Bachelor Thesis Real Estate

The impact of location factors on office rental rates

Differences between key cities and smaller towns in the Netherlands.

University of Groningen

Faculty of Spatial Science

Supervisor: Dr. Liu

Group 1: Real estate

Sterre de Neve

S2200325

22-1-2017

SUMMARY

Rental rates are mainly influenced by: economic factors, contractual factors, building specific factors, and location specific factors (Pekdemir & Öven, 2004). Research has mostly been done using a combination of these four influences. The contribution of this research is to focus on the impact of location factors on rental rates of office buildings, with a special focus on how location factors impact rental rates for offices located in the Randstad (Amsterdam, Rotterdam, The Hague, and Utrecht) compared to the peripheral areas (smaller cities and rural areas).

According to the literature, the main location factors that influence rental rates are: the number of office buildings in a radius of two kilometres from an office building, the distance to a station, the distance to the highway, distance to a supermarket and distance to green space. Hedonic regressions are run to determine the influences of every location factor, and to compare the differences between the Randstad and the peripheral areas. I found evidence that the average rent of office buildings in the Randstad is significantly higher (40%), than the average rental rates in the peripheral areas. This confirms the hypothesis that the location is a key factor in determining rental rates. Subsequently, this research focuses on what strengthens or weakens the impact of location factors.

The effect of a train station, and being closely situated to a supermarket changes the rental prices, depending on whether an office building is located the Randstad or peripheral area. The proximity of office buildings within two kilometres, the shorter distance to a highway ramp or exit have a similar effect on rental price, regardless if an office building is located in the Randstad or a peripheral area. The results of proximity to greenspace are not significant.

In addition, my data reveal that some location factors differ across the Randstad or peripheral areas. A closer distance to a train station leads to a decreases for office buildings rental rates in the Randstad and increases for office buildings rental rates located in the peripheral areas. The influence of having a supermarket close to the office location leads to an increase in the rental rates of office buildings in the Randstad, and a decrease for office buildings located in the peripheral areas.

Finally, this research indicated that the proximity of office buildings in a radius of two kilometres increases rental rates. This effect is more profound in peripheral areas compared to the Randstad. Moreover, the shorter distance to a highway ramp or exit leads to higher rental rates of office buildings in both the Randstad and the peripheral areas.

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CHAPTER 1: INTRODUCTION

1.1 Motivation research

The office market is a very fluctuating and uncertain market (Kempf, 2015; Chau & Wong, 2015). Major changes have been seen on rental rates of office buildings. The office building market and the factors that influence the rental rates is a well-researched topic. The factors that have an influence on the rental rates of office buildings are interesting and important for researchers as well as practitioners (Mills, 1992).

Rental rates are influenced by: economic factors, contractual factors, building specific factors, and location factors (Pekdemir & Öven, 2004). Location factors are considered the most important factors influencing the rental rates of office buildings, and is an extensive research topic (Fuerst, 2006; Öven & Pekdemir, 2006; Kempf, 2015). Consequently, it is of great importance to understand the influences of the location factors on the rental rates. This could help companies understand what determines rental rates, and what investments are worthwhile. This could help companies to find the best location depending on what a company prefers.

This research contributes by focusing on location factors and how the impact changes depending on whether an office is situated in the Randstad or a peripheral area. The Randstad in the research will include the following cities: Amsterdam, Rotterdam, Utrecht, and The Hague. The peripheral areas include the rest of the Netherlands. This will help to obtain better insights on what influences the location factors and what the differences are between the peripheral areas and the Randstad.

1.2 Research problem

Most researchers combine the various factors influencing the rental rates (o. a. Mills, 1992; Fuerst, 2006; Kempf, 2015). The key area of this research focusses on how the impact of location factors changes depending on whether an office is located in the Randstad or a peripheral area. This leads to the following main research question:

What is the impact of location factors on office rental rates, and how do these effects change depending on whether an office building is located in the Randstad or in peripheral areas in the Netherlands?

To be able to answer the main research question the following questions need to be addressed:

- What influences rental rates of office buildings?
- What are the location factors that influence the rental rates of office buildings?
- How does the impact of location factors change depending if an office building is located in the Randstad or peripheral areas, and how can this be explained?

In order to answer these questions, previous research is outlines and an empirical research is executed in the form of a hedonic regression.

1.3 Structure of the research

The thesis is structured as follows: the first chapter focuses on the introduction including the motivation of the research, the research problem and the structure of the research. The theoretical framework is developed in the second chapter. Chapter 3 focusses on the research methodology and shows the hedonic regression. The results of the regressions are discussed in chapter 4, and the conclusions and further recommendations are concluded in chapter 5.

CHAPTER 2: THEORETICAL FRAMEWORK

This chapter discusses some general rent theories, and office rent determinants. The chapter also focuses on research and key findings on the rental rates of office buildings. Next the main differences between the Randstad and peripheral areas will be discussed. Lastly this chapter will focus on the different location factors that are expected to have an influence on the rental rates.

2.1 General rent theories

Real estate prices are determined by the interaction of demand and supply. When the demand is at a higher level than supply, prices will go up[1] (and vice versa). Higher rental rates are often the result from buildings or areas where the demand is higher than the supply, and can thus be seen as favourable locations for companies (Kempf, 2015).

