The association between the lease term and office rents in the Netherlands: A quantitative study

Anke van de Gevel

March 3, 2020

Abstract. Flexibility has become an important need for office space users, due to changes within organizations and changed IFRS-rules. There are not many studies regarding the impact of flexibility in the lease term on rents and the results of those studies are mixed. In this study, a hedonic price model is used to investigate the association between the lease term and office rents. An empirical analysis of 1,062 office lease contracts in the Netherlands in the period 2016-2019 shows that in general, there is an association between the lease term and office rents. However, when time and location are considered, the results show on the one hand, only in 2019 an association, and, on the other hand, differences between the core areas of the four largest functional urban areas in the Netherlands and locations outside this whole area. But when considering initial lease terms less than five years and initial lease terms of five years or more separately, there are no differences between those core areas and locations outside it anymore. Thus, there is an association between the lease term and office rents, which could depend on time and location, but because no (exogenous) shocks are taken into account, it is not clear whether the lease term has an impact on office rents or not. For real estate owners, the results provide insight into the relationship between the lease term and rental income. The findings are also relevant in an investment context, because lease terms and rents are important determinants of investment returns.

Keywords: flexibility, lease term, office rents, hedonic price model, functional urban areas

University of Groningen
Faculty of Spatial Sciences
MSc Real Estate Studies
Master thesis

Colophon

Document	Master thesis Real Estate Studies
Title	The association between the lease term and office rents in the Netherlands: A quantitative study
Date	March 3, 2020

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University of Groningen
Faculty of Spatial Sciences

In association with ING

Preface

Before you lies my master thesis with the title ‘The association between the lease term and office rents in the Netherlands: A quantitative study’. This thesis was written in the period June 2019-March 2020, during my working studentship at ING, to complete the master Real Estate Studies at the University of Groningen.

I owe gratitude to my supervisor Michiel Daams for his useful feedback. I also want to thank some colleagues from ING: Roland van der Schoot, for brainstorming on the subject, Joe Mulder, for providing me the data that were essential for the empirical analysis, and Bart Eijsvogels and Ferdi Blom, for giving me the opportunity to write my thesis and, at the same time, to gain work experience at ING. I really enjoyed my time at ING. Finally, I want to thank my fellow student Tijmen Schoonderbeek for his helpful feedback on my empirical analysis.

I hope you enjoy reading it.

Anke van de Gevel

Eindhoven, March 3, 2020

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1. Introduction

Flexibility has become an important need for office space users, due to changes in organizations, workforce and work styles and changed IFRS-rules. Within organizations, the ownership of workplaces has become less important, so the focus shifted from the management of buildings to the management of people. As a result of this, workplaces are more and more designed as flexible facilities which deliver a high level of services and experience to their users. Workplaces provide a growing amount of services, including flexible options such as co-working space and the possibility to use and pay a workplace per hour (Harris, 2015). Besides that, it is expected that IFRS 16 – accounting rules obligated for listed companies in the EU, valid from 1 January 2019 – will increase the demand from listed tenants (in the Netherlands, tenants that are listed on the Euronext Amsterdam) for flexibility in lease contracts, because it requires that all lease contracts, except some exceptions such as leases with a maximum length of twelve months, must appear on the balance sheet of these tenants (SKEPP, n.d.; Holle, 2017; KPMG, 2017). According to Holle (2017), those tenants do not want to have long-term leases which must be included on the balance sheet as a big expense, thus it is expected that the demand for short-term leases, break options and options for extension will increase. In the Netherlands, currently approximately 2% to 3% of the total Dutch office market consisted of flexible office concepts; this percentage is expected to increase with 20% to 30% a year, resulting in a market share of 5% to 10% in 2023 (NVM Business, 2018). That is why it is timely that empirical studies provide insight into the relationship between flexibility of lease terms and rents.

There are not many existing studies that address the lease term, probably because data relating to leases are privately held and it is fragmented across different parties. Qualitative research of Halvitigala and Reed (2015) in New Zealand shows that tenants are willing to pay higher rents or penalties for flexible lease terms. This could be expected in the Netherlands, because Dutch brokerages argue that users of flexible office concepts are willing to pay a higher (all-in) rent for flexibility in time and space and for the use of common facilities and services (Dynamis, n.d.; NVM Business, 2018). Bond et al. (2008) found a negative relationship between the time to the first lease break and the rental value – which means the earlier the lease contract can be cancelled, the higher the rental value – but they also found a significant, positive and constant relationship between the lease term and the rent over time, implying a lower rental rate for a shorter lease term. The reason for the latter conclusion may be that Bond et al. (2008) used a data set with mainly 10, 15 and 20-year lease contracts. Gunnelin and Söderberg (2003), Englund et al. (2004) and Fang and Ruichang (2009), on the other hand, proved that the impact of the lease term on office rents is varying over time, implying different effects in different time periods. Thus, there are only a few studies regarding the impact of the lease term (and a break option) on rents and the results of those studies are mixed, so more in-depth data and research into this direction are needed. The central question of this research is: *What is the association between the lease term and office rents in the Netherlands?*

This research extends the existing literature by focusing on the association between the lease term and office rents based on a case study for the Netherlands. It focuses on the Netherlands, because in this country there is an increasing demand for flexibility in the lease term, various lease terms are used within the office market – in Europe, common lease terms fall within the range of one to ten years (Hines, 2000, in Fang & Ruichang, 2009) – and previous studies did not pay attention to the Netherlands. Besides that, it focuses on the period 2016-2019, while the few other studies used less recent data. Considering more recent data is relevant, due to the increasing demand for flexible lease contracts (Halvitigala & Reed, 2015; NVM Business, 2018). Lease contracts contracted with traditional landlords (office owners) are used, because traditional landlords invest in real estate and providing flexibility is expected to be increasingly important for them (NVM Business, 2018). The data set used in this study consists of 1,062 lease contracts (after cleaning the data) of office buildings in the Netherlands, financed by ING. It includes variables such as the location, size, building year, energy label and condition of the buildings and the start and end date of the leases, the date on which the lease term can end prematurely (if a break option is included in the lease contract) and the leased square meters. A hedonic model is used, following the earlier studies. The findings may be of interest to real estate owners, banks financing properties and developers, because when shorter lease terms are included in a lease agreement, income and capital return could be less certain (O'Roarty, 2001; Lizieri, 2003).

This study pays special attention to the role of time and location – locations are identified by the definion of functional urban areas (FUAs) of the OECD (see chapter 4) – within the scope of the research question. This is important, because existing studies show mixed results regarding the impact of this. Besides that, considering different time periods and locations is essential for a justified understanding of the relationship between the lease term and office rents in several stages of the real estate market cycle (Gunnelin & Söderberg, 2003; Englund et al., 2004).

The remainder of this thesis is organized as follows. Chapter 2 provides additional information about flexibility in general and within the Dutch office market. Chapter 3 includes the theory on the impact of the lease term on office (or commercial) rents. Chapter 4 describes the methodology and the data set is discussed in chapter 5. Chapter 6 presents the results. Finally, chapter 7 includes the conclusion and chapter 8 the discussion.

2. Flexibility in the office market

Financial or (contractual) flexibility is the possibility to rent space on a very short term or to exit quickly (Gibson, 2000; Gibson, 2003). According to Halvitigala and Reed (2015), large tenants prefer long-term lease agreements with flexible covenants, whereas small tenants prefer flexibility related to the lease term. However, Colliers International (2019) states that both long-term lease contracts (for core operations) and flexible work places (at different locations) are more frequently used by multinationals in Europe.

Tenants want to use shorter lease terms and tenant break options, but they also like to use adaptive space design to increase space flexibility and functionality, thus financial flexibility is related to other types of flexibility (Gibson, 2003; Hamilton et al., 2006; Halvitigala & Reed, 2015). Tenants, for example, need efficient floor plates, adaptive building structures, flexible building services, high-quality building amenities, advanced IT networking and modern building materials (Halvitigala & Reed, 2015). Gibson and Lizieri (1999) state that corporate tenants, particularly multinationals, require long-term leases with functional flexibility in their core portfolio and short-term leases (maximum of five years) with some services and the possibility to exit as well as very short-term leases (fully serviced) based on a 'pay as you use' principle, in their periphery portfolio.

