The impact of building features on the buildings financial performance

"Do pre-crisis and after-crisis building features decide?"

Master Thesis

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Preface

This report is the final graduation thesis of the Master Real Estate & Housing at the faculty of Architecture of the Delft University of Technology. This master thesis describes the results of the research that has been conducted within the area of Real Estate Management.

The subject of this research is the link between specific building characteristics and the net rental income generated by the property. Special attention is paid to whether building characteristics that have shown to be decisive in acquisition strategies during the 'pre-crisis' period are still a relevant decision-making indicator in the 'after-crisis' period.

This research will be based upon the real estate portfolio of NSI, a Dutch listed real estate fund. Quantitative research methods, using linear mixed models, are used for analysing the portfolio. The goal is to create a statistical prediction model capable of identifying performance indicators for office buildings based on the building characteristics itself.

Hopefully this study provides interesting insights and stimulating results.

Michiel Jacobus Anthon Kuyper
January 31th 2014

Word of thanks

In September 2012 an introduction meeting for all MSc 2 students was organised in which we were told to think of a graduation topic for our master thesis. This felt like a huge plunge in the deep and I would not have been able to complete this process without the support of many.

Above all, I would like to thank my parents for their patience and support throughout my years of studying. The knowledge that someone would back me up felt reassuring. Maryse, my amazing girlfriend, has been of great support over the last half year. She was always willing to listen to various stories, feelings and emotions, even though there was no practical point to them. Thank you for that!

Special thanks to John Buijs for giving me the opportunity to conduct my graduation research at NSI. It has been an exciting experience to be part of an institutional real estate investor. I have learned a lot from all colleagues in whose company I have conducted my daily research activities. Especially my meetings with Johan have been enlightening.

Furthermore I would like to thank Philip Koppels as first mentor and Clarine van Oel as second mentor. Philip has been able to provide me with the necessary economical input for my statistical model. Due to his consistent comments and criticism I have achieved a broader scope on performing statistical analysis. Clarine has spent hours helping me to perform a proper statistical analysis and I am truly grateful for that.

Ultimately I would like to thank my friends, fellow students and roommates for their company, necessary amusement and everlasting supply of espressos. Without all of you, my time as a student would not have come close to the wonderful time it has been!

Abstract

Introduction

After many years of ever increasing real estate prices during the beginning of the 21st century the industry has realised that challenging times have come. New investment opportunities are treated with great care and institutional real estate investors have become anxious about long term commitments. This has resulted into a situation in which office real estate, and in particular the building's qualities, have become subject of debate. When investing in real estate, institutional real estate investors tend to use a certain set of decision-making criteria for the acquisition of office buildings. This research tries to uncover which criteria are being used by the industry, related to either a booming cyclical momentum or a stagnating cyclical momentum of the economy as a whole. Even more important is the question how, and to which extent, investors might improve their set of decision-making criteria. By doing so it will be possible to align the investors real estate investments with the complex economic environments at each specific time.

A new assignment for institutional investors has originated, revising portfolio's based not merely based on 'location, location, location'. The actual building and its tangible features have to be taken into account when formulating an acquisition strategy. Building features that are of great influence to its users, their willingness to pay, and thereby closely related to the profit of a real estate investor, should play a more decisive role in acquisition strategies. Obviously these building features have to be placed within the right economical context at all times. Therefore, it is of great importance to differentiate between economic life cycles and closely map macro-, micro- and mesoeconomic factors that might blur the real effects of the underlying building features.

During the past five years the phrase 'financial crisis' has become a frequently heard phenomenon. The financial crisis started in 2008 with collapse of Lehman Brothers and has had a huge impact on the financial system (Bloomberg, 2010). Although the financial crisis has not been resolved yet, the nature of the crisis has changed over time. The focus of the crisis has shifted towards Europe and has taken shape of a 'monetary crises'. Even though the crisis has not 'officially' ended yet and many challenges still have to be resolved, the effects of the crisis have become clear. One of the many issues on numerous scales, such as socially, politically and monetary is that investments are being reviewed much more critically. Real estate investments have shown to be no exception. In order to support a critical review of investments that are made, and a proper evaluation of the choices that have been made, a better view on specific building characteristics and their impact on the involved stakeholders is needed. Therefore the following hypothesis is formulated:

Pre-crisis and after-crisis building features are of such importance to the net rental income of an office building that it needs to be considered as a decision-making criterion in the acquisition strategy of an institutional real estate investor.

The following research question has been formulated to test the hypothesis:

Which pre-crisis and after-crisis physical and non-physical office building features are to be distinguished to improve the set of decision-making criteria for the acquisition of office buildings by institutional real estate investors? What recommendations can be made to implement these features into an acquisition strategy?

Methodology

To provide an answer to the main research questions, a statistical analysis has been performed based upon the real estate portfolio of Nieuwe Steen Investments (henceforth called NSI). The portfolio of NSI consisted of 177 office buildings, geographically dispersed throughout all parts of the Netherlands. The financial performance of each office building is based upon the net rental incomes generated by that specific property. The net rental income is measured over a time-frame of 14 consecutive years. The first measurements start in 2000 Q1 and lasts until 2013 Q3. All rental incomes are corrected for inflation and presented according to the 2000 Q1 price level.

This research is based upon quantitative analysis using linear mixed modelling. Based upon a predetermined set of variables the financial performance of an office building is predicted. The set of variables that is used as input for the model, are referred to as input variables. They are categorised in three different factor groups: regional market features, location features and building features. An overview of all variables that have been analysed is provided in Table 0.1. During several modelling phases, a final model is constructed that reflects the effect of individual variables on the building's financial performance.

Regional market features	**Location features**	**Building features**	
Vacancy rate	Urbanisation classification	Age	Free Standing
Absorption rate	Position towards Randstad area	LFA / GFA ratio	Energy label
	Number of residents	Number of floors	Spatial lay-out
	Location surrounding typology	Average LFA per floor	Using typology
	Distance to public transport	Mixed use of functions	Flexibility
	Distance to Highway	Type of façade material	
	Distance to NS railway station	Shape of the building's footprint	
	Number of parking places	Shape of the building's façade	
	Parking norm	Charisma of the entrance inside	
		Charisma of the entrance outside	
		Heating, Cooling, Ventilation	

Table 0.1 : Physical and non-physical office building features used as investment criteria.

Results

It appears that the sole arguments 'location', 'location', 'location' do not hold up for office buildings which are located outside the top locations. This study shows that building features play a decisive role in an office building's financial performance. The known negative effects of ageing, as found in previous studies (Sah, 2011), are confirmed in this study. More interesting though, is the confirmation of the impact of the attractiveness of the building's entrance, the extent of flexibility that a tenant demands, the outperformance of multi-tenant offices by single tenant offices and the clear positive impact of urban office typologies. The impact of such factors was first reported in 2009 by Gijselaar. Therefore their validity was questioned since a historical track record was missing. The fact that such factors have yet again shown to be significant, justifies their determining role in optimising the net rental income of a commercial real estate portfolio.

In after-crisis periods the weight of different features seems to change. While the impact of number of inhabitants and the building's flexibility becomes questionable, the impact of the building's typology and the attractiveness of its entrance, remains unquestionably high on the building's financial performance. Since previous studies were unable to perform measurements before and after a severe financial crisis this clearly adds to existing knowledge.

Finally building features at micro-level (i.e. material, shape, layout, energy) have shown to be insignificant in determining the net rental income. Although it could be argued that building with a brick façade would yield a higher profits compared to glass facades (i.e. due to its monumental appearance), it was not found to have a significant impact. The same accounts for example to round offices compared to square offices which did not show to have a particular impact.

