on housing prices. ***Regional Science and Urban Economics***, ***40***(2-3), 161-172. https://doi.org/10.1016/j.regsciurbeco.2010.02.005

Informatiecentrum Cannabis. (n.d.). ***Geschiedenis wetgeving cannabis***. Retrieved March 10, 2020, from https://informatiecentrumcannabis.nl/wet-en-regelgeving/geschiedenis-wetgeving-cannabis/

Jellinek. (2015, November). ***Wat is de geschiedenis van cannabis?*** Retrieved March 11, 2020, from https://www.jellinek.nl/vraag-antwoord/wat-is-de-geschiedenis-van-cannabis/

Justis. (n.d.). ***Wet Bibob***. Rijksoverheid. https://www.justis.nl/producten/bibob/wet-bibob/

Knura, S. (2018, June 14). Geweld in Delft: het zou zo maar eens afpersing kunnen zijn. ***Omroep West***. https://www.omroepwest.nl/nieuws/3648714/Geweld-in-Delft-het-zou-zo-maar-eens-afpersing-kunnen-zijn

Koster, H. R., & Ommeren, J. V. (2015). A shaky business: Natural gas extraction, earthquakes and house prices. ***European Economic Review***, ***80***, 120-139. https://doi.org/10.1016/j.euroecorev.2015.08.011

Koster, H. R., & Rouwendal, J. (2012). The impact of mixed land use on residential property values*. ***Journal of Regional Science***, ***52***(5), 733-761. https://doi.org/10.1111/j.1467-9787.2012.00776.x

Levkovich, O., Rouwendal, J., & Van Marwijk, R. (2015). The effects of highway development on housing prices. ***Transportation***, ***43***(2), 379-405. https://doi.org/10.1007/s11116-015-9580-7

Linden, L., & Rockoff, J. E. (2008). Estimates of the impact of crime risk on property values from Megan's laws. ***American Economic Review***, ***98***(3), 1103-1127. https://doi.org/10.1257/aer.98.3.1103

Locatus. (2020, March 13). ***Wie is Locatus?*** Retrieved March 20, 2020, from https://locatus.com/wie-is-locatus

Loomis, J. B. (2013). Economic valuation: Concepts and empirical methods. ***Handbook of Regional Science***, 973-992. https://doi.org/10.1007/978-3-642-23430-9_54

Luttik, J. (2000). The value of trees, water and open space as reflected by house prices in The Netherlands. ***Landscape and Urban Planning***, ***48***(3-4), 161-167. https://doi.org/10.1016/s0169-2046(00)00039-6

Lynch, A. K., & Rasmussen, D. W. (2001). Measuring the impact of crime on house prices. ***Applied Economics***, ***33***(15), 1981-1989. https://doi.org/10.1080/00036840110021735

Meeus, J. (2014, December 6). Het begon met een paar simpele regels. ***NRC***. https://www.nrc.nl/nieuws/2014/12/06/het-begon-met-een-paar-simpele-regels-1444155-a283527

Mennes, R., Schoonbeek, I., Van Der Molen, J., & Bieleman, B. (2019). ***Coffeeshops in Nederland 2018*** (3036a). WODC. https://www.wodc.nl/onderzoeksdatabase/3060a-coffeeshops-in-nederland-2018.aspx

NVM. (n.d.). ***Over NVM***. Retrieved March 15, 2020, from https://www.nvm.nl/over-nvm/

Németh, J., & Ross, E. (2014). Planning for marijuana: The cannabis conundrum. ***Journal of the American Planning Association***, ***80***(1), 6-20. https://doi.org/10.1080/01944363.2014.935241

Oxford Dictionary. (n.d.-a). Amenity. In ***Oxford learner's dictionaries***. https://www.oxfordlearnersdictionaries.com/definition/english/amenity

Oxford Dictionary. (n.d.-b). Disamenity. In ***Lexico dictionaries | English***. https://www.lexico.com/definition/disamenity

Oxford Dictionary. (n.d.-c). Nimby. In ***Oxford learner's dictionaries.*** https://www.oxfordlearnersdictionaries.com/definition/english/nimby