In the Dutch office market, several flexible concepts have emerged. According to NVM Business (2018), the strong advance of these flexible concepts has been contributed to the decline of the vacancy rate in recent years. It is expected that the traditional office market will be more flexible in the long term, because offering services and flexibility will become more common in the market (NVM Business, 2018). Flexible office concepts (or business centers) – companies that rent (a part of) an office building for the long term, or buy an office building incidentally – have several (shared) workspaces and provide some services and/or facilities to multiple organizations. These concepts differ in the lease terms (one-hour to five-year contracts) and the amount of services (low to high service level) they offer (Calder & Courtney, 1992, in Weijs-Perrée et al., 2016; Weijs-Perrée et al., 2016; NVM Business, 2018). More than 50% of the flexible office concepts (of the 25 largest companies) in the Netherlands is located in the four largest cities (Amsterdam, Rotterdam, The Hague and Utrecht), almost 40% is located in smaller cities, such as Breda, Den Bosch, Nijmegen and Zwolle, and almost 10% is located in urban nodes, such as Maastricht and Groningen, in the more peripheral regions (NVM Business, 2018). The use of service office space, options for the tenant to exit before the end of the lease term (tenant break options) and short-term lease contracts are forms of financial flexibility (Gibson, 2003).

3. Literature review

3.1 The importance of the lease term

There are several hedonic studies of commercial (or only office) leases in which the lease term is a determinant of the rent. Most of these studies made use of data of the United States (Gunnelin & Söderberg, 2003; Englund et al., 2004). Fisher and Webb, for example, found a significant and positive coefficient of the lease term variable for the suburbs of Chicago in the period from 1985 to 1995 (Fisher & Webb, 1997, in Gunnelin & Söderberg, 2003). Benjamin et al. (1992) used data from lease agreements in the period from 1984 to 1987 in a multi-tenant office building in Greensboro, a city in North Carolina, and found a negative, but insignificant, effect of the lease term in years on the rent per square foot (Benjamin et al., 1992; Benjamin et al., 1992, in Gunnelin & Söderberg, 2003).

According to Öven and Pekdemir (2006), the lease term variable, the duration of the lease contract in years, falls within the category 'influential' when looking at influential determinants of office rents in the metropolitan area of Istanbul, on a scale using four categories: very influential, influential, little influential and not influential. The top five in the first category (very influential) consists of: building age, the depreciation of the building, the distance to the sea, the number of streets within one square kilometer and the number of square meters of office space within one square kilometer (Öven & Pekdemir, 2006).

3.2 The time-varying aspect of the lease term

Research in the field of the term structure of rents – the impact of the lease term on the rent, per year under study – is limited, but some studies found variations in the term structure of rents over time (Gunnelin & Söderberg, 2003; Englund et al., 2004). Grenadier (1995) shows that a time-varying variable for the lease term could improve a hedonic price model for the determination of rents (Grenadier, 1995; Grenadier, 1995, in Gunnelin & Söderberg, 2003). Stanton and Wallace (2002) found significant variations in the term structure across suburban malls in fourteen United States metropolitan areas (Stanton & Wallace, 2002, in Englund et al., 2004). Later, Gunnelin and Söderberg (2003) investigated the term structure of office rents in the Stockholm Central Business District (CBD) in the period from 1977 to 1991 and used a data set which consisted for around 84% of leases with a maturity one, two or three years. They allowed for the calculation of term structures for every year during the time period under study by including both a linear and a quadratic form of the term structure (the interaction between the year of signature and the lease length). They found a significant and negative term structure for the lease contracts signed during the time period October 1990-January 1991, a significant and single-humped term structure for the leases signed in the time period October 1984-January 1985 and a significant and positive term structure for the majority of the 'years' (in their research 4-month periods) – the latter implies a lower rent per square meter for a shorter lease term – and they concluded that it is meaningful to control for term effects when generating rental indices (Gunnelin & Söderberg, 2003). Gunnelin and Söderberg (2003) tried to interpret the term structure by considering demand and supply levels in the years under study. They assume that a peak in rents and property prices and a subsequent increase in supply and decrease in property prices relate to a downward-sloping term structure and that demand in excess of supply and a low vacancy rate both relate to an upward-sloping term structure. However, they argue that further research, focusing on different time periods and real estate markets, is needed for a justified understanding of the relationship between the term structure of rents and the dynamics of the real estate market.

Englund et al. (2004) also argue that adding the lease length to a hedonic rent equation and allowing for this effect to be time-varying – and controlling for other features of lease contracts and locational and physical building characteristics – increases the explanatory power of a hedonic price model. They used data on office leases signed in the period from 1998 to 2002 in Stockholm (CBD, inner city and suburbs), the inner city of Malmö and the inner city of Gothenburg. The average lease term in the five submarkets in their data set was approximately 37 to 39 months. Englund et al. (2004) did not find a consistent pattern at the short end of the term structures of these districts/cities, which means that they cannot confirm that a short-term lease contract (i.e. a 12-month contract) generally leads to a higher rent per square meter (Englund et al., 2004). For all years in the city of Stockholm (except 1998), Gothenburg and the CBD of Stockholm, the term structure tends to have an upward slope, while the term structure is more diverse for Malmö and the suburbs of Stockholm (Englund et al., 2004). However, Englund et al. (2004) also argued that data of longer time periods and more regions are needed to investigate the term structure in several stages of the real estate market cycle.

In contrast to the findings of Gunnelin and Söderberg (2003) and Englund et al. (2004), Bond et al. (2008) found evidence for a positive and constant (not time-varying) relationship between initial lease rates and the lease length over time in the period from 1994 to 2004, implying a higher rent per square meter for longer leases compared to shorter leases. They investigated the impact of the lease term on office rents in London – their data set consisted for around 64% of leases with a maturity of ten, fifteen or twenty years – and initially allowed for the lease length to be time-varying. To allow for variation in the term structure over time, Bond et al. (2008) started with including the interaction between the origination year of the lease and the lease length in their hedonic model. After that, they also included the interaction between the origination year of the lease and the square of the lease length. They were not sure whether the linear or the quadratic form was most suitable for the lease term. However, they did not find a changing pattern to the relationship between the lease length and the rental value, so they removed both interaction variables from their model and included the lease term and the squared lease term. Finally, they found significant parameters for both the lease term and the squared lease term (Bond et al., 2008).

Fang and Ruichang (2009) investigated the term structure of office rents in Shanghai in the period from 2005 to 2008 and found evidence for a downward-sloping term structure in 2006 and 2007, although no term structure could be found in 2005 and 2008. The former means a significant and negative coefficient of the lease term in 2006 and 2007, implying a higher initial rental value for a shorter lease term. Fang and Ruichang (2009) used several forms of the lease term variable. They started with including both the lease term and the square of the lease term in their first model. In their second model, they excluded the square of the lease term and concluded that the results were similar to those of the first model. They argue that a quadratic form is not likely to assume, because their data set has a small interval, it consists for almost 80% of leases with a maturity of two to three years and it has a range of six years. In their third model, they included two interactions: the interaction between the origination year of the lease and the lease term and the interaction between the origination year of the lease and the squared lease term. In their fourth model, they excluded the latter interaction. However, almost all interaction variables in the last two models were insignificant. Fang and Ruichang (2009) concluded that the term structure of office rents in Shanghai is more volatile because of the short lease terms and they concluded that conclusions with regard to the term structure must be made carefully when a data set consists mainly of typical leases – for example mainly 10-, 15- or 20-year leases, as is the case in the study of Bond et al. (2008) – due to the lack of other lease maturities (Fang & Ruichang, 2009).

The existing studies about the time-varying impact of the lease term show that the results are mixed, implying that results depend on the common lease terms in the office market of a country and on the year in which the lease contracts were signed. From that point of view, it makes sense to mention that the common lease term differs between continents: 1-3 years in Asia, 5-10 years in North America and 1-10 years in Europe, Middle East and Africa. In England, Scotland and Wales, common office lease terms are 5, 10 or 15 years (Hines, 2000, in Fang & Ruichang, 2009).