2.2 Office rent determinants

A lot of research has been done on factors that influence rental rates (a. o. Rosen, 1984; Brennan et al., 1984; Mills, 1992; Sivitanidou, 1995; Öven & Pekdemir, 2006; Fuerst, 2007; Kempf; 2015). Four types of influences can be distinguished: economic influences, contract variables, building specific factors, and location factors (Pekdemir & Öven, 2002). This answers the first question: what influences rental rates of office buildings? These different influences will be discussed below. The different factors influencing rental rates of office buildings are explained in the conceptual model in figure 1. In the figure the different influences on rental rates are projected in an overview, as well as location factors, which are the main focus in this research.
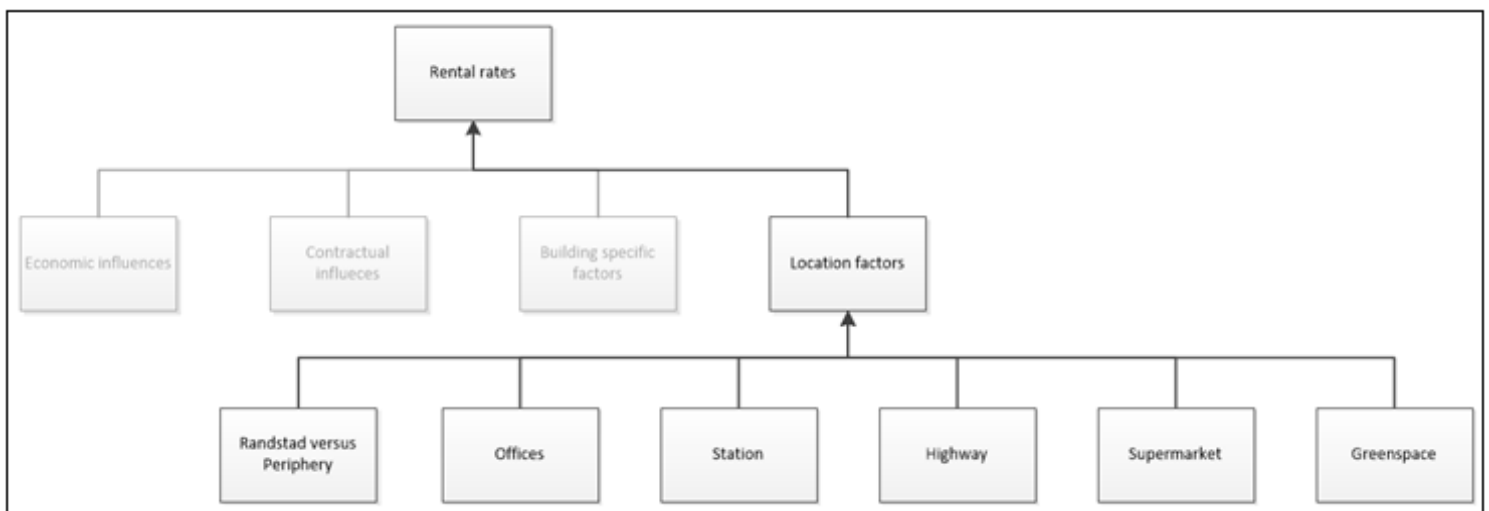

Figure 1: Theoretical framework. Authors own production.

[1] Retrieved from https://isites.harvard.edu/fs/docs/icb.topic1143374.files/Rena__Chap%202.pdf

Economic determinants on rental rates are influences by the supply and demand. Changes in demand can be the result of: price adjustments paired with supply responses by developers (Rosen, 1984), changes in the buying, selling and construction of office buildings (Ball et al., 2012), and changes in employment rates influences changes in demand (McDonald, 2002). The supply and demand of office buildings also influences of the vacancy and occupancy rates. Even in a market equilibrium there is a natural vacancy rate (Orr & Jones, 2003). This exists because it takes time for tenants to move in and out of buildings (Chau & Wong, 2015). Vacancy rates are also often seen as a proxy for the attractiveness of an office building (Fuerst, 2007).

Next to economic influences, contractual variables also influence rental rates of office buildings. These contractual variables include among other things operational expenses, duration of the contract, and the duration of free rent (Öven & Pekdemir, 2006).

The third important influence on rental rates of office buildings are building specific factors (Öven & Pekdemir, 2006). These can be divided into two groups: architectural quality and internal building factors. Good and new architectural quality leads to a higher rental rate level (Hough & Krats, 1983). In addition, rental rates of office buildings are also influenced by various internal office buildings factors.

Internal building factors include a lot of different factors and is a matured researched topic. The most important influences on rental rates are the age of an office building and the total square meters of the office building (Öven & Pekdemir, 2006). The younger an office building or the more recently renovated the higher the rental rates (a. o. Mills, 1992; Dunse et al., 1998). The age gives information on the quality and technological infrastructure of a building (Fuerst, 2006). In addition, the importance of the total square meters is examined by Clapp (1980). He argues that a larger total floor area the more possibilities for face-to-face interaction (Clapp, 1980). A large continuous space is considered to be more efficient (Bollinger et al., 1998). Next to these two important building specific factors, other building specific factors that lead to higher rental rates are for example: more stories (Fuerst, 2007), and better and more amenities in a building (a. o. Clapp, 1980; Nitsch, 2006).