Conclusion

In the end, it can be concluded that both pre-crisis and after-crisis office building features are of such importance to the building's financial performance that they have to be incorporated into the decision-making process. Many real estate professionals already had a certain awareness that such building factors existed. However, frequently decision-making took place based upon their gut feeling. This research confirmed these presumptions. It provides tangible features that can be used to optimise the building's financial performance and improve the decision-making process.

Questioning the importance of location, as an indicator for the financial performance of a property, was not the main goal of this study. Nevertheless the results showed a clear distinction between performance in cities and in backward areas. This is interesting in relation to the user's willingness to pay. It enhances the fact that an office building is primarily meant to support the tenant in exercising its business. Therefore the building should enhance this process and by doing so increases the tenant's willingness to pay.

The building characteristics that showed to be the most relevant indicators for the financial performance of an office building all related to its physical nature (i.e. entrance, building type). Nevertheless, non-physical factors such as the using typology were found to have a positive impact as well. It turned out that such building features remained significant regardless of the economic environment. Where the significance of these building features is even slightly bigger in after-crisis periods compared to pre-crisis periods.

A rather limited amount of comparable studies is available regarding the Dutch office market. It is crucial that similar studies are performed on different real estate portfolios. The results of this research have to be tested against such studies, to improve the conclusions that are drawn and to enhance the implications for real estate industry.

Recommendation

- Investments in real estate should go beyond the strict location of a property and focus on the building and its qualities.
- The decision-making criteria in an institutional real estate investor's acquisition strategy have to be diversified regarding investments at A^+ locations and other locations.
- Repeat this study every three to five years to exclude the impact of expiring rental contracts (p. 86) and economic bubbles. Building features that remain significant are true performance indicators.
- An investor is advised to focus on building features in both pre-crisis and after-crisis periods. Location features tend to be slightly less important in after-crisis periods compared to pre-crisis periods. The investment object should be situated in one of the bigger cities outside the Randstad. The building is to have an attractive entrance. The building should be adjustable, however not necessarily highly flexible. Other advisable selection criteria are to focus on offices in residential areas which are suitable for single tenant use.

Table of content

Introduction

Den Haag, Koninginnegracht

1 Introduction

This chapter provides an introduction into the subject of this research. Brief background information regarding the topic of this research is given and it is explained why this research needs to be conducted. The problem definition is elaborated upon, and based on the problem definition a hypothesis is formulated. Based on trending real estate- and economic developments, the relevance of this research is discussed and the research goal is determined. Finally the set of research question around which this research is built are formulated and a brief overview of the research outline is given.

1.1 Motivation

After many years of ever increasing real estate prices during the beginning of the 21st century the industry has realised that challenging times have come. New investment opportunities are being treated with great care and institutional real estate investors have become anxious about long term commitments. This has resulted into a situation in which office real estate, and in particular the building's qualities, have become subject of debate. When investing in real estate, institutional real estate investors tend to use a certain set of decision-making criteria for the acquisition of office buildings. This research tries to uncover which criteria are being used by the industry, related to either a booming cyclical momentum or a stagnating cyclical momentum of the economy as a whole. Even more important is the question how, and tot which extent, investors might improve their set of decision-making criteria. By doing so it will be possible to align the investor's real estate investments with the complex economics environments at each specific time.

Previous research related to decision-making criteria for the office market is primarily focussing on factors that might affect market rents (gross). Using hedonic pricing models such research has yielded a wide variety of factors influencing market rents. These factors are mainly economic and location related. However, decisive evidence linking the impact of physical building features on market rents is scarce and has not been produced until recently (Gijselaar, 2009)

This research will build upon the graduation thesis of R. Gijselaar, a former student at the TU Delft who has graduated in April 2009. It will continue were he has left off and build upon conclusion he has drawn. The research by Gijselaar (2009) had come up with the following conclusions: 'If the building's age goes up its performance goes down', 'If the number of floors within the building goes up, its performance goes up', 'If the building has an attractive entrance, its performance goes up', 'If the building can be characterised as high rise or complex, its performance goes down', 'If the building has one single tenant instead of multiple tenants, its performance goes up' and 'If the building has a medium adjustable layout, its performance goes up'.

However, due to the effects of the financial crisis and the ravages of time, his conclusions need to be studies from a different perspective. Whereas the research of Gijselaar (2009) has clearly mapped the effect of building features on the net rental income in a booming economic cycle, crucial effects of the financial crisis have not been incorporated into his research. Therefore further research is needed to place his conclusion and new findings into the correct perspective. This research will focus on the effect of building features on the net rental income in stagnating economic cycles and even recessions compared too booming economic cyclical phases. Furthermore the effect of crucial building features, such as

sustainability (i.e. energy labels and/or energy cost per m^2) have not, or not completely, been taken into account in previous research.

A new assignment for institutional investors has originated, revising portfolio's based not merely based on 'location, location, location. The actual building and its tangible features have to be taken into account when formulating an acquisition strategy. Building features that are of great influence to its users, their willingness to pay, and thereby closely related to the profit of a real estate investor, should play a more decisive role in acquisition strategies. Obviously these building features have to be placed within the right economical context at all times. Therefore it is of great importance to differentiate between economic life cycles and closely map macro-, micro- and mesoeconomic factors that might blur the real effects of the underlying building features.

These conclusions need to be tested in the light of present market circumstances. As indicated in the previous paragraphs further research is needed on both an economic level as well as on the building level, in order to formulate solid theories and come up with reliable predictions models for acquisition strategies. New conclusions will be drawn and the validity of previous conclusions in changing (economic) circumstances is tested.

1.2 Problem definition

During the past five years the phrase 'financial crisis' has become a frequently heard phenomenon. The financial crisis started in 2008 with collapse of Lehman Brothers (Bloomberg, 2010) and has had a huge impact on the financial system. Although the financial crisis has not been resolved yet, the nature of the crisis has changed over time. The focus of the crisis has shifted towards Europe and has taken shape of a 'monetary crises'. This was reflected by the huge depreciation of the euro and the problem concerning governmental deficits (FD, 2012). Today people tend to refer to the current crisis as a 'budgetary crisis'. This is clearly reflected by the enormous pressure upon governments to reduce their deficits. In the Netherlands special attention is paid to the enormous pile of mortgage debts present within our system (C.A. Kam, 2009). Even though these three types of crisis are not directly related to real estate they were either partially caused by real estate related products (i.e. U.S. Alt-A mortgages) (J.R. Barth, 2009) or are still a substantial part of the current 'budgetary crisis' (i.e. total Dutch mortgage debts). Either way it can be concluded that real estate is closely related to the financial problems the world is currently facing. One shared aspect that all crisis have had in common being that they have changed the way in which we look at 'value'.

Even though the crisis has not 'officially' ended yet, and many challenges still have to be resolved, the effects of the crisis have become clear. One of the many issues on numerous scales, such as socially, politically and monetary is that new investment are reviewed much more critically. Real estate investments have shown to be no exception. In order to support a critical review of investments that are made and a proper evaluation of the choices that have been made, a better view on specific building characteristics and their impact on the involved stakeholders is needed. Taken into account the above described problem definition the following hypothesis is formulated.

Hypothesis:

Pre-crisis and after-crisis building features are of such importance to the net rental income of an office building that it needs to be considered as a decision-making criterion in the acquisition strategy of an institutional real estate investor.

1.3 Relevance

When studying the real estate market in current times it can be characterised as a market dominated by uncertainty. This is due to an immense variety of factors influencing the market both on a policy level as well as on an investment and building levels. New insights that would reduce these levels of uncertainty are highly relevant for the real estate market.