Panhuysen, M., & Maalsté, N. (2015, September 13). Doe criminelen een lol: hou wiet illegaal. ***Trouw***. https://www.trouw.nl/nieuws/doe-criminelen-een-lol-hou-wiet-illegaal~bab9d4fa/

Pope, D. G., & Pope, J. C. (2015). When Walmart comes to town: Always low housing prices? Always? ***Journal of Urban Economics***, ***87***, 1-13. https://doi.org/10.1016/j.jue.2014.10.004

Pope, J. C. (2008). Fear of crime and housing prices: Household reactions to sex offender registries. ***Journal of Urban Economics***, ***64***(3), 601-614. https://doi.org/10.1016/j.jue.2008.07.001

Portnov, B., Genkin, B., & Barzilay, B. (2009). Investigating the effect of train proximity on apartment prices: Haifa, Israel as a case study. ***Journal of Real Estate Research***, ***31***(4), 371-395.

Poudyal, N. C., Hodges, D. G., & Merrett, C. D. (2009). A hedonic analysis of the demand for and benefits of urban recreation parks. ***Land Use Policy***, ***26***(4), 975-983. https://doi.org/10.1016/j.landusepol.2008.11.008

Rekenkamer Amsterdam. (2018). ***Het onderzoek van de Rekenkamer Amsterdam naar project 1012***. https://publicaties.rekenkamer.amsterdam.nl/project-1012/

Rijksoverheid. (n.d.). ***Gedoogbeleid softdrugs en coffeeshops***. https://www.rijksoverheid.nl/onderwerpen/drugs/gedoogbeleid-softdrugs-en-coffeeshops

Rosen, S. (1974). Hedonic prices and implicit markets: Product differentiation in pure competition. ***Journal of Political Economy***, ***82***(1), 34-55. https://doi.org/10.1086/260169

Sangers, I. (n.d.). Moet wiet helemaal legaal worden? ***NPO Focus***. https://npofocus.nl/artikel/7671/moet-wiet-helemaal-legaal-worden

Schravesande, F. (2017, July 24). Zulk streng beleid, en toch drugsoverlast. ***NRC***. https://www.nrc.nl/nieuws/2017/07/24/drugsoverlast-12225349-a1567731

Simons, R., Seo, Y., & Robinson, S. (2014). The effect of a large hog barn operation on residential sales prices in Marshall County, KY. ***Journal of Sustainable Real Estate***, ***6***(2), 93-111.

Stichting Maatschappij en Cannabis. (2018). ***Verkiezingen Amsterdam 2018 - Cannabis Kieswijzer***. Cannabis Kieswijzer. https://www.cannabis-kieswijzer.nl/verkiezingen-main-menu/verkiezingen-2018/gemeenteraadsverkiezingen-amsterdam-21-03-2018.html

Stichting Maatschappij en Cannabis. (2019, June 20). ***Beleid Tweede Kamer***. Cannabis Kieswijzer. Retrieved March 22, 2020, from https://www.cannabis-kieswijzer.nl/beleid/tweede-kamer.html

Sunak, Y., & Madlener, R. (2016). The impact of wind farm visibility on property values: A spatial difference-in-differences analysis. ***Energy Economics***, ***55***, 79-91. https://doi.org/10.1016/j.eneco.2015.12.025

Theebe, M. A. (2004). Planes, trains, and automobiles: The impact of traffic noise on house prices. ***The Journal of Real Estate Finance and Economics***, ***28***(2/3), 209-234. https://doi.org/10.1023/b:real.0000011154.92682.4b

Van den Heuvel, J., & Van Wely, M. (2016, October 20). Coffeeshops Afgeperst. ***De Telegraaf***. https://www.telegraaf.nl/nieuws/1282209/coffeeshops-afgeperst

Van Der Boom, V., & Van Eijk, G. (2017, June 28). Nederlandse bovenwereld zit dik in de cannabismarkt. ***Financieel Dagblad***. https://coffeeshops.fd.nl/?_ga=2.197026287.238085360.1498554868-349611238.1496310422

Van der Hooft, M. (2018, October 28). Protest tegen beoogde coffeeshop. ***RTV Zwolle***. https://www.rtvfocuszwolle.nl/protest-tegen-beoogde-coffeeshop/amp/