The last group of factor that influence rental rates of office buildings are location factors. This will be the main focus of this research. Location factors used in other research that lead to higher rental rates are: being closely situated to a subway station (a. o. Mills, 1992; Fuerst, 2006; Cervero & Duncan, 2002; Kempf. 2015), the number of buildings situated close to the office building or the distance to the Central Business District (CBD) (a. o. Fuerst, 2006; Koster, 2012). Next to that the different city districts also shows different rental rates (a. o. Mills, 1992; Fuerst, 2006l Öven & Pekdemir, 2006).

2.3 Previous research

The influences of economic, contractual, building specific and location factors are well researched themes since the 1980s. Most research gives a combination of these four influences (a. o. Mills, 1992; Fuerst, 2007; Brennan et al., 1984; Öven and Pekdemir, 2006). The research will contribute in two ways to the previous research. First it will contribute by solely focussing on location factors, as this is seen the most influential factor on rental rates of office buildings. By only focusing on location factors and including more variables than in previous research, my research will provide a better understanding of location factors. Secondly the research will contribute by focussing on the Netherlands and in particular looking at the differences between the impact of location factors in the Randstad (Amsterdam, Rotterdam, The Hague, and Utrecht) compared to the peripheral areas (for the practicability of this research this will include the smaller cities in combination with the rural areas).

2.4 Randstad versus peripheral areas in the Netherlands

On average companies are willing to pay 10% rent premium for a location in an agglomeration (Koster, 2012). One reason for this is that in agglomeration higher productivity levels can be found (Gleaser & Gottlieb, 2009; Puga, 2010). This could explain the differences in rental rates of office buildings between the Randstad and peripheral areas.

Other factors that lead to preference of office buildings located in the Randstad compared to being located in peripheral areas can be found below. The Randstad hosts the most important headquarters, and business services and ICT firms that operate at a supra-regional level (Koster, 2012). The Randstad also has higher employment rates, which lead to an increase in demand paired with higher rental rates for office buildings (McDonals, 2002; Rosen, 1984). The advantage of the Randstad leads to differences between the rental rates in the Randstad and the peripheral areas. By looking at the different impacts location factors have on rental rates, better insights can be gained for companies when choosing their office location.

2.5 Location factors

There are a lot of different location factors that influence the rental rates. The second sub question this study is: what are the location factors that influence the rental rates of office buildings? The following location factors will be outlined in this paragraph:

- The number of office buildings within a radius of two kilometres
- The distance to the closest train or subway station
- The distance to the closest highway ramp or exit

- The distance to the closest supermarket
- The distance to the closest green space.

For every location factor an explanation along with a hypothesis will be given.

The first location factor is the number of office buildings within a radius of two kilometres. Several benefits can be found from the existence of more offices within these two kilometres. The main reason for preferring a location in the vicinity of other offices are benefits from potential interactions with other firms. These interactions include: face-to-face contact between professionals, deal-making, relationship exchange, tacit knowledge, new ideas, and creative insights (Clapp, 1980; Storper & van Venables, 2004; Amiti & Cameron, 2007; Anas et al, 1998; Öven & Pekdemir, 2006). However, recently it has been argued if the proximity of multiple offices is still as important now as it used to be, as transportation costs are lower and better information and communication technologies are available (Dixon et al, 2003). Despite this, the following hypotheses seems feasible:

Hypothesis 1: The proximity of more office buildings located within a radius of two kilometre of the office building is positively related to the rental rates of the office building.

Next to the issue of having other office buildings close to the office building location, it is important to look at the accessibility of the office building. Accessibility will include two location factors: the influence of a station, and the influence of a highway close to an office building. First the distance to a station will be discussed. In this research the term station includes both train station and subway stations.

Having an office building closely situated to a station can have both positive and negative effects on rental rates of office buildings. Cervero and Duncan (2002) found that having an office that is located within 400 meters of a train station leads to a 120% higher rental rate of the office buildings. This positive relationship was also found by Dunse et al. (1998). An explanation for this is that the working environment has become more important for choosing a location for an office building (Wheaton & Torto, 1994). The proximity of a station decreases the commuting distance for the employees. However, Ryan (2005) found that the prices of office buildings decrease when the building is located closer to a railway station. Explanations for this could be negative externalities, for example higher crime rates (Öven and Pekdemir, 2006'. Despite the negative externalities, the positive impacts of being close to a station are expected to have a stronger impact. This leads to the following hypothesis:

Hypothesis 2: Distance to a station is negatively related to the rental rates of office building.

As well as the proximity of a station, there are also positive and negative correlations found for the distance from an office building to a highway ramp or exit. Being close to a highway would lead to minimizing commuting time for employees (Ryan, 2005). On the other hand, highways also have some negative externalities, for example: the congestion and noise. This, however seems to balance the shorter commuting time (Frew & Jud, 1988). The following hypotheses can be found:

Hypothesis 3: Distance to a highway is negatively related to the rental prices of office buildings.