3.3 Locational characteristics

Besides lease characteristics, characteristics of the location, such as the access to public transport, the distance from prestigious office locations, the proximity of a main shopping center, the business environment and the quality of the built environment are important determinants of office rents (Dunse & Jones, 1998). Looking at the impact of location, Nitsch (2006) argued that besides the access to public transport (both train and metro), the distance to the city center and the distance to the nearest airport have an impact on office rents. Jennen and Brounen (2009) found that office buildings located closer to a railway station generally generate higher rents, but they stated that the proximity to highways decreases the rent. Clustering of office space leads to higher rents, regardless of prevalent economic circumstances (Jennen & Brounen, 2009; Huynh, 2014). According to Ozus (2009), the vacancy in the vicinity, the accessibility of the location and banks in the vicinity have significant effects on office rents. In line with that, Pivo and Fisher (2011) and Kok and Jennen (2012) added the Walk Score, a measure for the ‘walkability’ of an office building – the location of the office building relative to facilities, such as shops and restaurants – to their analysis. Kok and Jennen (2012) concluded that office buildings located in multi-functional areas, with access to facilities and public transport, have higher rents than office buildings located in mono-functional office districts. Pivo and Fisher (2011) also found evidence for a positive impact of the Walk Score on the net operating income of office buildings. In line with the findings of Kok and Jennen (2012) and Pivo and Fisher (2011), Liusman et al. (2017) concluded that tenants of offices are willing to pay more when an office is located close by hotels and shopping malls. Bond et al. (2008) added a micro location variable to their hedonic analysis (omitted in earlier studies) and found a significant coefficient for 19 of the 44 micro locations. Fang and Ruichang (2009) also included micro location by dividing the Shanghai office market into 11 small CBDs and found for some of the CBDs significant coefficients.

3.4 Building characteristics

Dunse and Jones (1998) also argue that characteristics of the building in which an office unit is located, such as the floor area, the internal accessibility, internal services and the physical structure are important in the determination of office rents. Social facilities in the building, the number of floors in the building, the rental office floor and the aesthetics of the building all have significant effects on office rents (Ozus, 2009). Office space in larger office buildings has higher rents, older buildings have lower rents and the size of the space leased has a positive effect on the rent (Jennen & Brounen, 2009). Fuerst and McAllister (2011) and Reichardt et al. (2012) confirm that older buildings generate lower rents, however, the former also found a negative relationship between the lot size of the building and the rental value. According to Fuerst and McAllister (2011) and Koster et al. (2014), there also exists a positive relationship between building height and rental value. In line with that, Gabe and Rehm (2014) concluded that the vertical location of a tenant within a building has a positive impact on office rents. Reichardt et al. (2012) stated that the number of years since the last major refurbishment (1-3 years or 4-6 years) has a significant effect on office rents. Finally, according to Fuerst and McAllister (2011) and Reichardt et al. (2012), office buildings with a sustainable building certification generate higher rents than office buildings without a sustainable certificate. In line with that, Kok and Jennen (2012) confirm that energy efficient office buildings have higher rents than non-energy efficient office buildings, while Gabe and Rehm (2014) did not find evidence for energy efficiency rent premiums.

3.5 Hypotheses

The theoretical framework above describes the relationship between the lease term and office rents and the importance of other variables. Based on previous studies, it is expected that the lease term has a positive effect on office rents, resulting in lower rents per square meter for shorter lease terms compared to longer lease terms, because in existing literature, for most of the years under study, a positive relationship between the lease term and the rent was found. However, findings in existing literature are not conclusive. Besides that, any (exogenous) shocks that might have occurred could not be taken into account (see paragraph 5.1). Therefore, this study will consider the following hypothesis:

> **H1:** There is an association between the lease term and office rents in the Netherlands.

Besides that, it is possible that the association between the lease term and office rents in the Netherlands is time dependent, because of the real estate market cycle, following the results and assumptions of Gunnelin and Söderberg (2003) and Englund et al. (2004). According to O'Roarty (2001), a real estate investor requires compensation for providing lease terms which serve to decrease the value of an asset, when demand in the market is either in balance or higher than the supply, implying that the stage of the real estate market cycle could affect rental values. Therefore, a second hypothesis will be considered:

> **H2:** The association between the lease term and office rents in the Netherlands is time dependent.

Results from empirical studies vary over time and between markets, and even when research is done in the same country (e.g., comparing Gunnelin and Söderberg (2003) and Englund et al. (2004)), there are differences. When looking at the Dutch office market, most of the flexible office concepts are located in Amsterdam, Rotterdam, The Hague and Utrecht (NVM Business, 2018). It could be expected that at these locations there is more demand for flexibility in the lease term, which could result in differences in the association between the lease term and office rents, between those cities and locations outside it. Thus, it is expected that the location will influence the association between the lease term and office rents. Therefore, a third hypothesis will be considered:

> **H3:** The association between the lease term and office rents in the Netherlands differs between the core areas of the four largest functional urban areas and the remaining locations.

A focus on the core areas of the four largest functional urban areas is chosen to consider the largest metropolitan areas (including the cities Amsterdam, Rotterdam, The Hague and Utrecht) of the Netherlands (see chapter 4).

4. Methodology

4.1 Hedonic analysis

Hedonic analysis assumes that the value of a good is determined by its characteristics (Rosen, 1974). It is widely used for determining the prices of goods and services. Any object can be seen as a combination of its characteristics. Consequently, the price of an object depends on the price of its characteristics. Hedonic analysis is mostly applied to real estate property, especially housing. However, to a more limited extent, it is applied to office buildings to determine rents or transaction prices (Nappi-Choulet et al., 2007).

By relating the rental price of an office unit to its attributes, hedonic analysis makes it possible to determine the implicit price of every attribute. The rental value of an office unit can be determined by three categories of characteristics: 1) the tenure rights reflected in the lease characteristics 2) the locational characteristics of the building and 3) the characteristics of the building itself, i.e. the physical characteristics of the building and the amenities within it (Dunse & Jones, 1998; Kim et al., 1999; Nagai et al., 2000; Fuerst et al., 2013). This results in the following equation:

$$Rent = f(T, L, B) \tag{3.1}$$

Tenure rights (T) relates to variations contrary to conditions of traditional leases, long-term lease contracts without flexibility (Dunse & Jones, 1998; O'Roarty, 2001). In the United Kingdom, traditional lease is a lease contract with a length of at least fifteen years with (over) 5-yearly rent reviews (Dunse & Jones, 1998; O'Roarty, 2001). According to O'Roarty (2001), deviations from traditional lease relate to the inclusion of break options and shorter leases. Variations in lease conditions will result in the alteration of the market rent (Dunse & Jones, 1998). Thus, lease characteristics must be included in the hedonic price model.

Besides the lease characteristics, locational characteristics (L) and the physical characteristics of the building and the amenities within it (B) also contribute to the rental value of an office unit. Each specific characteristic contributes to the rental value of an office unit, but the characteristics cannot be separated (Dunse & Jones, 1998). Thus, when determining the rental value, locational characteristics and characteristics of the office building must be taken into account. The independent variables used in this study (and underlying the three categories) are explained in chapter 5.

Regarding the calculation of the rent, Bond et al. (2008) used an effective lease cost to spread a rent-free period over the lease term when information on rent-free periods was available. Englund et al. (2004) indicated that there was no information about lease discounts, the percentage with which leases were indexed and improvements done by the tenant, so they were not able to completely control for all cash flows related to a specific lease. Gunnelin and Söderberg (2003) state that they wanted to adapt the rents in their data set for tenant improvement clauses by deducting the annuity of the cost associated with tenant improvements from the rents, but they did not have any information about tenant improvements. However, Gunnelin and Söderberg (2003) argued that this was not a big problem in their research, because they stated that those improvements are more common in a weak market with a lot of vacancy and that was not the case in the period they examined. In this study, the natural logarithm of the GRI per square meter per year is used as independent variable (see paragraph 4.2). This variable takes rental discounts into account.

4.2 A hedonic regression model

According to Dunse and Jones (1998), the log-linear form of the hedonic price model is found to be the most robust. Location fixed effects and year fixed effects must be included in the hedonic price model to control for location and time-variant characteristics (Avendano, 2012; Koster et al., 2014). Assuming a log-linear form, the following equation can be formulated:

$$ln\, R_{ijt} = \propto + \beta_1 L_i + \beta_2 B_i + \beta_3 ln\, Term_i + \beta_4 ln\, UR_i + \delta_j + \gamma_t + \varepsilon_{ijt} \quad (3.2)$$

with

$ln\, R_{ijt}$	the natural logarithm of the gross rental income (GRI) per square meter per year of lease contract *i* at location *j* and in year *t*;
L_i	a set of locational characteristics of lease *i* which include the Walk Score and the distance to the nearest train station;
B_i	a set of building characteristics of lease *i* including the age, condition and energy label of the building;
$ln\, Term_i$	the natural logarithm of Term, the length of lease *i* in months;
$ln\, UR_i$	the natural logarithm of Usable rent, the leased square meters of lease *i*;
δ_j	location fixed effects;
γ_t	year fixed effects;
$\propto$ and β_{1-4}	the parameters to be estimated;
ε_{ijt}	the error term.