As described above there is still a lot of uncertainty associated with investing in Real Estate, this restrains institutional investors from investing more wealth into Real Estate. Converting real estate investment uncertainties into tangible acquisition strategies is one of the main objectives of this research. Findings of this research will bring the involved stakeholders closer together and by doing so it contributes stabilising the real estate market. The construction phase within the entire real estate cycle will gain insight into the type of buildings that is actually a market for. Investors gain insight into the type of investments that are still profitable for them. As a result of these investments in the real estate market will go up, having positive economic cyclical effects. Furthermore tenants will benefit since the realised building will better suit their needs. Last but not least this research is highly relevant for municipalities since the outcome of this research can be used to add to a solution of (structural) on-going vacancy problems.

The relevance of this research is supported by the following quotes:

- *"Within the current real estate market tenants have a strong bargaining position and can be more critical in assessing individual elements of the real estate objects."*
  (FD, 15/04/2013)

- *"It has become more important to start your line of reasoning from the tenant's perspective in order to anticipate their wishes. Physical building aspects, from both the interior as well as exterior of the building, are expected to be become a focus point from the tenant's perspective."*
  (DTZ, VastgoedVisierapport januari 2013)

Although these opinions and facts do not directly specify which physical building features are decisive they do point out that it is not merely about location anymore. Furthermore they expect that physical building features will gain more attention in the near future. However, it remains unclear which aspects to focus on and how to incorporate these into the composition of a real estate portfolio and its belonging acquisition strategy. This research aims at providing answers to these questions.

1.4 Research questions

Following from the previously describe problem definition and the context in which these problems have arisen this paragraph will state the hypothesis, main research question and belonging sub research questions. These questions cover all other researchable topics concerning the to be conducted research.

1.4.1 Main research question

The following research question is the main research question:

Which pre-crisis and after-crisis physical and non-physical office building features are to be distinguished to improve the set of decision-making criteria for the acquisition of office buildings by institutional real estate investors? What recommendations can be made to implement these features into an acquisition strategy?

1.4.2 Sub research questions

Belonging to the main research as stated above the following sub-questions are to be distinguished:

1. ***Which decision-making criteria do institutional real estate investors currently apply in the acquisition of office buildings?***

   This sub question reflects the current 'status-quo' within the industry. The answer to this sub question provides the baseline measurement to this research. Answers to the main research question can be compared to this sub question. By doing so trends within the market can be distinguished and possible errors within current decision-making criteria in the acquisition of office buildings can be corrected. Both a literature study as well as interviews with experts from institutional real estate investors in the field of real estate portfolio management need to be conducted in order to come up with possible answers to this sub research question.

2. ***What physical and non-physical office building features can be qualified that potentially have influence on an office building's net rental income?***

   Listing all physical and non-physical office building features that might influence the building's net rental income is nearly impossible. Therefore a selection of relevant features needs to be made beforehand to simplify this complex problem. This selection is made based on previous research from Gijselaar (2009) and Meijners (2012). Based on findings from the literature review and common sense, physical and non-physical building features have been included that have shown to be relevant elsewhere but were not incorporated into previous research.

3. ***To what extent do the qualified physical office building features determine the office building's net rental income?***

   Once the physical and non-physical office building features that potentially influence the office building's net rental income have been determined, their actual impact on the net rental income needs to be analysed. This sub question will answers whether there is, and the extent to which, an actual relationship between the determined features and the office building's net rental income. Specific interest is paid to the role of physical building

features. To answer this sub research question a quantitative study needs to be conducted using regression analysis and specifically linear mixed modelling. The net rental income of all the office buildings in the portfolio is taken as the dependent variable and the selected physical and non-physical office building features are taking as independent predictor factors.

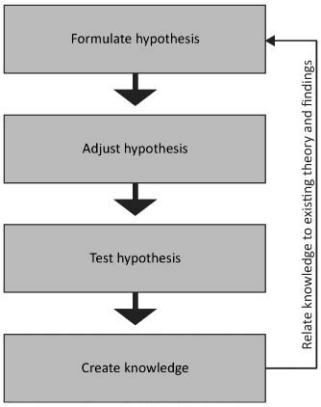
4. ***How should knowledge about physical office building features be implemented into an asset acquisition strategy as decision-making criterion for institutional investors?***

   Finally the results of the performed quantitative study are translated into practical advice for institutional real estate investors concerning the composition of their real estate portfolio and their belonging acquisition strategies. The extent to which the results of this study will actually be taken into account as decision-making criteria will depend upon numerous elements such as the 'mind-set of the real estate investors' and current economic circumstances.

1.5 Research Outline

Based on the formulated research question and research objectives figure 1.2 represents the research outline that is being used. The main steps taken within this research are shown and the specific categories they belong to. It shows the process that should result into an adequate answer to the main research question. Furthermore it provides a brief introduction into the research methods and techniques used throughout this research.

At first a theoretical framework is created in which the overall themes of this research are addressed. First of all investing in real estate and the real estate market (i.e. listed vs. non-listed funds) has been studied in general. After which more specific topics such as the Dutch office market, the acquisition process of real estate and possible decision-making criteria have been mapped. These subjects needed to be studied in order to derive the most relevant performance indicators influencing the building's financial performance. That is, simply entering random variables into the statistical model would not yield any reliable results.



The second phase is to gather data at NSI on the selected variables that can be used as input for the statistical model that is being used to simulate the influence of building features on the office's financial performance. This phase is followed by part in which the results of the final model are to be interpreted. These results will be compared with finding from previous research as well as with representatives from NSI themselves and other experts in the field of real estate. This should result into an advice meant for the office industry in general. However, more specifically aimed at the portfolio and acquisition strategy of NSI.

Figure 1.1: Basic research outline (own work).

In short it all comes down to creating a hypothesis which indicates possible factors that have an impact on the financial performance of an office building. This hypothesis has been revised over and over again in order to enable it to generate new knowledge on physical and non-physical building features. After which this new knowledge can be related to earlier findings and problems from practice. This process is shown in figure 1.1.

The first chapter of this paper provides an introduction to the to be conducted research and places to topic of the research within its broader context. The motivation is elaborated on and the specific relevance of the topic is stated. Consecutively the main research question the belonging sub research questions are formulated.

Chapter 2 provides the theoretical framework. This chapter elaborates on studies and publications that have shown to be relevant to the context of this research. This chapter can be considered the theoretical heart of this research. Themes discussed in this chapter are the main source of information used to derive the variables needed for the statistical analysis.

Chapter 3 describes the methodology that is used to conduct this research. All methods and techniques are discussed and a description of the quantitative analysis is given. The first three chapters have given a clear overview of the topic, its (historical) background and the research objectives. Contrary this chapter provides a step-by-step description of the methods and techniques that will be used. Finally a description of the type of data is given.

Chapter 4 will state the descriptive results as gathered throughout the research. The impact of all the qualified variables on the net rental income is given. A distinction is made between regional market features, location features and specific building features. The numerical results will be elaborated on and preliminary findings regarding the impact of physical and non-physical building features on the net rental income are given.