The next location factor is the proximity to a supermarket. As to my knowledge this is a location factor that has not been researched before. However, research has been done on the influence of amenities close to the office building. From an employee's view, it is attractive to be closely situated to amenities, like a supermarket. This improves the working environment for the employees, which is considered important nowadays (Wheaton & Torto, 1994). The following hypotheses would be expected for this research:

Hypothesis 4: Distance to a supermarket is negative related to the rental price of office buildings.

The last location factor that will be included in the research is the distance to green space. Research found that being closely located to green space would lead to higher rental rates (Laverne & Winson-Geideman, 2003). Other benefits from green space are: better air quality (Scott et al, 1998; Beckett et al. 2000), storm-water management (Scott et al., 1998), and others.

Hypothesis 5: Distance to green space is negatively related to the rental prices of office buildings.

CHAPTER 3: METHODOLOGY

This chapter outlines empirical specification of the hedonic regression analysis and the sample selection.

3.1 Hedonic regression

The hedonic regression will be a log-linear function, that will have the following form:

$$LN\ RENT\ THE\ NETHERLANDS$$
$$= \alpha + \beta_1 OFFICES + \beta_2 STATION + \beta_3 HIGHWAY + \beta_4 SUPERMARKET$$
$$+ \beta_5 GREENSPACE + \beta_6 RANDSTAD + \varepsilon$$

The regression has the following dependent and independent variables. For the dependent variable of RENT a log function is used. α gives the constant variable and ε shows the error function. OFFICES is used for describing the number of offices within a radius of two kilometres from the office building with β_1 as the coefficient. The second independent variable is STATION with β_2 as the coefficient. With this the straight line distance to the closest subway station or train station will be addressed. HIGHWAY is the straight line distance to the closest highway ramp or exit with β_3 as the coefficient. The independent variable SUPERMARKT with β_4 as the coefficient is the straight line distance to the closest supermarket. The independent variable GREEN SPACE with β_5 as the coefficient is the straight line distance to the nearest green space. The last independent variable is RANDSTAD with β_6 as the coefficient. This is a dummy variable and has value 1 if the office is located in the Randstad, and value 0 otherwise.

3.2 Sample selection

Different types of data acquisition methods were used for this research. Data on the rental rates of the office buildings included in the research are acquired from Cushman & Wakefield. Data of the independent variables were acquired using Geographical Information Systems (GIS). The dataset received from Cushman & Wakefield consists of the rental rates given in the first quarter of 2016 for 5000 office buildings, it also includes the addresses of these office buildings (Cushman & Wakefield). The rental rates per square meter for a year. After geocoding the dataset consists of 4720 office buildings. A spatial distribution can be found in figure 2 on the next page. The office buildings used in the research contains 10.5% of all office buildings in the Netherlands, when using the number of office buildings in the LISA file. I used the rule of thumb that data <1% and 99%> are outliers. As this measurement shows that my dataset contains a certain amount of extreme data in Amsterdam, no extreme outliers were removed in order to include this very interesting data group.

The data acquisition for every location factor will be described shortly. For the independent variables offices data of the location of all office buildings in the Netherlands are used. All the offices included were identified by the LISA2016 file. This file includes all office buildings in the Netherlands where at least one person is working (LISA, 2016). This dataset is used to determine the number of office buildings within a radius of two kilometers.

The distance to the nearest station, was found using a file from ArcGis Online[2]. This includes both the subway stations as well as the train stations. The highway ramps and exits were tracked using a map layer from the Rijkswaterstaat[3].The closest supermarket was found using a data layer from ArcGIS Online[4]. This includes 35 different supermarket chains in the Netherlands. For an overview of these supermarket chains see appendix 1. Lastly for green space a lot of different sorts of parks and public gardens are included. The green space included is mainly handmade green space. The full description of green space can be found in appendix 2.
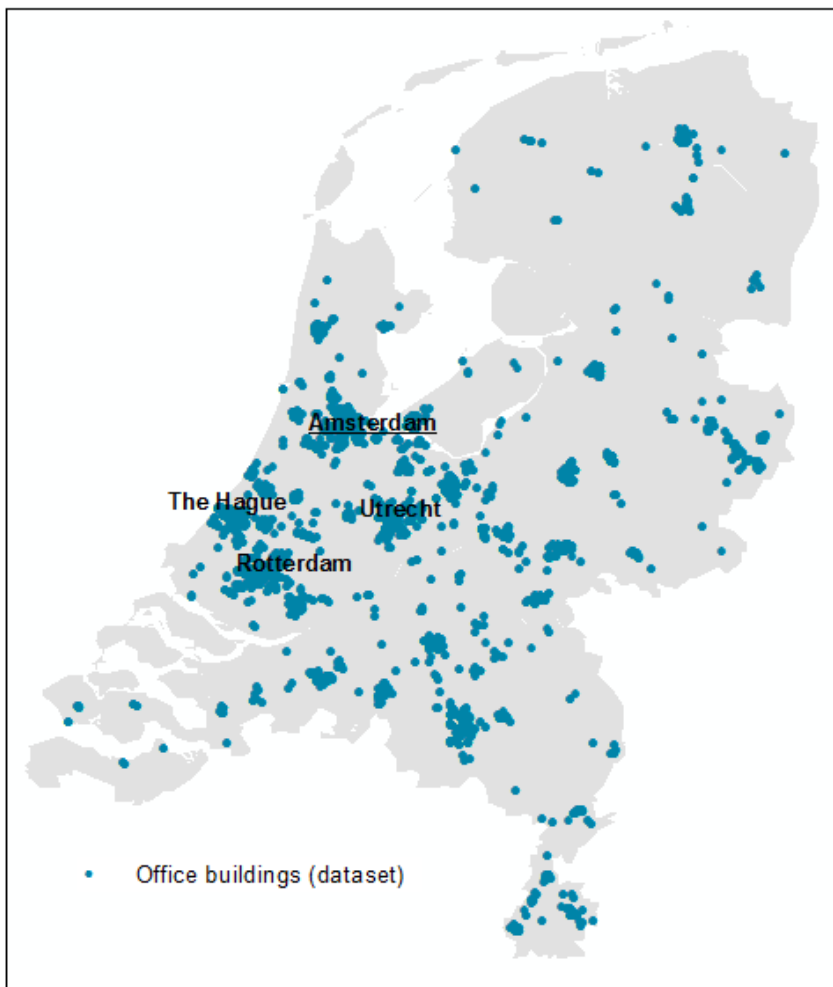
Figure 2: Spatial representation of office buildings in the Netherlands. Authors own production.