Van Dun, M. (2014, April 29). Westelijk Havengebied verzet zich tegen komst The Bulldog. ***Parool***. https://www.parool.nl/nieuws/westelijk-havengebied-verzet-zich-tegen-komst-the-bulldog~b125872b/

Van Weezel, T. (2016, November 2). Waarom worden in Amsterdam zoveel coffeeshops beschoten? ***Volkskrant***. https://www.volkskrant.nl/nieuws-achtergrond/waarom-worden-in-amsterdam-zoveel-coffeeshops-beschoten~b8b464a2/

Weltevreden, D. (2019, July 3). Aangekondige komst coffeeshop Aktama roept ook in De Schooten weerstand op. ***Noordhollands Dagblad***. https://www.noordhollandsdagblad.nl/cnt/dmf20190703_77761194/aangekondige-komst-coffeeshop-aktama-roept-ook-in-de-schooten-weerstand-op

Wen, H., Bu, X., & Qin, Z. (2014). Spatial effect of lake landscape on housing price: A case study of the West Lake in Hangzhou, China. ***Habitat International***, ***44***, 31-40. https://doi.org/10.1016/j.habitatint.2014.05.001

Zhang, L., Zhou, J., Hui, E. C., & Wen, H. (2018). The effects of a shopping mall on housing prices: A case study in Hangzhou. ***International Journal of Strategic Property Management***, ***23***(1), 65-80. https://doi.org/10.3846/ijspm.2019.6360

Appendix

A – Descriptive statistics for other independent variables.

In this section the descriptive statistics for the different definitions of 250m-store nearby, no-250m-store nearby, retail-store nearby, leaves-retail-store nearby, hospitality-store, and leaves-hospitality-store are shared.

Table A.1 Descriptive Statistics for (no-)250m-stores nearby, (leaves)-hospitality-stores nearby, (leaves)retail-stores nearby

	Mean	St.Dev	min	max
No- 250m-store in PC6	.022	.145	0	1
250m-store in pc6	.004	.06	0	1
no-250m-store within 50m	.057	.231	0	1
250m-store within 50m	.009	.094	0	1
no-250m-store in street 50m	.037	.188	0	1
250m-store in street 50m	.005	.072	0	1
no-250m-store in street 100m	.087	.282	0	1
250m-store in street 100m	.009	.093	0	1
no-250m-store in street	.236	.425	0	1
250m-store in street	.028	.166	0	1
no-250m-store within 20m	.014	.117	0	1
no-250m-store 20 to 50m	.043	.203	0	1
no-250m-store 50 to 100m	.12	.325	0	1
250m-store within 20m	.002	.048	0	1
250m-store 20 to 50m	.007	.081	0	1
250m-store 50 to 100m	.017	.129	0	1
hospitality-store in PC6	.02	.139	0	1
leaves-hospitality-store in PC6	.006	.078	0	1
hospitality-store within 50m	.051	.22	0	1
leaves-hospitality-store within 50m	.016	.127	0	1
hospitality-store in street 50m	.033	.178	0	1
Leaves-hospitality-store in street 50m	.009	.097	0	1
hospitality-store in street 100m	.081	.272	0	1
Leaves-hospitality-store in street 100m	.02	.141	0	1
Hospitality-store in street	.219	.413	0	1
Leaves-hospitality-store in street	.066	.249	0	1
hospitality-store within 20m	.012	.111	0	1
hospitality-store 20 to 50m	.039	.193	0	1
hospitality-store 50 to 100m	.112	.315	0	1
leaves-hospitality-store 20m	.004	.06	0	1
leaves-hospitality-store 20 to 50m	.013	.113	0	1
leaves-hospitality-store 50 to 100m	.032	.176	0	1

	Mean	St.Dev	min	max
retail-store in PC6	.022	.146	0	1
leaves-retail-store in PC6	.004	.063	0	1
retail-store 50m	.056	.23	0	1
leaves-retail-store 50m	.011	.103	0	1
Retail-store in street 50m	.036	.187	0	1
leaves-retail-store in street 50m	.006	.078	0	1
Retail-store in street 100m	.087	.282	0	1
leaves-retail-store in street 100m	.013	.113	0	1
Retail-store in street	.233	.423	0	1
Leaves-retail-store in street	.042	.202	0	1
retail-store 20m	.014	.116	0	1
retail-store 20 to 50m	.042	.201	0	1
retail-store 50 to 100m	.12	.325	0	1
leaves-retail-store 20m	.002	.049	0	1
leaves-retail-store 20 to 50m	.008	.091	0	1
leaves-retail-store 50 to 100m	.02	.14	0	1

Note: The number of observations is 58,159.