To focus on the impact of time and location, interaction variables are added to the base model represented by equation 3.2. The interaction between the year of signature and the natural logarithm of the lease term is added first, because it provides insight into the time dependence of the association between the lease term and office rents, see chapter 6. However, because the time period under study is short and any (exogenous) shocks that might have occurred within that time period are not taken into account, it cannot provide a justified understanding of the association between the lease term and office rents in several stages of the real estate market cycle.

To investigate differences between locations, in this study, a distinction is made between the largest metropolitan areas and the remaining locations. This is done by using the well-established definition of functional urban areas (FUAs) from the Organization for Economic Co-operation and Development (OECD). Based on population density and commuting data, the OECD (2019) defines FUAs as “economic units characterized by a city (or core) and a commuting zone that is functionally interconnected to the city”. In appendix I, figure 3 shows the core areas and commuting zones in the Netherlands and figure 4 shows the metropolitan region on which this study focuses: the core of the four largest FUAs in the Netherlands (i.e. Amsterdam, Rotterdam, The Hague and Utrecht).

To investigate the impact of that metropolitan region on the association between the lease term and office rents, the second interaction added, is the interaction between the core of the four largest FUAs and the natural logarithm of the lease term. Besides that, a distinction is made between initial lease terms less than five years and initial lease terms of five years or more, following research of Bond et al. (2008). The latter was done to investigate whether there are differences between short-term leases and longer lease terms, see chapter 6.

5. Data

5.1 Data set

The data set used in this research consists of data from office buildings in the Netherlands[1] financed by ING. On September 12, 2019, this data set consisted of 5,137 lease contracts. The data set is supplemented with the Walk Score, the distance to the nearest train station and the FUAs. ING is a major player in the market for providing loans to professional and private investors that want to invest in real estate, so it is assumed that the data can give a good view of the traditional office market. A disadvantage of the data set is that the number of break options is very low, perhaps partly because information about break options that have expired, is not available. Thus, the impact of the break option is not taken into consideration. The data set contains cross-sectional data, thus any (exogenous) shocks that might have occurred within the time period under study, could not be taken into account. Based on the literature review and the methodology, a selection of the variables, that are used in this study, was made. A summary of the variables and data sources is shown in table 1.

Table 1: The variables used and their description

Attribute class	**Variable**	**Description**	**Source**
	Gross rental income	Gross rent per square meter leased floor space per year	ING
Lease contract	Usable rent	A variable for the leased square meters consisting of the following categories: 0-100, 101-200, 201-500, 501-1000, 1001-5000 and > 5000 leased square meters	ING
	Term	The length of the lease contract in months	ING
	Year of signature	A variable for the year of signature consisting of the following categories: 2016, 2017, 2018 and 2019	ING
Location	Core largest FUAs	A dummy variable for the location (core areas of FUAs Amsterdam, Rotterdam, The Hague and Utrecht and locations outside this whole region)	ING, ArcGIS (2019), OECD (2019)
	Walk Score	A measure for the walkability of a location (0-100)	Walk Score (n.d.)
	Distance to the nearest train station	Euclidean distance to the nearest train station in kilometers	Vastgoeddata Nederland (n.d.)
Building	Building age	A variable for the age of the building consisting of the following categories: 0-10, 11-20, 21-30, 31-40, 41-50, 51-100 and > 100 years	ING, BAG (n.d.)
	Object condition	A variable for the condition of the building consisting of the following categories: bad, good, moderate, very good and without defaults	ING
	Energy label	A variable for the energy label consisting of the following categories: A, B, C, D, E, F, G and not assigned (i.e. no label requirement or unknown)	ING

The lease contracts in the data set were signed between 1969 and 2019. However, a pre-selected subset of the data is used. The end dates of the lease contracts in the data set had to be manually reset to the initial end date, so using the whole time period was not feasible within the period in which this research

[1] A few of the buildings are located abroad, but these observations are deleted, because of missing values.

was conducted. Thus, the lease contracts signed before January 1, 2016 were not considered. Omitting a large part of the data decreases the reliability of this study, but because data about lease contracts is difficult to obtain, this study remains relevant. After that, all non-office lease contracts (lease contracts for retail, parking places, et cetera, in the data set) are deleted, because this study only focuses on office leases. Then all additional agreements after concluding a lease (in Dutch: ‘allonges’), too old lease contracts (lease contracts originally signed before January 1, 2016, but with a more recent start date in the data set), leases with owner-occupiers and leases of which the initial lease term was not available, were deleted. Finally, outlying observations, observations with missing values, with a GRI of zero, a usable area of zero and/or observations where no object condition was assigned, were deleted. The number of lease contracts that remained is 1,062 (shown in table 2).

Table 2: Sample selection

	Sample selection
Data set offices ING	**5,137**
Deleting the lease contracts signed before January 1, 2016	- 2,456
Deleting all non-office lease contacts	- 694
Deleting all additional agreements, too old lease contracts, leases with owner-occupiers and leases of which the initial lease term was not available	- 772
Sample	**1,215**
Deleting missing values and object condition ‘not assigned’	- 134
Deleting outlying observations	- 19
Final sample	**1,062**

Outlying observations are defined by using the median absolute deviation (MAD), because this method is, in contrast to the mean and standard deviation, not sensitive to outlying observations (Leys et al., 2013). The MAD is determined by calculating the absolute differences between each observation and the median of the natural logarithm of the GRI, calculating the new median and multiplying this new median by 1.4826 (because normality of the data is assumed). The lower and upper threshold are calculated respectively by ‘median - 3 * MAD’ and ‘median + 3 * MAD’, which means that all leases with a GRI per square meter per year of more than €501.30 or less than €38.54 are excluded. The choice of the exclusion criteria (a deviation of 2, 2,5 or 3 units) is subjective (Leys et al., 2013). Looking at rental values in the Netherlands – €475 per square meter per year in the center of Amsterdam, €450 per square meter per year in the South Axis area of Amsterdam on average in June 2019 and lower limits of €40-€140 per square meter per year mid-2018 in Zwolle, Apeldoorn and Deventer (Cushman & Wakefield, 2018, 2019) – three units was chosen.

The age of each office building is calculated based on the year of construction of the building. When the year of construction was missing, it was filled in with data from BAG, official data of all addresses and buildings in the Netherlands. Some buildings have a construction year before 1900, so the building age could not be calculated. Those buildings are classified in the highest category (> 100 years). Gunnelin and Söderberg (2003) and Englund et al. (2004) both used the effective age of the building, taking refurbishments into account as determined by the tax assessment authority. This might be a better measurement for the age of the building, but refurbishments are unfortunately not included in the data set.

After cleaning the data set, it was checked whether the data meet the assumptions made in linear regression. The dependent variable was transformed to be normally distributed by using the natural logarithm of it. Independent variables were transformed and/or dummy or categorial variables have been made to realize a linear relationship between the dependent variable and each independent variable to meet the assumptions of multicollinearity, exogeneity and homoscedasticity (Brooks & Tsolacos, 2010).

Figure 1 shows the percentage of lease contracts by year of origination, divided into four categories: lease contracts with a lease term of maximum three years (47% of the total amount), with a lease term of more than four years, but maximum five years (33% of the total amount), with a lease term of more than nine years, but maximum ten years (8% of the total amount) and lease contracts with other durations (12% of the total amount). In the case of lease contracts for an indefinite period, the minimum rental period is used (equal to one day plus the cancellation period).