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[2] Retrieved from http://services.arcgis.com/nSZVuSZjHpEZZbRo/arcgis/rest/services/Stations/FeatureServer
[3] Retrieved from http://www.rijkswaterstaat.nl/apps/geoservices/geodata/dmc/nwb-wegen/geogegevens/shapefile/Nederland_totaal/01-11-2016/
[4] Retrieved from
http://services6.arcgis.com/rSIMRLo7BGD5Pwl7/arcgis/rest/services/Supermarkten_Formules/FeatureServer

CHAPTER 4: RESULTS

In this chapter the results from the hedonic regression will be discussed as well as the descriptive statistics and correlation matrix. Three different regressions are done: one for the Netherlands, one for the Randstad, and one for the peripheral areas. The last two will be discussed and compared and will give an answer to the third sub question.

4.1 Descriptive statistics

The descriptive statistics for the Netherlands, the Randstad and the peripheral areas can be found below. To give a better insight in the descriptive statistics the distances will be in meters. In the rest of the research the distance to closest station and highway will be given in kilometres, and for supermarket and green space in 100 meters.

Table 1: Descriptive statistics. Authors own production.

	NETHERLANDS		RANDSTAD		PERIPHERAL AREAS	
	Mean	Sd	Mean	Sd	Mean	Sd
Rent €	122.60	42.72	154.57	54.06	110.93	30.25
Offices	223.24	238.623	389.46	372.43	163.67	117.73
Station (M)	1662.08	1961.6	101.24	913.24	1897.42	2177.42
Highway (M)	1581.36	1268.6	1529.48	1190.99	1600.29	1295.42
Supermarket (M)	631.37	456.13	530.57	385.32	668.17	474.12
Green space (M)	375.35	440.7	327.39	259.27	392.84	489.33
Amsterdam	-	-	182.55	69.28	-	-
N		4720		1262		3458

The descriptive statistics can be found in table 1. Looking at the rental rates it comes forward that the mean rental rates of office buildings located in the Randstad are €43.64 per m² higher than the mean rental rates of office buildings in the peripheral areas. Within the Randstad the mean rent in Amsterdam is €27.98 per m² higher compared to the average rental rate in this area. These major differences in rental rates are one of the reasons to look at the regressions separately for the Randstad and the peripheral areas. Of the total dataset 26.74% of the office buildings in this study are located in the Randstad.

Looking at the independent variables separately other differences between the Randstad and peripheral areas come forward. The Randstad has twice as many office buildings within a radius of two kilometres, then the peripheral areas. The distance to a highway is similar for the Randstad and peripheral areas, as well as the distance to the closest supermarket and the distance to green space.

4.2 Correlation matrix

A correlation indicates the degree of linear association between two variables. Values are between -1 and 1. Closer to -1 or 1 means a strong correlation, and values closer to 0 show a weak correlation (Moore & McCabe, 2009). In the dataset no very strong correlations were found (above 0.7), all variables have a correlation lower than 0.4. The highest correlation is seen between the number of offices within a radius of two kilometres and the rental rates. The other correlations show a moderate to weak correlation. The correlation matrices can be found in appendix 4.

4.3 Regression analysis

The formula used for the regression of the Netherlands is shown in table 2. The model for the Netherlands explains 29.07% of the rental rates. All coefficients are significant on a 99% significant level, except green space. The coefficients and their influences on office rental rates will be discussed in the following.

For every extra office located within the radius of two kilometres, the price level increases with respectively 0.05%. This corresponds with the hypothesis that the rental rates would be higher due to the proximity of more office buildings. The distance to station (hypothesis 2) and highway (hypothesis 3) both have a negative coefficient. Meaning every kilometre an office building is located further away from a station or highway, a decrease in the rental rates will be found. The percentage of price decrease shows stronger results for station than for highway. However, this difference is only minimal, respectively 1.16% and 0.86%.