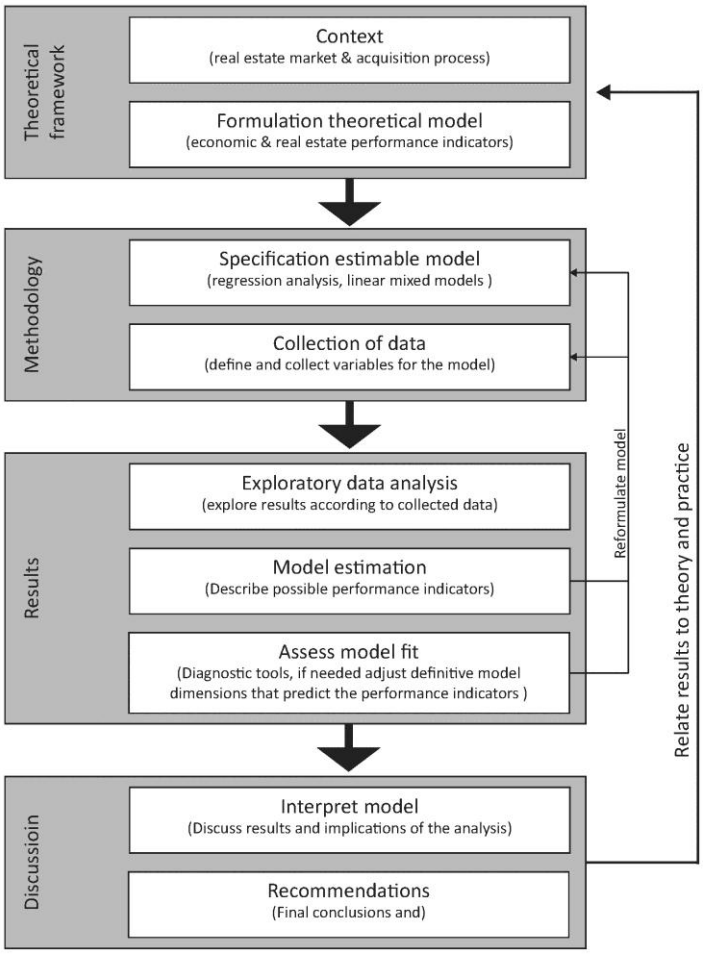


Figure 1.2: Extended research outline (own work).

Chapter 5 and 6 will elaborates on the statistical models that have been tried. The results are linked to available literature, results from previous research and experiences from experts in the field of real estate investments. Based on these results conclusions are drawn.

In Chapter 7 the total research will be subject of debate. All methods and techniques used will be discussed and given the chance heavily criticised. Specific attention will be paid to what new insights have been gained by this research and it is decided whether the main questions has been answered sufficiently. If possible the possibilities for further research are pointed out.

1.5.1 Research themes

This research can be divided into five main research themes (figure 1.3). These are incorporated into the main research question and are reflected in the sub question as well. The theoretical framework will provides a more elaborate insight into these various themes.

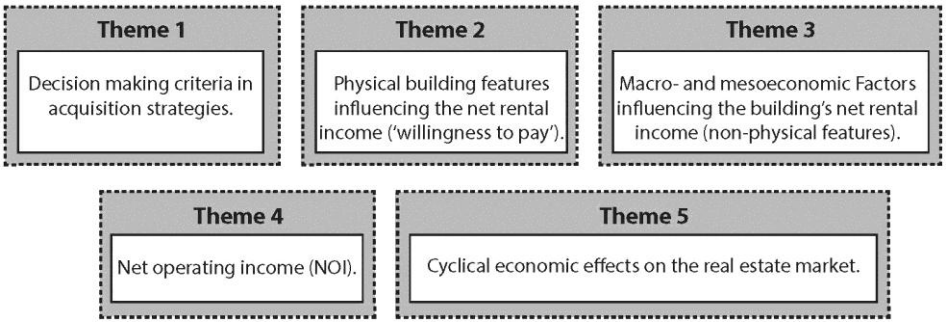


Figure 1.3: research themes (own work).

1.5.2 Target groups

Within this research three main target groups can be distinguished; Real estate investors, municipalities and tenants.

First of all real estate investors are the main target group of this research. The outcome of this research will provide real estate investors with better decision-making criteria as well as a model that helps them to support their past and future choices in different economic circumstances. Furthermore municipalities are highly interested in the outcome of this research as well. Since all municipalities are facing high office vacancy rates the outcome of this research provides them with concrete guidelines towards the type of office buildings that are still of interest to both investors and tenants. Knowledge gained by this research can be used granting building permits as well as for redevelopment programs.

Finally the tenant can definitely be seen as a target group of this research. Although this research is not primarily aimed at 'user preferences' is does provide clear insight into what users are actually looking for in practise. Since an investor's return is dependent on the extent to which is tenant is willing to pay. Within the current market the fact that a tenant is prepared to paying long term leases or high rents this reflects shows that they are satisfied with the building and its belonging characteristic. This knowledge can be used to map building features that tenants are looking for and anticipate on this when realising, or investing in, real estate. So the tenant is benefitting from this information in a way that the office building stock can be better tailored to their needs and preferences.

1.6 Research objectives

1.6.1 Expected products

Obviously real estate investors have a set of decision-making criteria when deciding whether certain acquisitions should be pursued or not. This decision-making process usually heavily relies upon subjectivity. Decision based on ones 'gut-feeling' or personal experiences are not exception. Especially lines of reasoning that have played out in the past are repeated over and over again. A sound rational basis in the decision-making process is lacking.

Therefore the main objective of this research is to generate a set of rational determined decision-making criteria regarding the role of physical office building aspects in the acquisition of office buildings. In order to do so a quantitative study is performed using the real estate portfolio of Nieuwe Steen Investments (NSI). The creation of a statistical model can show the existence of certain physical and non-physical building features that influence the office building's financial performance. These results will be incorporated into an advice given to the real estate industry in general and Nieuwe Steen Investment themselves. Such an advice regarding the impact of building features might provide tangible counselling to improve the current decision-making criteria in different economic circumstances for the acquisition of office real estate.

1.7 Graduation company

The research is conducted within NSI, Nieuwe Steen Investments. It can be seen as a combination of graduation project that is being combined with an internship. The reason for doing this research at NSI is based on three main lines of reasoning. First of all the company has good access to specific data, data crucial to the successful completion of this research. Secondly the company can add knowledge from practise that might be missing within the academic span of the Technical University of Delft. Finally this research can be characterised as a follow up research, continuing where others left off. Since previous research has also been conducted within NSI, it is merely logical that this research will be within NSI as well in order to make it comparable with previous research and draw sound conclusion.