B – Coefficients for the control variables of the baseline results.

Table B1 contains the full regression results of equation (2) with PC5 level location specific fixed effects and coffeeshop within 50 meters as the independent variable of interest.

Table B1 – Coefficients for the control variables

Variables		Variables	
Log Size (m^2)	0.771***	D: Central heating	0.0444***
	(0.00587)		(0.00268)
D: leasehold	-0.0255***	D: monumental	0.0267***
	(0.00308)		(0.00518)
D: von	-0.0109**		
	(0.00515)	Constr Before 1905	-0.0574
Semi detached	0.00835		(0.0428)
	(0.0321)	Constr 1906-1930	-0.0718*
apartment	-0.0928***		(0.0426)
	(0.0298)	Constr 1931-1944	-0.0826*
terraced	-0.0441		(0.0427)
	(0.0296)	Constr 1945-1959	-0.117**
D: garden	-0.0294***		(0.0453)
	(0.00643)	Constr 1960-1970	-0.153***
D: Private Parking Space	0.0908***		(0.0447)
	(0.0158)	Constr 1971-1980	-0.129***
D: garage	0.0272*		(0.0436)
	(0.0151)	Constr 1981-1990	-0.146***
N of rooms	0.0202***		(0.0430)
	(0.00151)	Constr 1991-2000	-0.0583
N of Bathrooms	0.00514**		(0.0429)
	(0.00242)	Constr after 2000	-0.0552
N of Kitchens	-0.0116***		(0.0432)
	(0.00224)	D: auction	-0.163***
N of balconies	-0.00180		(0.0306)
	(0.00213)	D: occupied	0.0139
N of Rooftop terraces	0.0513***		(0.0112)
	(0.00247)	D: partly rent	-0.155***
N of floors	0.00435**		(0.0296)
	(0.00213)		
N of dormer windows	-0.000443	Km to Dam Square	-0.0864***
	(0.00534)		(0.0126)
D: Office available	0.0617***	Km to Highway Ramp	-0.0378***
	(0.0236)		(0.0137)
D: Maintenance Good	0.0390***	Km to Train station	-0.00718
	(0.00321)		(0.0122)
Maintenance State Inside	0.114***		
	(0.0107)		
Maintenance State Outside	0.227***		
	(0.00837)	Constant	9.069***
N of types of Insulation	0.00529***		(0.101)
	(0.000598)	Observations	58,159

Notes: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 Time FE by quarter. Location FE by PC5. Quality is a scale 0-1 for both inside and outside a house. Dependent variable = Logarithm of the Price D = Dummy variable. Base values: Detached; Construction missing.

C - Results time on market with PC4 fixed effects

Table C1 contains the regression results of equation (3) with the log of the days a house had been offered on the market before it was sold as the dependent variable. Location specific fixed effects were controlled for at the PC4 level.

Table C1: Days on market analysis with PC4 FE

(dependent variable: The logarithm of the days a house is offered on the market)

	(1)	(2)	(3)	(4)	(5)
Variables	pc6	50m	Street 50m	street 100m	Street
Cannabis store in the (..)	0.0502**	0.0272	0.0583	0.0404*	0.0557***
	(0.0226)	(0.0251)	(0.0355)	(0.0234)	(0.0174)
pc4 FE (50)	YES	YES	YES	YES	YES
Quarter FE (60)	YES	YES	YES	YES	YES
Housing Characteristics	YES	YES	YES	YES	YES
Observations	56,774	56,774	56,774	56,774	56,774
R-squared	0.166	0.166	0.166	0.166	0.166

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1