The supermarket (hypothesis 4) has a positive coefficient, indicate that every 100 meters' distance between an office building and a supermarket positively impacts the rental rates of an office building. This does not correspond with the hypothesis that higher rent levels would be found closer to a supermarket. An explanation for this is that supermarkets are large buildings, and thus prefer to be located in low rent areas. This would mean that the office buildings that are located close to the supermarket will probably have lower rents as well. This could explain the positive relation between the longer distance between a supermarket and the increased rental rates for office buildings. Green space

(hypothesis 5) does not have a significant coefficient, meaning that it shows no impact on rental rates of office buildings.

Lastly, office buildings located in the Randstad have 20.99% higher rent levels. Koster (2012) found that rental rates are 10% higher in agglomerations, what partly explains the higher rent. The other reason for the higher rents in the Randstad could be explained by looking at the office location raking 2016 of Jones Lang LaSalle. In the top 25 ranking position only 5 office buildings are located outside of the Randstad (JLL, 2016).

Table 2: Hedonic regression. Authors own production.

	NETHERLANDS		RANDSTAD		PERIPHERAL AREAS	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Constant	4.6012**	0.0110	4.8375**	0.0239	4.5810**	0.0143
Offices	0.0005**	0.0000	0.0004**	0.0000	0.0047**	0.0000
Station	-0.0116**	0.0022	0.0155	0.0098	-0.0124**	0.0022
Highway	-0.0086**	0.0033	-0.0104	0.0086	-0.0046	0.0036
Supermarket	0.0049**	0.0010	-0.0058*	0.0026	0.0063**	0.0011
Green space	0.0004	0.0010	-0.0030	0.0031	0.0010	0.0010
Randstad	0.2099**	0.0097	-	-	-	-
Amsterdam	-	-	0.1517**	0.0188	-	-
N	4720		1262		3458	
R-square	0.2916		0.2280		0.0604	
Adjusted R-square	0.2907		0.2846		0.0591	

* significant at p<0.05, ** significant at p<0.01

4.4 Comparison regression Randstad and peripheral areas

Two different regressions were done, one for the Randstad and one for the peripheral areas. Both formulas can be found below. Table 2 gives the results of these regressions.

$LN\ RENT\ RANDSTAD$
$$= \alpha + \beta_1 OFFICES + \beta_2 STATION + \beta_3 HIGHWAY + \beta_4\ SUPERMARKET$$
$$+ \beta_5\ GREENSPACe + \beta_6\ AMSTERDAM + \varepsilon$$

$$LN\ RENT\ PERIPHERAL\ AREAS$$
$$= \alpha + \beta_1 OFFICES + \beta_2 STATION + \beta_3 HIGHWAY + \beta_4\ SUPERMARKET$$
$$+ \beta_5\ GREENSPACe + \varepsilon$$

The model of the Randstad explains 28.46% of the rental rates, and consists of 1262 office buildings. The model of the peripheral areas only explains 5.91%, and consists of 3458 office buildings.

Every coefficient will be discussed and compared below between the Randstad and the peripheral areas. These comparisons will answer the third sub question: what are the different effects of location factors for the Randstad compared to the peripheral areas, and how can they be explained? This will lead to better insight in the different location factors and their influence on rental rates of office buildings.

For both the Randstad and the peripheral areas the coefficient for the number of offices that are located within a radius of two kilometres show a positive relation, corresponding with the hypothesis. Meaning that every extra office that is found within these two kilometres will lead to an increase in the rental rates of office buildings. However, the impact of an extra office building within the two kilometre has a smaller effect in the Randstad than the peripheral areas. A reason for this could be that the mean number of office buildings within the radius of two kilometres is a lot higher in the Randstad than in the peripheral areas (see table 1). Because of this one extra office building within the two kilometres will have a larger impact in the peripheral areas.

The next coefficient is station, measuring the distance to the closest train or subway station. When comparing both coefficients, the coefficient for peripheral areas is negative and the coefficient for the Randstad is positive. This does not correspond with the stated hypotheses (2), that the closer an office is located the higher rental rates would be found. An explanation for this different outcome could be that because there are less stations in the peripheral areas, every station that is found has a very strong impact. In the Randstad so many stations are found that the impact of one station is not that strong, because another one will be close as well. The mean distance to the closest station is also shorter in the Randstad (1017,24m) than in the peripheral areas (1897,42m). However, the coefficient for Randstad is not significant.

For highway, it is expected that an office building located close to the highway would have higher rental rates. This was also found in the regression. Both coefficients are negative, meaning that lower rental rates are found for office buildings located further from a highway. A stronger decrease in rental rates is found in the Randstad. An explanation for the higher coefficient in the Randstad could be that the companies in the Randstad find a shorter commuting time more important than those in the peripheral areas. However, both coefficients are not significant and thus the hypothesis (3) cannot be accepted.

The next location factor is supermarket. The coefficient for supermarkets in the Randstad is negative, whereas it is positive in the peripheral area. Both are significant on a 95% significance level. In the peripheral areas, offices have higher rental prices if they are further away from a supermarket. The negative coefficient for the peripheral areas was also found for the regression of the Netherlands. As explained before this could be because supermarkets take up a lot of space and thus prefer locations with lower rental rates, this can also be the case for the peripheral areas. The negative coefficient for the Randstad, and thus lower rents further from a supermarket could be explained that the well-being of the working environment, and thus being located closer to amenities are seen more important here.