1.7.1 About NSI

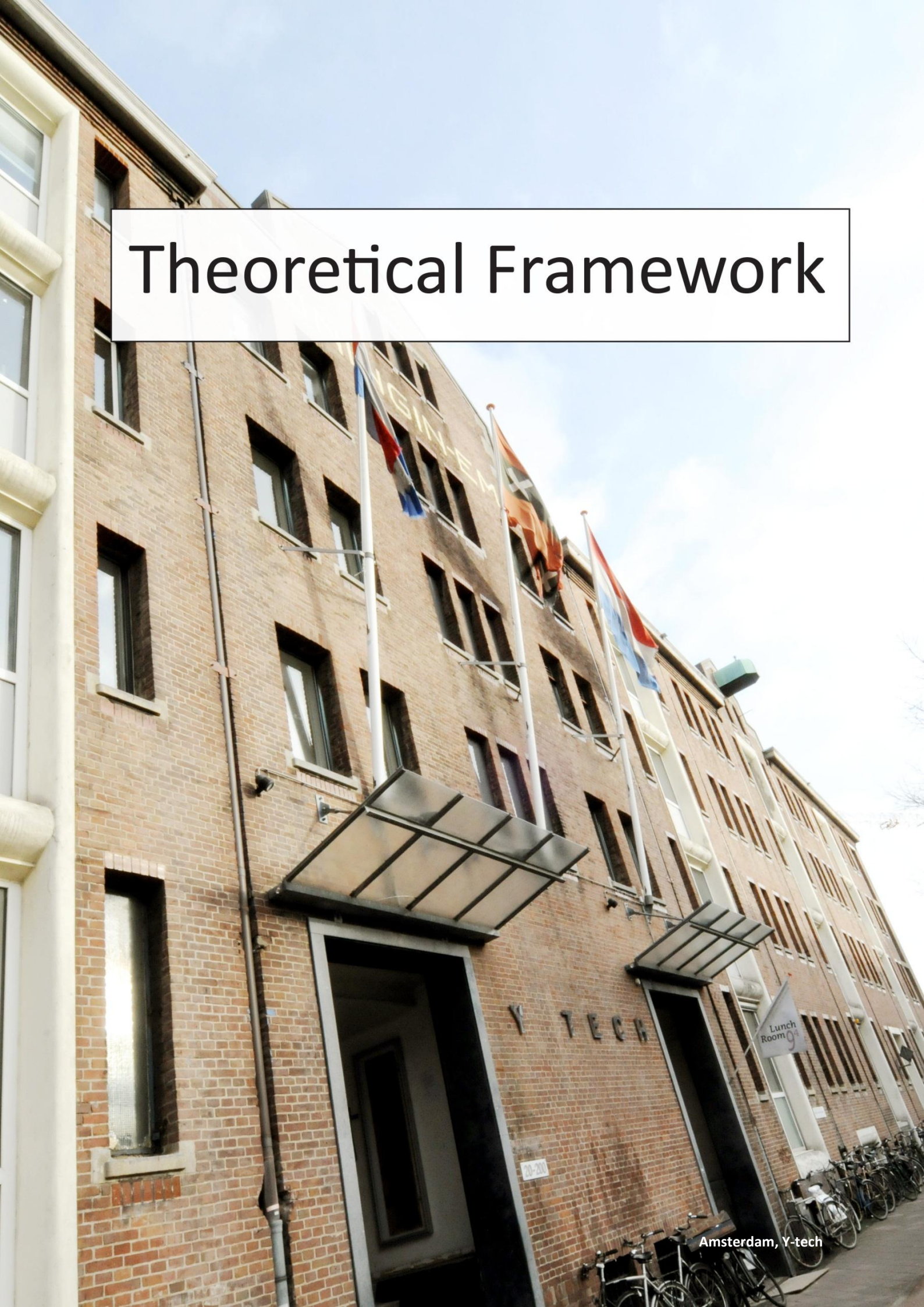
NSI is a closed-end real estate fund with 'changing equity' (bevek), investing in real estate. NSI is founded on the 1st of March 1993 and is listed on the Amsterdam Stock Exchange since the 3th of April 1998.

NSI is located at the Antareslaan 69 in Hoofddorp. The fund is managed by a small, decisive organisation consisting of 64 members, including the 2 board members. The mission statement of NSI is: 'offering tenants a sustainable accommodation in order to provide these tenants with the possibility of execute their profession successfully on the long term. By doing so both institutional and private investors are offered a continuous return on their invested equity. NSI is capable of delivering this by investments in offices and retail on premium and active locations'.

The targets of NSI, as can be derived from the mission statement, is a sustainable returns per share. In order to reach this goal NSI aims at:

- Investments on the long run of about half in retail and half in offices;
- Allocation of risks by investing in multiple European markets, currently The Netherlands and Belgium;
- Creating value within the existing portfolio for stockholders by investments in existing objects. By doing so an optimum of objects rented out is reached. If possible objects are (re)developed, combined with an active acquisition strategy.

Theoretical Framework



Amsterdam, Y-tech

2 Theoretical framework

2.1 Introduction

The first part of this chapter provides a brief background into the primary principles of this research. The background information gains insights into the field of research and leads to a basic understanding of the research that has been performed. Compiling a real estate portfolio and designing real estate acquisition strategies is not to be taken light hearted. Furthermore this chapter provides an extensive and in depth study of the themes that are addressed within this study. Multiple articles from various authors will be discussed. Conclusions that can be drawn based on the studied literature will be given. The theoretical framework will be the basis of this research and explains where theories used in this research are derived from. Furthermore the theoretical framework provides a basis for the variables that are used to analyse the building features

2.2 Real estate investment

For a thorough comprehension of this research and the possible results it might yield, a basic understanding of the real estate investment market is required. This chapter will elaborate on both the positive and negative aspects of investing in real estate. A more specific overview of the exact context of real estate investments on a micro level is provided in the next chapters. The main reason for institutional investors to allocate a fair share of their equity to real estate is their wish to increase diversification within their portfolio (Geltner, Miller, Clayton, & Eichholtz, 2007). The amount of equity they allocate to real estate differs for each investor. This is mainly due to the fact that they have different goals and risk profiles. The most interesting question is why they have chosen to invest in real estate in the first place? According to Meijners (2012), Geltner et al. (2007), Matysiak & Tsolacos (2003) and Nappi-Choulet, Missonier-Piera & Cancel (2009) several of the most common advantages of devoting equity to real estate investments are:

- Diversification of the portfolio.
- To hedge against inflation.
- Fairly stable and predictable cash flows.
- High returns.

2.2.1 Why invest in real estate?

By incorporating real estate into a portfolio consisting of other assets such as bonds, stocks and raw materials its diversity is increased the risk of the portfolio as a whole will decrease (Meijners, 2012). This is mainly due to the fact that historically seen the correlation between stock and real estate is rather low (Musil, 2011). Nevertheless these findings should be placed within a different perspective looking at the current circumstances. Since recent studies show a higher correlation between stocks and real estate (Vijverberg, van Aart, van der Mark, van den Heuvel, & Ong, 2012).

Real estate is believed to be a reliable hedge again inflation. The main goal of hedging against inflation being to compensate for inflation. This is the result of the fact that rents are usually adjusted on a yearly basis whereas stocks, bonds and raw materials are not. More traditional theories as stated by Geltner et al. (2007) state that real estate is generally considered to be a good hedge against inflation. However, other studies question the exact capabilities of real

estate to hedge against inflation (Brooks, Tsolacos, & S., 2000). When taking into account the current loose monetary policies of the biggest economies (i.e. U.S., Japan) the hedging effects of real estate are to be tested once again. However, due to the fact that real estate is tangible and many other assets are not, the hedging capacities of real estate are generally accepted (Geltner et al., 2007). Furthermore real estate provides rather stable cash flows as a result of long-term contracts with tenants. This gives real estate an edge over other assets which easily change hands. The long-term contract usually includes agreements regarding the increase of rent levels over time making it fairly reliable and reducing the risk of vacancy.

Finally the high returns that can be achieved by incorporating real estate in a portfolio are subscribed by market developments over the last 37 years. As shown in figure 2.1 Vijverberg et al. (2012) have compared the profits of real estate versus other assets such as bonds, stocks, cash and raw materials. From this figure it can be concluded that real estate has yielded substantially higher results. Nevertheless it must be said that its volatility has increased dramatically over the past six years reducing the reliability and predictability of real estate.

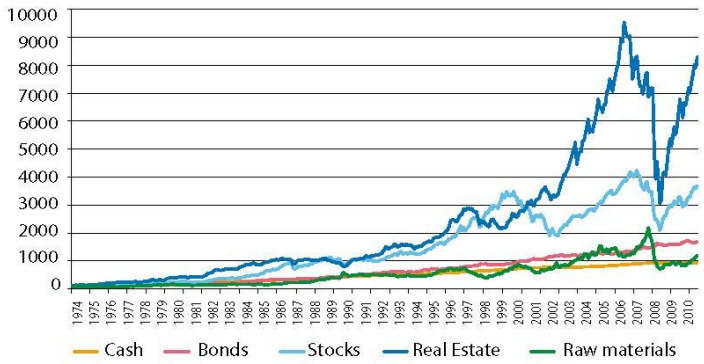


Figure 2.1: Total returns of different investment classes on the Dutch market (Vijverberg et al., 2012).