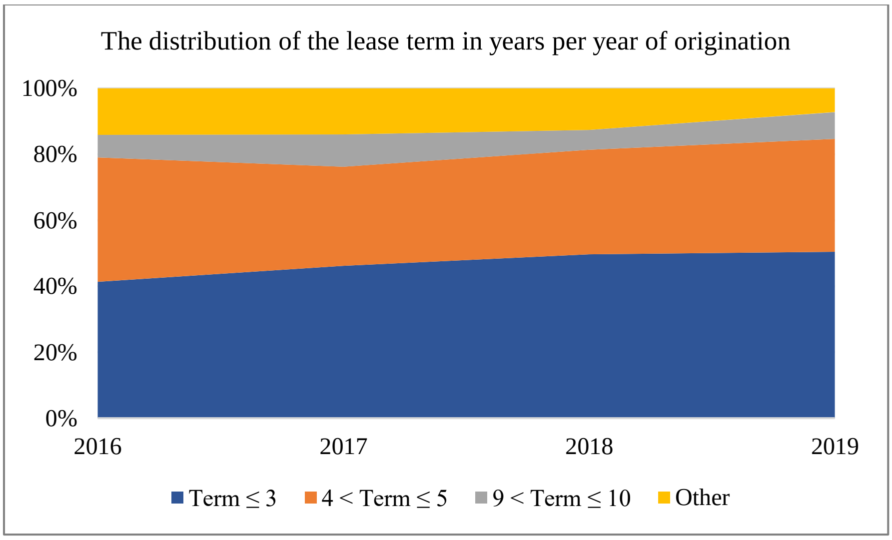

Figure 1: The distribution of the lease term in years (rounded) per year of origination

Figure 2 shows a linear relationship between the natural logarithm of the GRI per square meter per year and the natural logarithm of the lease term in months. It is clearly shown that some lease terms are more common than others: (the natural logarithm of) 12, 24, 36, 60 and 120 months. Looking at the figure, it can be said that there is a variety in lease maturities, because the data set does not only include typical leases, such as 10-, 15- or 20-year leases. Following Fang and Ruichang (2009), this will make conclusions regarding the relationship between the lease term and office rents more reliable.

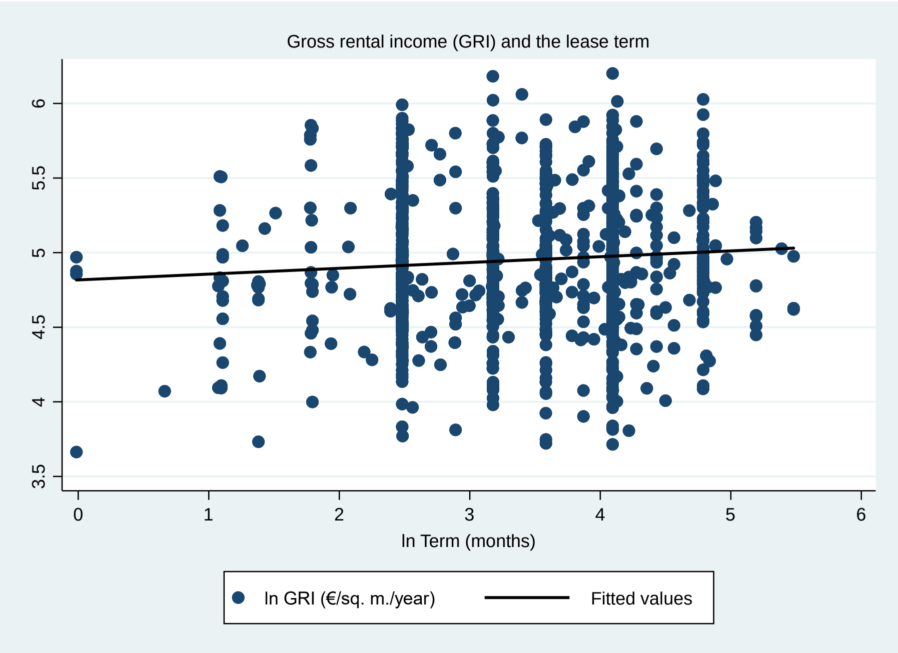

Figure 2: The relationship between the natural logarithm of the GRI and the natural logarithm of the lease term

5.2 Descriptive statistics

The descriptive statistics of the data set are shown in table 3. On average, a tenant pays around €156 per square meter per year for an office unit. All office buildings are located within approximately eight kilometers of a train station. The lease contracts have an average duration of approximately four years. The shortest lease contract has an initial lease term of one month and the longest lease contract has an initial lease term of twenty years.

Table 3: Descriptive statistics of 1,062 lease contracts in the period January 1, 2016-September 12, 2019

Variable	Obs.	Mean	Std. dev.	Min.	Max.
GRI (€/sq. m./year)	1,062	156.20	71.05	39.00	493.42
Walk Score (0-100)	1,062	78.10	18.87	14	100
Distance to nearest train station (km)	1,062	2.12	1.63	0.10	8.20
Term (months)	1,062	48.25	36.39	1	240
Building age (years)	1,062	50.87	37.33	1	279
Usable rent (sq. m.)	1,062	370.50	855.90	6	13,357

The location, object condition, energy label of the office building and the year of signature are not shown in table 3, because these variables are used as dummy or categorial variables. The building age and the usable rent are shown in table 3, but are used as categorial variables. Considering location: 58% of the lease contracts is signed in the core areas of the four largest FUAs in the Netherlands. Returning to the break option: only 46 of the 1,062 lease contracts (4%) contain a break option in 2019 or later. As mentioned before, data regarding break options before 2019 are not available.

6. Results

6.1 OLS regression

Model 1 in table 4 shows the results of equation 3.2. These results show a significant coefficient (at the 1% level) of the lease term variable, which means that there is an association between the natural logarithm of the lease term and the natural logarithm of the GRI per square meter per year. Because both variables are transformed into a natural logarithm ('double log' relationship), the GRI per square meter per year increases with 0.12% when the lease term increases with 1% (Brooks & Tsolacos, 2010). In other words, when the lease term increases from five to ten years (+100%), the gross rent a tenant must pay per square meter per year increases with 12%. This result is in line with the findings of Bond et al. (2008) which show an upward-sloping term structure, implying tenants requiring longer lease terms, pay higher initial rents than those asking shorter lease terms. The adjusted R-squared of this model is 29.10%, which implies that 29.10% of the variance in the natural logarithm of the GRI per square meter per year is explained by the independent variables in equation 3.2.

6.2 The impact of the year of signature

Because the real estate market cycle may affect the association between the lease term and office rents and because previous studies found evidence for a time-varying term structure, the interaction between the year of signature and the natural logarithm of the lease term is included in the second model. Again, the results show a significant association between the natural logarithm of the lease term and the natural logarithm of the GRI per square meter per year. However, the coefficient of the lease term cannot be viewed on its own anymore, because of the included interaction. In each year, the interaction is not significant, except for 2019. This shows that the year of signature generally does not have an impact on the association between the natural logarithm of the lease term and the natural logarithm of the GRI per square meter per year, apart from a significant, positive and strong effect in 2019 (relative to 2016). This means when the lease term increases with 1%, the GRI per square meter per year increases with 0.21% (0.091% + 0.119%) for lease contracts signed in 2019, this increase is 0.12% higher relative to lease contracts signed in 2016. When a lease contract was signed in 2016, 2017 or 2018, the GRI per square meter per year increases only with 0.09%, when the lease term increases with 1%. The adjusted R-squared of the second model is slightly increased to 29.80%.

Table 4: Regression results model 1, 2 and 3

	Model 1	Model 2: 1 interaction	Model 3: 2 interactions
Ln Term	0.117***	0.091***	0.044
	(0.016)	(0.033)	(0.035)
2017 * ln Term		-0.012	0.007
		(0.039)	(0.039)
2018 * ln Term		0.014	0.001
		(0.037)	(0.037)
2019 * ln Term		0.119***	0.110**
		(0.043)	(0.043)
Core largest FUAs * ln Term			0.101***
			(0.027)
Ln Usable Rent	-0.120***	-0.120***	-0.122***
	(0.012)	(0.012)	(0.012)
Walk Score^2	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)
Distance to train station	-0.007	-0.007	-0.006
	(0.008)	(0.008)	(0.008)
Energy label: A	0.039	0.046	0.058
	(0.054)	(0.054)	(0.053)
Energy label: B	0.010	0.0155	0.040
	(0.060)	(0.060)	(0.060)
Energy label: C	0.062	0.064	0.061
	(0.059)	(0.059)	(0.059)
Energy label: D	0.148**	0.159**	0.167***
	(0.063)	(0.063)	(0.063)
Energy label: E	-0.005	0.011	0.031
	(0.073)	(0.072)	(0.072)
Energy label: F	0.010	0.013	0.013
	(0.082)	(0.081)	(0.081)
Energy label: not assigned	0.085*	0.075	0.081*
	(0.049)	(0.049)	(0.049)
Building age: 11-20 years	-0.205***	-0.206***	-0.196***
	(0.076)	(0.076)	(0.075)
Building age: 21-30 years	-0.082	-0.090	-0.090
	(0.080)	(0.079)	(0.079)
Building age: 31-40 years	-0.183**	-0.190**	-0.175**
	(0.081)	(0.081)	(0.081)
Building age: 41-50 years	-0.110	-0.123	-0.119
	(0.091)	(0.090)	(0.090)
Building age: 51-100 years	0.016	0.002	0.028
	(0.078)	(0.078)	(0.078)
Building age: > 100 years	0.041	0.036	0.059
	(0.080)	(0.080)	(0.079)
Object condition: bad	-0.358***	-0.315**	-0.361***
	(0.126)	(0.126)	(0.126)
Object condition: good	0.005	-0.007	-0.019
	(0.078)	(0.078)	(0.078)
Object condition: moderate	-0.190**	-0.204**	-0.217***
	(0.081)	(0.081)	(0.081)
Object condition: without defaults	-0.189	-0.211	-0.231*
	(0.138)	(0.138)	(0.137)
Constant	4.978***	5.081***	5.236***
	(0.114)	(0.153)	(0.158)
Location fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Number of observations	1,062	1,062	1,062
F	18.42	17.08	17.19
R-squared	0.308	0.317	0.326
Adjusted R-squared	0.291	0.298	0.307
Root MSE	0.370	0.368	0.366