Moreover, the regression has different coefficients for the Randstad and peripheral areas when looking at the distance to greenspace. Being a 100 meter closer to green space will lead to an increase in rental rates in the Randstad, but to a decrease in rental rates of office buildings in the peripheral areas. Both variables are not significant. Therefore, we reject the hypothesis (5). An explanation for this difference may be found in the fact that data of green space in this research refers to mainly green space by humans. This excludes the natural areas. This could be an explanation for the fact that green space is never significant in the regression. It could be possible that this leads to the differences between the Randstad and the peripheral areas (Compendium voor leefomgeving, 2016).

Finally, the influence of rental rates of office buildings situated in Amsterdam, is compared to the rest of the Randstad, is 15.17% higher. This could be explained by looking at the top 25 ranking of office locations in the Netherlands by Jones Lang LaSalle. 12 of the 25 office buildings in this list are located in Amsterdam (JLL, 2016).

CHAPTER 5: CONCLUSION

5.1 Conclusion

The purpose of this research was to investigate the impact of location factors on office rental rates, and to examine the differences between the key cities and the smaller towns and rural areas in the Netherlands. This research contributed to the literature by investigating how the impact of location factors is different when an office building is located in the Randstad or in peripheral areas.

This research included several location factors: the number of office buildings within a radius of two kilometres, the distance to the closest train or subway station, the distance to the closest highway, the distance to the closest supermarket and the distance to green space. Most of which were expected to lead to an increase of the rental rates when being closer located to the office building.

The empirical analysis is done by using a hedonic regression. The results are that the influences of one office extra within two kilometre has a stronger positive effect on the rental rates of office buildings in the peripheral areas than the rental rates of office buildings in the Randstad. This is explained by the fact that there are more office buildings in the Randstad, the increase of one extra office will not have a strong influence. The impact of the distance to a station differs per area. It is shown that office buildings located in the Randstad that are located closer to stations, have decreasing the rental rates. On the other hand, the distance to the station in peripheral areas leads to an increase of the rental rates. The coefficient of the Randstad however is not significant. The influences of being close to a highway are as expected, both lead to increased prices when having an office building closer to the highway.

The influences of a supermarket located nearby to an office location would lead to a decrease in rental rates in the peripheral areas. This could be explained that supermarkets take up large space and thus are located in low rental rate areas. In the Randstad, however, having a supermarket closer to the office building would lead to an increase of the rental rates. This can be explained because of the importance of the working environment for employees. Lastly, the influences of green space do not give significant results. This could be because the green space only includes artificial green space.

5.2 Limitations and recommendations

Several limitations are acknowledged in the research. First, future research should include the economic, contractual, and building specific factors in the research (Öven & Pekdemir, 2006). It is likely that this provides better results, and its impact on location factors. Besides, by constructing more different groups and making a larger variety of geographic areas, rather than only Randstad and peripheral areas, it could give more detailed insight into the location factors on rental prices.

Finally, another recommendation for future research would be to take the real estate cycle (Kempf, 2015) into account. In this study, now only a certain point in time is analysed. However, by looking at a period over time, the influence of location factors might even be sharper researched.

APPENDIX 1: SUPERMARKET CHAINS[5]

Agrimarkt
Albert Heijn XL
Albert Heijn
ALDI-markt
Amazing Orie
Attent
Boni
Boon's Markt
Coop
Coop Compact
Dagwinkel
Deen Supermarkt
Dekamarkt
Dirk
Ekoplaza
EMTÉ
Estafette
Hoogvliet
Jan Linders
Jumbo
Jan Linders
Jumbo
Lidl
M&S Foodhall
Marqt
MCD
Nettorama
Plus
Pojesz
Sahan
Spar
Supercoop
Superr
Tanger
Troefmarkt
Vomar

APPENDIX 2: EXPLANATION OF GREEN SPACE[6]

Botanic garden
Green strip/ green area
Greening
Botanic garden with local planting
Deep park
Children's farm
Meadow for lying and playing
Park
Green
Playground

All the areas consist of at least 1 hectare.

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[6] Retrieved from: https://www.cbs.nl/NR/rdonlyres/5B353A4E-6B56-4756-A19C-4BF6AA520C65/0/BestandBodemgebruikProductbeschrijving.pdf