2.2.2 Why not to invest in real estate?

Obviously there is a downside to every type of asset one chooses to invest in, real estate being no exception. According to Meijners (2012), Geltner et al. (2007), Matsyiak & Tsolacos (2003) and Nappi-Choulet et al. (2009) several of the most common disadvantages of devoting equity to real estate investments are:

- Labour intensive.
- Transaction costs.
- Absence of liquidity.
- Indivisibility.
- Imperfect market.

Real estate investments can be considered as labour intensive. Compared to stocks and bonds one does not simply buy an item, waits for a couple of years, and sell the item with a decent profit. First of all it takes a lot of knowledge about the market before an investment can be made. When the investment finally has been made it takes a continuous effort to manage and maintain the property.

Furthermore most countries have certain taxes that need to be paid when real estate properties change hands. The Dutch conveyance tax is set at 6% which needs to be paid besides other expenses that come along when buying real estate (i.e. broker, notaries etc.).

There is no international legislation regarding this taxes. Other countries tend to have a conveyance tax which is somewhere between six and ten per cent. Since investments in real estate usually are about several million of euros one can imagine that that these costs are not to be taken light hearted.

Finally other main disadvantages of investing in real estate such as the absence of liquidity, indivisibility and imperfect markets are closely related. When investing in real estate this usually is a long term commitment. Therefore money invested into a property is not easily retrieved. Whereas for stocks and bonds it is fairly common to change hands on a weekly or even daily basis, this does not account for real estate. Thereby making it extremely difficult to retrieve cash money in the case of a crisis, such as the one that has hit the world in 2008. The same problem accounts for the indivisibility of real estate. Whereas it is possible to sell a certain amount of the same stock while keeping the other part, this is not possible in the case of real estate. As a result of this the risk of investing in real estate can be considered higher compared to stocks and bonds. Furthermore the stock and bond market can be regarded as 'a perfect market'. Inequalities in prices or differences between supply and demand are immediately corrected by the market (Galbraith & Darity, 2005). Since it takes time to build real estate, supply and demand are almost never in equilibrium, causing friction in the market. This is illustrated by the four-quadrant model touched upon in the following paragraph.

2.3 Cyclical economic tendencies

During a period of several years the economy as a whole goes through several different stages. Whereas some economic cycles are characterised by economic slowdown, or even decline, others can be characterised as highly prosperous and continuously growing. The economic cycles that can be distinguished are commonly referred to as: depression, recession, recovery, expansion and peaks (Galbraith & Darity, 2005). When the financial crises started both the U.S. and Europe were hit by a huge recession that eventually turned out to be a depression. Currently the economy is in the recovery phase of the economic cycle. As is the case with most investments, real estate being no exception, they are vulnerable the changes in the economic cycles as previously described (Hamilton, 2011). Therefore it is of the utmost importance to identify the right economic cycle. Aligning the real estate investor's strategy with it might create a huge competitive advantage (Liow, 2007). Figure 2.2 provides an overview of the different economic cycles that exist within our modern world economy.

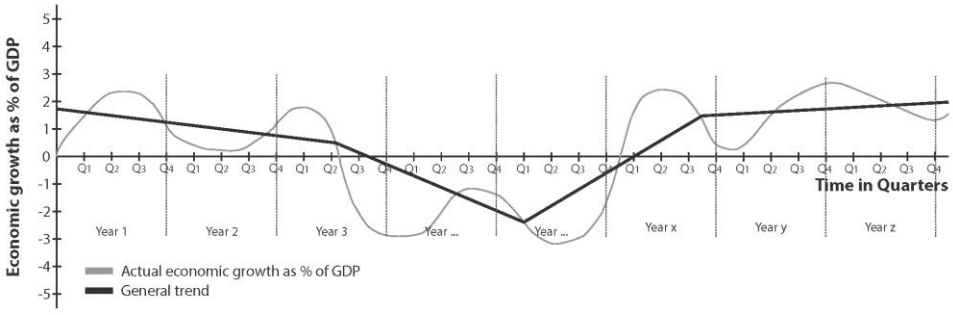


Figure 2.2: Economic cycles (own work).

As previously has been explained the real estate market is vulnerable to economic cycles as well. As a result of these different cycles there is a continuously changing balance between demand, supply and rents within the real estate market. When studying the real estate market in particular a specific model was developed by Dipasquale & Wheaton (1992) to describe the cycles the corporate real estate market is going through. Figure 2.3 represents the four quadrant model explaining the different cycles within the real estate market. This model shows how the space market, asset market, development market and the addition to office stock market are connected. At some point in time an equilibrium state can be found, represented by the black line ($D_{equilibrium}$). However, it also shows how a change in the office demand function (D_1) influences all other markets present within the model.

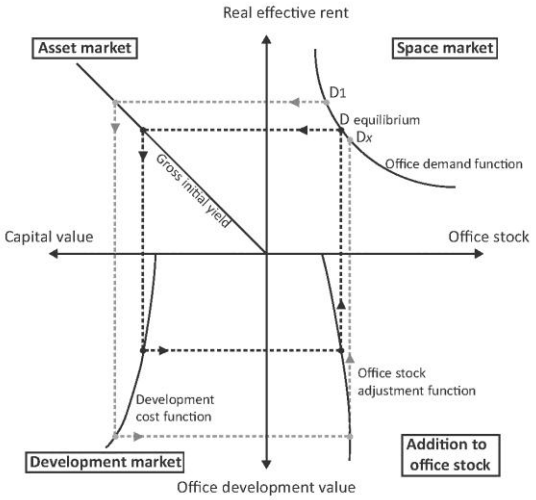


Figure 2.3: The four-quadrant model (DiPasquale & Wheaton, 1992), modified by Soeters and Koppels (2008).

The asset market can be regarded as a representative of the general capital markets. As a result of this, any changes within the real estate market have its influence on movements within the economy and financial market as a whole. Unfortunately the real estate market cannot be regarded as a perfect market (Musil, 2011). This is due to the fact that, even though the basic principles of demand and supply are applicable to the real estate market, a certain delay is present within the market. This delay in market response causes the presence of continuous imbalance. With regard to this research it is highly relevant to know if the presence of difference economic and real estate cycles have an influence on the set of office buildings that are to be studied. In particular if a distinction can be made between physical and non-physical office building features that show to be a good representative of the office building's financial performance during one economic cycle (i.e. recession) compared to the other economic cycle (i.e. recovery).

2.4 Dutch office market

By making use of representative indicators (i.e. market rents, supply of office space, shortage) of the Dutch office market this paragraph illustrates a wide range of differences that exist between various regional sub-markets in The Netherlands. When comparing multiple offices across the country it is crucial to be aware of these existing differences. One of the most eye catching observations that can be derived from figure 2.4 is the market rent difference between several regions within The Netherlands. There is a huge variation in office market rents between the North-West of The Netherlands and the other regions. The impact of the Randstad, in particular Amsterdam, is apparently substantial. Especially when looking at new office buildings compared to existing office building this difference is enhanced (figure 2.5).