Note: Standard errors are in brackets. The independent variable is the natural logarithm of the GRI per square meter per year. Reference categories: energy label G, building age 0-10 years, object condition very good, year of signature 2016 and locations outside the cores of the FUAs Amsterdam, Rotterdam, The Hague and Utrecht. Significance at the 0.10, 0.05 and 0.01 levels are represented by *, ** and ***, respectively.

6.3 The impact of the location

Previous studies showed differences in the impact of the lease term between cities and within cities. To examine the differences between the core areas of the four largest FUAs (see appendix I) and the remaining locations, in the third model the interaction between those core areas and the natural logarithm of the lease term is included (table 4). Looking at the overall fit of the model, 30.68% of the variance in the natural logarithm of the GRI per square meter per year is explained by the variables in the model, a small increase relative to the previous models. However, a notable result is that there is no longer a significant association between the natural logarithm of the lease term and the natural logarithm of the GRI per square meter per year.

Looking at the interaction between the year of signature and the natural logarithm of the lease term, the interaction is only positive and significant (at the 5% level) in 2019. This means that in general, there is no association between the lease term and the GRI per square meter per year, unless it concerns lease contracts signed in 2019. The second interaction is significant at the 1% level. For lease contracts signed in 2019 in one of the core areas of the four largest FUAs, this means an increase of 0.21% (0.110% + 0.101%) in the GRI per square meter per year when the lease term increases with 1%, relative to lease contracts signed in 2016, 2017 or 2018 outside those core areas. When lease contracts are signed in 2016, 2017 and 2018 outside the core areas of the four largest FUAs, there is no association between the lease term and the GRI per square meter per year. The GRI per square meter per year of lease contracts signed in 2016, 2017 or 2018 within one of the core areas of the four largest FUAs, increases with 0.10% when the lease term increases with 1%, relative to leases signed in these years outside those core areas. The GRI per square meter per year of lease contracts signed in 2019 outside the core areas of the four largest FUAs increases with 0.11% when the lease term increases with 1%, relative to lease contracts signed outside those core areas in 2016.

When the third model is performed again, with 2019 as reference year, the interactions between the year of signature and the natural logarithm of the lease term are all significant (at the 1% or 5% level) and negative. The coefficient of the natural logarithm of the lease term is also significant at the 1% level (table 6, appendix II). Thus, when the lease term increases with 1%, the GRI per square meter per year of a lease contract signed in 2019 in one of the core areas of the four largest FUAs increases with 0.26% (0.155% + 0.101%) relative to leases signed in 2019 outside those core areas. The GRI per square meter per year increases with 0.15%[2] for lease contracts signed in one of the core areas of the four largest FUAs in 2016, 2017 or 2018, when the lease term increases with 1%, a decrease of 0.11% in 2016 and 2018 or 0.10% in 2017, relative to leases signed in 2019 in one of the core areas of the four largest FUAs.

[2] 0.155% - 0.110% + 0.101% = 0.15% (2016), 0.155% - 0.104% + 0.101% = 0.15% (2017) and 0.155% - 0.109% + 0.101% = 0.15% (2018).

Finally, to control for micro location, following Bond et al. (2008) and Fang and Ruichang (2009), the interaction between the Walk Score – a measure for density and accessibility on a very small scale – and the natural logarithm of the lease term is included in the third model. However, this interaction variable turned out to be insignificant.

6.4 Identifying sub-groups

Bond et al. (2008) excluded lease terms lower than five years from their sample as a final check, because their data set consisted mainly of longer leases such as ten, fifteen and twenty years. Following their approach, in this study a distinction is made between lease contracts with an initial duration less than five years (52% of the total amount) and lease contracts with an initial duration of five years or more (48% of the total amount). The results of these regressions are shown in table 5. In the fourth model (including initial lease terms for less than five years), the adjusted R-squared is slightly decreased to 29.54%. In the fifth model (including the other part of the sample), the adjusted R-squared is 34.19, which means that 34.19% of the variance in the natural logarithm of the GRI per square meter per year is explained by the variables in the models, an increase relative to the previous models.

In the fourth model – the model that only considers initial lease terms shorter than five years – again there is no association between the lease term and the GRI per square meter per year. When lease contracts are signed in 2019, the interaction between the year of signature and the natural logarithm of the lease term is no longer significant (table 5). The core areas of the four largest FUAs do not have a significant impact either. These results are inconsistent with the results of the previous models, so the fourth model is performed again with 2019 as reference year. Now, the results show a positive and significant (at the 1% level) coefficient of the lease term variable. The interaction between the year of signature and the natural logarithm of the lease term is significant (at the 10% level) and negative in the case of 2017 and 2018. Finally, the core areas of the four largest FUAs still have no significant impact.

The fifth model – the model that only considers the leases with an initial duration of five years or more – also shows an insignificant coefficient of the lease term variable, but when lease contracts are signed in 2019, the interaction between the year of signature and the natural logarithm of the lease term is significant at the 5% level. Likewise, in this model the interaction between the core areas of the four largest FUAs and the natural logarithm of the lease term is not significant (table 5). This means that the GRI per square meter per year increases with 0.30% when the lease term increases with 1%, for a lease contract signed in 2019 relative to a lease contract signed in 2016, 2017 or 2018. When 2019 is taken as the reference year, the coefficient of the lease term is positive and significant at the 5% level. When leases are signed in 2016, the interaction between the year of signature and the natural logarithm of the lease term is significant (at the 5% level) and negative. The core areas of the four largest FUAs still have no significant impact.

Table 5: Regression results model 4 and 5

	Model 4: Term < 5 years	**Model 5: Term ≥ 5 years**
Ln Term	0.064	-0.048
	(0.070)	(0.110)
2017 * ln Term	-0.016	0.106
	(0.080)	(0.128)
2018 * ln Term	-0.005	0.136
	(0.076)	(0.139)
2019 * ln Term	0.127	0.305**
	(0.091)	(0.148)
Core largest FUAs * ln Term	0.080	0.042
	(0.051)	(0.107)
Ln Usable Rent	-0.189***	-0.071***
	(0.019)	(0.016)
Walk Score^2	0.000**	0.000***
	(0.000)	(0.000)
Distance to train station	-0.018	0.006
	(0.012)	(0.011)
Energy label: A	0.179**	-0.071
	(0.084)	(0.071)
Energy label: B	0.066	-0.035
	(0.086)	(0.086)
Energy label: C	0.145*	-0.019
	(0.087)	(0.080)
Energy label: D	0.176*	0.106
	(0.091)	(0.089)
Energy label: E	-0.016	0.028
	(0.103)	(0.105)
Energy label: F	0.007	0.005
	(0.126)	(0.105)
Energy label: not assigned	0.103	0.015
	(0.072)	(0.068)
Building age: 11-20 years	-0.450***	-0.113
	(0.150)	(0.084)
Building age: 21-30 years	-0.304*	-0.065
	(0.156)	(0.089)
Building age: 31-40 years	-0.393**	-0.103
	(0.159)	(0.091)
Building age: 41-50 years	-0.340**	-0.052
	(0.166)	(0.111)
Building age: 51-100 years	-0.162	0.065
	(0.156)	(0.089)
Building age: > 100 years	-0.111	0.084
	(0.155)	(0.090)
Object condition: bad	-0.149	-0.413**
	(0.228)	(0.161)
Object condition: good	0.145	-0.089
	(0.176)	(0.083)
Object condition: moderate	-0.086	-0.272***
	(0.180)	(0.088)
Object condition: without defaults	0.018	-0.390*
	(0.228)	(0.218)
Constant	5.586***	5.371***
	(0.273)	(0.492)
Location fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Number of observations	548	514
F	8.91	10.19
R-squared	0.333	0.379
Adjusted R-squared	0.295	0.342
Root MSE	0.391	0.331

Note: Standard errors are in brackets. The independent variable is the natural logarithm of the GRI per square meter per year. Reference categories: energy label G, building age 0-10 years, object condition very good, year of signature 2016 and locations outside the cores of the FUAs Amsterdam, Rotterdam, The Hague and Utrecht. Significance at the 0.10, 0.05 and 0.01 levels are represented by *, ** and ***, respectively.