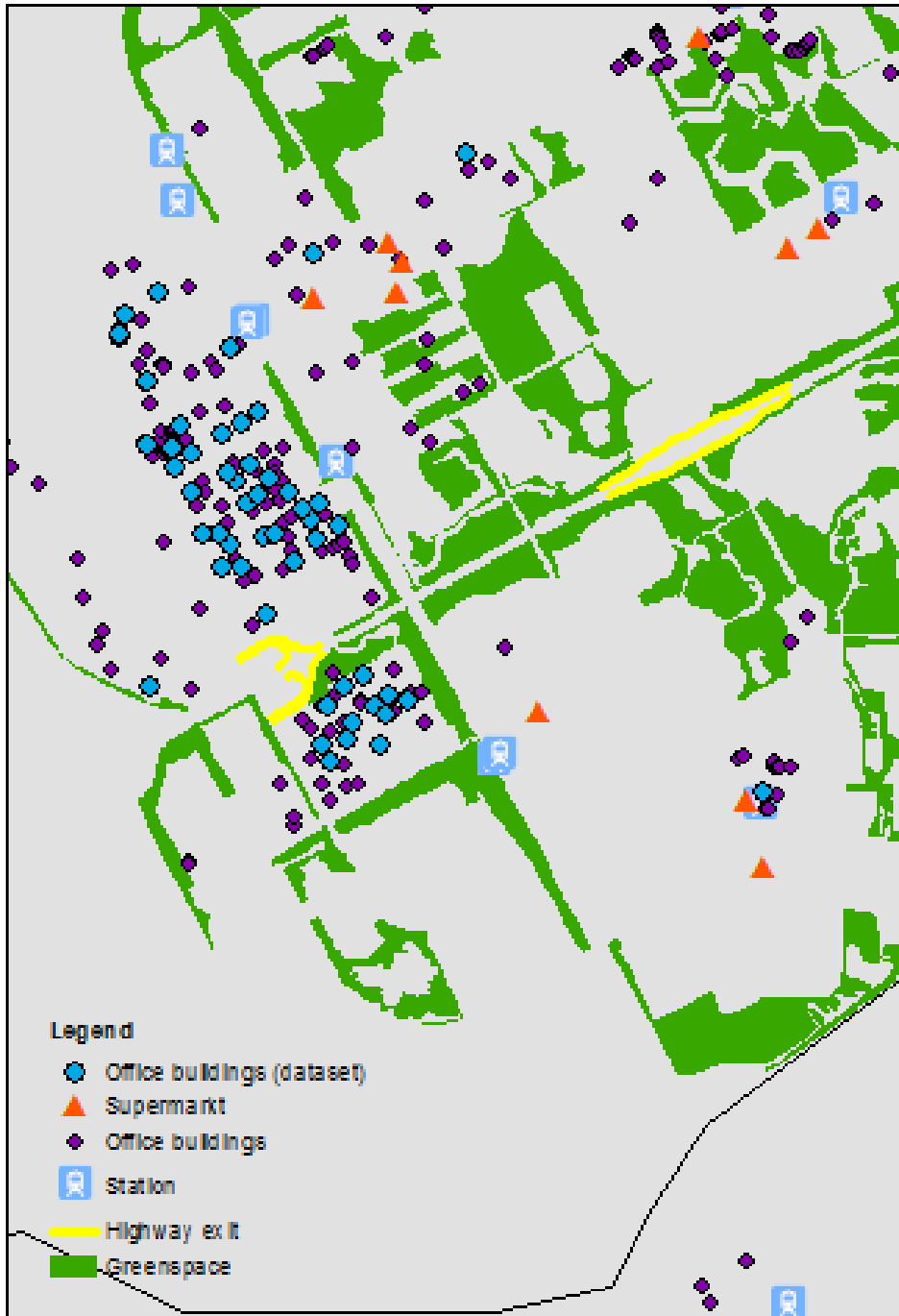# APPENDIX 3: VISUAL REPRESENATION OF OFFICE BUILDINGS AND THE LOCATION FACTORS

Figure 3: Visual representation location factors. Authors own production.

APPENDIX 4: CORRELATION MATRICES

Table 3: Correlation for the Netherlands. Authors own production.

	Rent	Offices	Station	Highway	Supermarket	Green space	Randstad
Rent	1.0000	-	-	-	-	-	-
Offices	0.4517	1.0000	-	-	-	-	-
Station	-0.1990	-0.2592	1.0000	-	-	-	-
Highway	-0.0066	0.1709	0.0538	1.0000	-	-	-
Supermarket	-0.0887	-0.3247	0.2886	-0.2727	1.0000	-	-
Green space	-0.0316	-0.0613	0.2332	0.0687	0.3223	1.0000	-
Randstad	0.4403	0.4133	-0.1986	-0.0247	-0.1225	-0.0657	1.0000

Table 4: Correlation for the Randstad. Authors own production.

	Rent	Offices	Station	Highway	Supermarket	Green space	Amsterdam
Rent	1.0000	-	-	-	-	-	-
Offices	0.4884	1.0000	-	-	-	-	-
Station	-0.1053	-0.1726	1.0000	-	-	-	-
Highway	0.1042	0.3900	0.1766	1.0000	-	-	-
Supermarket	-0.2060	-0.4166	0.3268	-0.4276	1.0000	-	-
Green space	-0.0093	0.1212	-0.0020	0.2051	0.0787	1.0000	-
Amsterdam	0.3591	0.3250	-0.2154	-0.2232	0.0281	-0.0958	1.0000

Table 5: Correlation for the Randstad. Authors own production.

	Rent	Offices	Station	Highway	Supermarket	Green space
Rent	1.0000	-	-	-	-	-
Offices	0.2037	1.0000	-	-	-	-
Station	-0.1421	-0.3580	1.0000	-	-	-
Highway	-0.0350	0.0769	0.0340	1.0000	-	-
Supermarket	0.0268	-0.3266	0.2694	-0.2384	1.0000	-
Green space	-0.0016	-0.1592	0.2440	0.0443	0.3584	1.0000

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