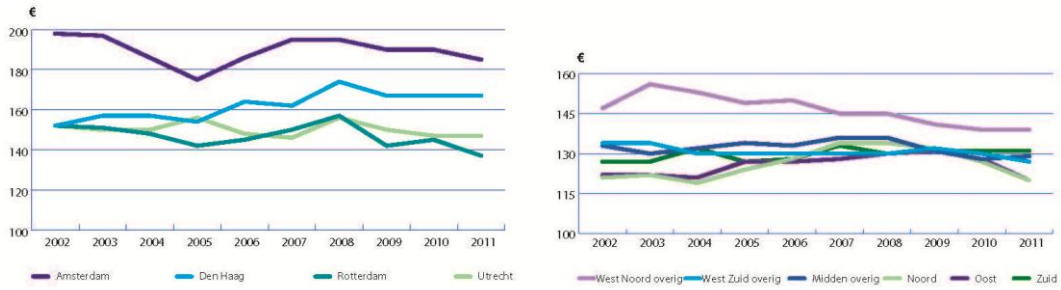


Figure 2.4: Market rent development of existing office buildings (Bak, 2013).

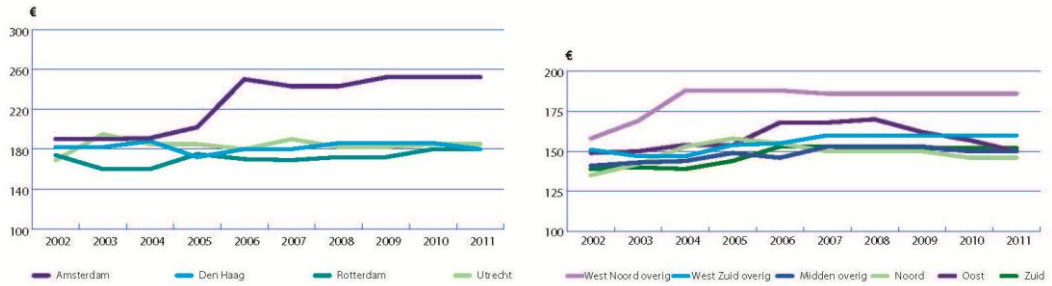


Figure 2.5: Market rent development of new office buildings (Bak, 2013).

Furthermore figure 2.4 and figure 2.5 show an interesting pattern regarding the stability of the regional markets office rents. Whereas Amsterdam turned out to be rather volatile the other cities and non-Randstad regions have shown to be rather stable. For example the new office buildings in the Amsterdam area show a steep incline in office rents in 2005 compared to stable office prices in other cities during the same period. A similar trend can be distinguished in the office space absorption rate as shown in figure 2.6. Office space in the North-West region of The Netherlands was absorbed much faster compared to other regions in The Netherlands. The same account for the supply of offices as shown in figure 2.7. Whereas the Randstad area alone accounts for over 60% of the total office supply all the other regions within The Netherlands combined account for the other 40%. Both these differences in office supply and absorption indicate that a clear distinction between sub-regions must be made.

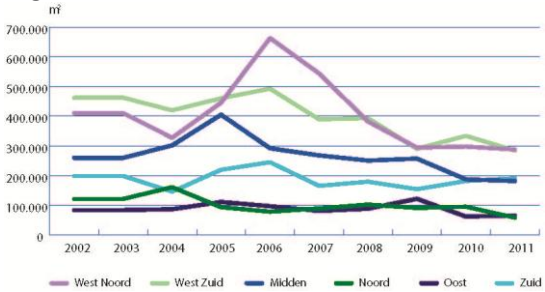


Figure 2.6: Office space (m2) absorption rate (Bak, 2013).

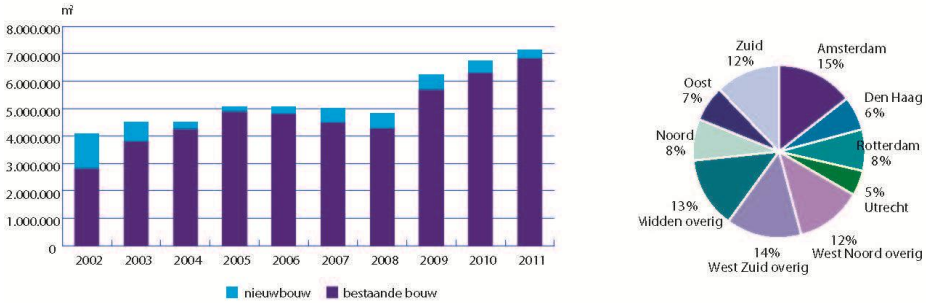


Figure 2.7: Supply of office space (m2) (Bak, 2013).

When studying the different market indicators it can be said that there is a notable discrepancy between various sub-regions in The Netherlands. Most interesting however are the office rental prices in the Randstad, in particular Amsterdam, compared to other regions and cities within the Netherlands. Taking into account the various regional differences as illustrated in this chapter it shows to be highly relevant to incorporate regional impacts, as being a non-physical building feature, into this research.

2.5 Acquisition process

If one has decided to invest in real estate a wide range of investment opportunities is to be considered. Investments can be made in categories such as office, retail, housing and industrial properties. Within The Netherlands there are five major real estate investors active on the Dutch market. The investors that can be distinguished are NSI, NIBC, VastNed, BPF Bouwinvest and CBRE. Each investor had a different background and has different motives to invest in real estate. Some investors are listed on a stock exchange, others are a pension fund and there are non-listed corporate funds as well. Due to their differentiating background and attitude towards risk they employ different investment strategies and styles such as core funds, value-added funds and opportunity funds (Hwa, 2008). Whereas a listed real estate funds such as CBRE only tends to invest in offices on top locations, pension funds are more willing to invest in less risky retail and dwelling properties.

In line with the organisation's strategy pre-selections are made of a set of properties that have a certain investment potential for acquisitions. During this phase general information is gathered. The current economic circumstances are assessed and the building's specific characteristics are reviewed. Other, more formal, contractual obligation such as length and status of the rental contract are studied. Followed by an analysis of possible tenants and specific functions for the property. Since all these factors might influence the value of an object.

Continuously the building is assessed in a more technical way (Nunnington & Haynes, 2011). A cash flow model is constructed to predict the future costs and income of the specific building. Furthermore the building is checked for possible construction or maintenance defects. These must be detected beforehand and if necessary be included into the cash flow model. If the investors is still positive about acquiring the building negotiations with the original owner can take place. Before a final deal can be made all the details have to be approved by the responsible committee of the investing real estate fund. This research is less interested in the generation of cash flow models and possible negotiation that take place afterwards. However, the decision-making criteria that are being used in the pre-selection phase are highly relevant for this research. During the next few pages a closer look at individual pre-selection criteria is taken.

2.6 Decision-making criteria

During the process of acquiring an office building decisions are made regarding several areas of expertise. When looking on a micro level, the building and its characteristics has to be judged. Physical building features such as construction material, architectural quality, and amount of floor levels are considered amongst others. However, a properties investment potential is not only determined by physical building features. On a mesoeconomic scale non-physical building features such as the distance to surrounding facilities, transportation hubs or even the image of a certain business district might turn out to play a decisive role in the building's financial performance. Finally there will be macroeconomic factors influencing the acquisition decision-making process. Without any doubt the national or even world-wide

economic tendency will influence the objects investment potential. Besides such major trends, other factors such as the overall vacancy rate and office demand/supply are assumed to be highly relevant. Öven & Pekdemir (2006) have made a meta-analysis about numerous different researches on different factors influencing office rents since the 1980's. They have come up with 64 predictors that are ought to influence office building rents. These variables were divided into four different groups: econometric, location, contract and building features. The statistical analysis as conducted in their research is based upon both a standard regression form as well as a simplified regression form. Consequently both models are performed two times, one model with a linear version and the other with a log-linear version. The exact SPSS syntax as used in their study was not reported. This chapter aims at providing an overview of all relevant features, on different scales that are expected to influence the office building's financial performance. Information gathered in this chapter is used to identify the correct and most influential input variables needed to perform the quantitative analysis in this research.