When looking at the results of the third, fourth and fifth model as 2019 is chosen as refence category, the results of the sub-groups are in line with the main results (model 3), except for the impact of the location. In the whole market, the core areas of the four largest FUAs have a significant impact on the association between the natural logarithm of the lease term and the natural logarithm of the GRI per square meter per year, but in each sub-group the interaction between the four largest FUAs and the lease term is no longer significant.

7. Conclusions

In this study, the relationship between the lease term and the GRI per square meter per year in the Netherlands is investigated. This follows earlier studies by Gunnelin and Söderberg (2003), Englund et al. (2004), Bond et al. (2008) and Fang and Ruichang (2009). In this quantitative study, the following main research question is answered: *What is the association between the lease term and office rents in the Netherlands?* In general, there is an association between the lease term and office rents. However, when time and location are considered, the results show on the one hand, only in 2019 an association, and, on the other hand, differences between the core areas of the four largest functional urban areas in the Netherlands and locations outside this whole area. But when considering initial lease terms less than five years and initial lease terms of five years or more separately, there are no differences between those core areas and locations outside it anymore. Thus, there is an association between the lease term and office rents, which could depend on time and location, but because no (exogenous) shocks are taken into account, it is not clear whether the lease term has an impact on office rents or not. For real estate owners, the results provide insight into the relationship between the lease term and rental income. The findings are also relevant in an investment context, because lease terms and rents are important determinants of investment returns.

8. Discussion

8.1 State of knowledge in the existing literature

When interpreting the results of this study, based on the first model, the first hypothesis – there is an association between the lease term and office rents in the Netherlands – cannot be rejected, because in general, the natural logarithm of the lease term is significant and positive. However, the results of the third and fifth model show an association between the lease term and office rents in 2019, but no association was found in the period 2016-2018. This implies that the association between the lease term and office rents depends on the period in which the lease was signed, which is in line with the findings of Gunnelin and Söderberg (2003): they found an upward-sloping term structure for a few years under study, but also a downward-sloping term structure for one other year under study. Based on these findings, the second hypothesis – the association between the lease term and office rents in the Netherlands is time dependent – cannot be rejected. The third model shows differences in the association between the lease and office rents in the core areas of the four largest FUAs compared to locations outside it, causing that the third hypothesis – the association between the lease term and office rents in the Netherlands differs between the core areas of the four largest functional urban areas and the remaining locations – cannot be rejected. However, considering the insignificance of the interaction between those core areas and the natural logarithm of the lease term in the fourth and fifth model, the third hypothesis can be rejected.

As a further investigation, a Chow test is done to test the hypothesis that the parameters of the third model are stable when considering different lease terms. So, the third model is used as the restricted model and the fourth and fifth model are the sub-groups. The resulting F-statistic is 1.54[3]. This value is lower than the critical value from the F-distribution (a value between 1.8664 and 1.7867) which means that the null hypothesis cannot be rejected at the 5% significance level (Stanford University, n.d.). Thus, there are no differences in the parameters of the two sub-groups. This supports that the third hypothesis can be rejected.

Research into the term structure of rents was limited, as already pointed out by Englund et al. (2004). Since then, there were some more studies regarding the impact of the lease term on office (or commercial) rents. Fang and Ruichang (2009) state that there were a few studies in real estate finance focusing on the determinants of lease rates, but that the results were not yet conclusive. Regarding data concerning lease contracts, there is still a lot to be gained. Gunnelin and Söderberg (2003) and Englund et al. (2004) already indicated that some relevant data, such as costs related to tenant improvements, were not available. Data included in lease contracts, such as costs associated with break options, tenant

[3] ((137.939397 - (78.9951739 + 52.8799261)) / (78.9951739 + 52.8799261)) * ((1062 - 2 * 30) / 30) = 1.536

improvements and rent-free periods, are still hard to receive. The topics in the next paragraphs are related to this.

Besides that, Gunnelin and Söderberg (2003) and Englund et al. (2004) argued that more studies, focusing on different time periods and real estate markets, are needed for understanding the term structure in several stages of the real estate market cycle. This is still important, because, due to the short period of time under study, the results in this study may be influenced by the stage of the cycle, because not a whole cycle is considered. Besides that, the data set used contains mainly prime offices which may also have influenced the results, when tenants are willing to pay for the good quality and location of an office unit.

8.2 Implications for further research

First, the time to the first lease break should be considered in follow-up research to expand existing knowledge in this area. Adding the break option to the regression models could enrich the empirical analysis, because hardly any research has yet been done into this type of financial flexibility. Only Bond et al. (2008) included the time to the first lease break in their analysis and found a significant (at the 10 % level) and negative relationship between the time to the first lease break and the rental value. However, when they included tenant type, micro location and credit worthiness of the tenants, the time to the first lease break had still a negative sign, but was not significant anymore.

Secondly, in follow-up research clientele effects related to a lease should be considered when data are available. McCann and Ward (2004) state that, from the perspective of a tenant, there are five types of cost components related to a lease that depend on the lease term: opportunity costs, financial liability costs, property repair costs, firm relocation costs and lease contracting costs. For a tenant, the optimal structure of a lease depends on the exit costs related to the lease (consisting of those cost components). Exit costs depend on the characteristics of both the location of the property and the individual tenant. When there are low or no exit costs, a tenant will tend to prefer short-term leases. McCann and Ward (2004) argue that a complete study into the relationship between lease terms and rents requires a simultaneous treatment of the clientele effects – i.e. the impact of the rental costs for a tenant – and the supply within the market. According to them, the clientele effects should be more careful considered in the term structure of rents. In contrast to other previous studies, McCann and Ward (2004) viewed the rent from the perspective of an individual tenant and stated that exit costs influence the choice for a shorter lease term. Thus, the impact of such costs must be considered in subsequent research. In this study, data regarding those costs were unfortunately not available.

8.3 Implications for the office market

For real estate owners, the results in this study provide insight into the relationship between the lease term and rental income. The findings are also relevant in an investment context, because lease terms and rental prices are important in the determination of investment returns. When shorter lease terms and tenant break options are included in a lease agreement, income and capital return are less certain (O’Roarty, 2001; Lizieri, 2003). However, the risk does not necessarily rise, and returns do not necessarily fall, because flexible lease terms reallocate the risk and return between real estate owner and tenant. As tenants are willing to pay for flexible lease terms and the office market finds its equilibrium, a more diverse supply of contracts is expected, to meet tenant requirements (O'Roarty, 2001). However, the results in this study did not find evidence for a willingness to pay.

McAllister (2001) confirms that break options and short-term leases have changed the distribution of risk and return between real estate owner and tenant. According to McAllister (2001), for a real estate owner, the termination of a lease is financially beneficial when the revenues of a termination exceed the costs. This may occur when a tenant must pay a financial penalty when exercising a break option or when reletting creates an opportunity for the real estate owner to strengthen covenants. However, those scenarios are limited in practice, they seem to go together with ‘hot’ markets, but in those markets, tenants are less likely to terminate a lease. Thus, a short lease could result in an unnecessary decrease in income (McAllister, 2001).

Besides the financial implications, real estate owners must think about what strategy they want to use in the upcoming years, because of the demand for flexibility. NVM Business (2018) expects that the traditional Dutch office market will become more flexible in the long term to meet the increased demand for flexibility, resulting in traditional real estate owners offering more flexible lease terms and a part of the services that flexible office concepts offer, but it is also possible that the letting of office space will become more indirect in nature, when real estate owners assign the provision of services to an intermediary.

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Appendices

Appendix I: Functional urban areas (FUAs) in the Netherlands

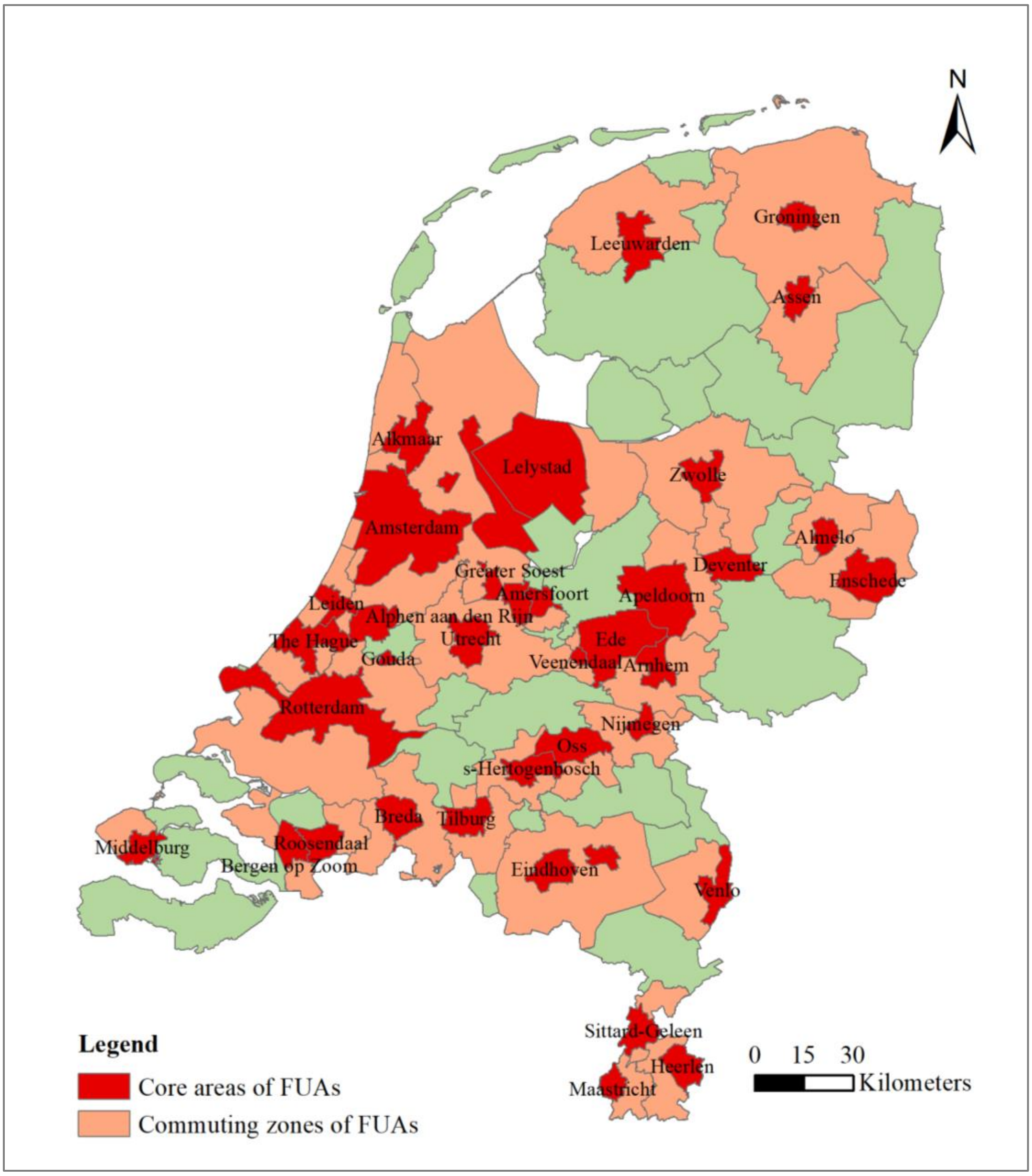

Figure 3: FUAs and their names, divided into core areas and commuting zones (ArcGIS, 2019; OECD, 2019)

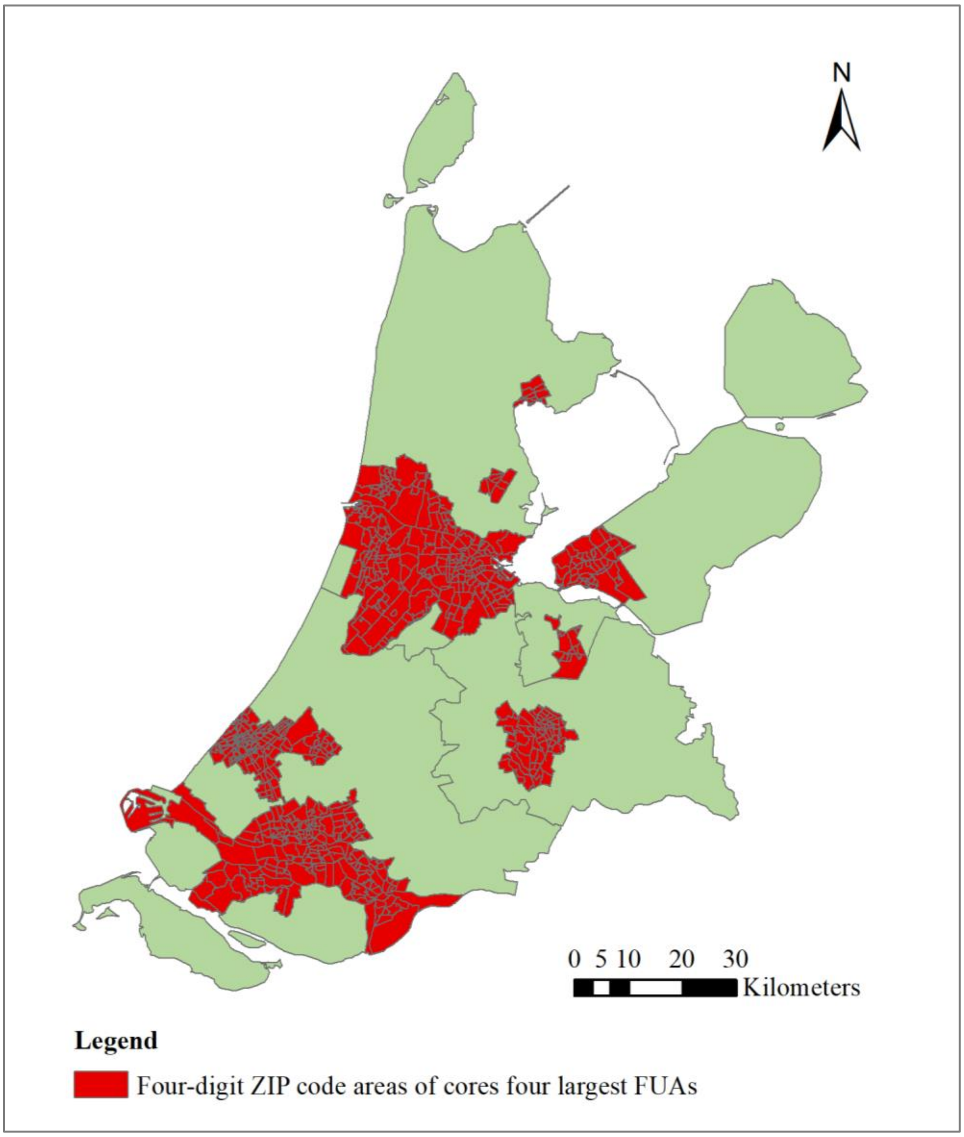

Figure 4: The four-digit ZIP code areas of the core areas of the four largest FUAs (Amsterdam, Rotterdam, The Hague and Utrecht) (ArcGIS, 2019; OECD, 2019)

Appendix II: Variation on regression model 3

Table 6: Regression model 3 with 2019 as reference year

	Model 3
Ln Term	0.155***
	(0.034)
2016 * ln Term	-0.110**
	(0.043)
2017 * ln Term	-0.104***
	(0.039)
2018 * ln Term	-0.109***
	(0.036)
Core largest FUAs * ln Term	0.101***
	(0.027)
Ln Usable Rent	-0.122***
	(0.012)
Constant	4.847***
	(0.151)
Locational characteristics	Yes
Building characteristics	Yes
Location fixed effects	Yes
Year fixed effects	Yes
Number of observations	1,062
F	17.19
R-squared	0.326
Adjusted R-squared	0.307
Root MSE	0.366

Note: Standard errors are in brackets. The independent variable is the natural logarithm of the GRI per square meter per year. Reference categories: year of signature 2019 and locations outside the cores of the FUAs Amsterdam, Rotterdam, The Hague and Utrecht. Significance at the 0.10, 0.05 and 0.01 levels are represented by *, ** and ***, respectively.