2.6.1 Economical features

The vacancy rate is crucial importance according to multiple studies performed by Öven & Pekdemir (2006), Lim, Berry & Sieraki (2013) and Sah (2011). They concluded that the vacancy rate is of crucial importance independent from factors such the location, building typology and geographical discrepancies. Yet, there are some studies that suggest that the impact of the vacancy rate is bigger in larger cities compared to smaller ones. This is indirectly subscribed by facts and figures described in the previous paragraph regarding the Dutch office market in which a high volatility within bigger cities (i.e. Amsterdam, The Hague, Rotterdam and Utrecht) was visible compared to a more constant performance in smaller cities.

In their study of the office market in Istanbul Öven & Pekdemir (2006) concluded that the Gross Domestic Product was not a major factor influencing the office building's rent levels. Other researchers (Bispinck, 2013) have come up with findings that the Gross Domestic Product is a significant predictor for the office building's financial performance. Although it must be noted that these findings only apply to cities with an office stock of over 4 million m^2. This would only be applicable to Dutch cities such as Amsterdam, Rotterdam, Utrecht and The Hague. Most important however, the studies previously mentioned have targeted individual office markets. This research examines the impact of numerous physical and non-physical office building features on a national level. Therefore the impact of changes in the Gross Domestic Product on office rent levels might lead to a deviating outcome.

Finally absorption rate, office stock and unemployment rates can be distinguished as determining variables (Öven & Pekdemir, 2006), (Lim et al., 2013). The absorption rate reflects the time that a new office building is unused before it is being occupied. Neither studies agree on the exact impact of the absorption rate however they do agree that the absorption rate is of minor importance compared to the vacancy rate. All authors are on the impact of the office stock and unemployment rate. Stating that both variables are of minor influence to the building's financial performance and that no conclusive evidence regarding both variables can be given. All in all it can be said that the vacancy rate has the highest impact when determining office building rent levels. Therefore this can be considered the most important economic factor in the quantitative analysis. This is especially due to the fact that the vacancy rate tends to be independent from any other variables (i.e. spatial differences). Furthermore the Gross Domestic Product and absorption rate are expected to have a substantial impact on the office building rent levels. Variables such as the office stock and unemployment rate do not have, or at best a very minor, impact.

2.6.2 Location features

Geographical characteristics are of great impact to the rental income generated by the specific property (Clapp, 1980), (Öven & Pekdemir, 2006). These studies have shown that the distance towards the city centre, business district and secondary centre can be regarded as important indicators. Although it must be noted that these studies do not apply to the Dutch office market and therefore might be less relevant. However, it is safe to say that these variables do reflect the types of locations within a city that are expected to perform better.

Furthermore other location features that are expected to have an influence on the office building's financial performance are the distance towards important transportation hubs. Debrezion, Pels & Rietveld (2007) have shown that commercial real estate properties, in the Netherlands (stratification) that are located within a quarter of a mile from a railway station have over 10% higher profits compared to properties located further away. Similar research by de Graaf, Rietveld & Debrezion (2007) has yielded equal results. Their research produced convincing results linking the value of office buildings to their distance to Schiphol airport. One of their findings was that when the distance towards the airport was doubled the value of the office buildings was reduced by 6%. The same research has also examined the relationship between the property value and its distance towards a railway station. It was found that when an office building was located near a railway station its value would increase with 16%. Nevertheless this increase was made undone if the distance would be more than 1 kilometre. Most likely this was due to what users considered to be a proper walking distance.

It can be concluded that the distance to (main) transportation hubs is of significant importance to the office building's rental income and should therefore be included as a predictor variable in the quantitative analysis. Geographical characteristic related to the distance towards the city centre or other business district are less conclusive variables however substantial enough to be incorporated as input variables.

2.6.3 Building features

There are several studies that have tried to determine which physical building characteristics are of influence to the building's financial performance. Most research has taken a look at physical building characteristics in relation to the building's asking rent level which excludes operating and management costs. Such a research by Öven & Pekdemir (2006) has found a number of physical building characteristics that have shown to be relevant. Listed hierarchically from most influential to least influential these factors are: building age, percentage of unused space in the office, total floor area, number of floors and the percentage of common space in the building. The variable 'age' is the building's characteristic that is most widely agreed upon (Clapp, 1980), (Sah, 2011), (Lusht, 2012). Although there are researches who doubt the actual importance of the building's age (Matysiak & Tsolacos, 2003).

Some research has tried to identify the impact of building features on the net rental income (Gijselaar, 2009). This provides more reliable results regarding the underlying motivations for investing in a certain property and the decision-making criteria that have been used. In addition to earlier findings by Clapp (1980) and Öven & Pekdemir (2006), Gijselaar (2009) concluded that variables such as number of floors, flexibility, ceiling height, lay-out, type of façade and type of entrance are of significant importance to the building's net rental income as well.

Furthermore building amenities are logically expected to influence the office building's potential. Both Öven & Pekdemir (2006) and Gijselaar (2009) have discussed this variable and agreed that the presence of numerous building amenities (i.e. shops, fitness centre, conference facilities) could have a positive impact on the net rental income. Although they have failed to provide decisive evidence due to a lack sufficient data. Since no conclusive statements regarding the exact impact, either positive or negative, of building amenities can be made it seems relevant to incorporate them into this research.

Finally the impact of 'architectural quality' on an objects potential has always been a subject of debate. Numerous studies have tried to demonstrate tangible benefits of a building possessing a high level of architectural quality (Geltner et al., 2007),(Lusht, 2012), (Lim et al., 2013). Some have carefully suggested that an extra architectural point might lead to a certain percentage of rent increase. However, major criticism regarding such studies has always been the extent to which architectural quality or building aesthetics are measurable. Therefore it has been decided not to incorporate a variable that is so vulnerable to subjectivity in this research.

Neither studies have touched upon the building's energy efficiency or the presence of an energy label as a predictor factor for the net rental income. Looking at the attention that is being paid to this issue by both national governments and consumers it could be considered as an important factors. Recent studies regarding the impact of energy performance of office buildings have failed to yield any conclusive evidence. A study by Bonde & Song (2013) reported that there was no link between the building's energy performance and the value of the property. However, research by Popescu, Bienert, Schützenhofer, & Boazu (2012) concluded that the energy efficiency and energy certification of office buildings does provide tangible benefits for the office building's value. Although all-embracing evidence regarding the exact impact of energy performance measures on the office building investment potential is missing, it could still have an impact. It might for example be that although no direct financial gains are obtained it does have a positive impact on the office building's image (Popescu et al., 2012). Which once again might be highly important to the tenant's willingness to pay. Therefore the office building's energy performance should be included as a variable in this research.

2.7 Side notes

Before any conclusions about which variables to use can be made some side notes about the studied literature need to be made. Most studies as described in this chapter have studied the property's asking rent. Which does not directly relate to the investors profits. Therefore this research makes use of the net rental income as a dependent variable. By doing so operating- and management costs are taken into account as well which enables this research to make statements about the actual decision-making criteria for real estate investors. As a result of this different research perspective it is expected that this research will yield deviating outcomes compared to studies such as conducted by Öven & Pekdemir (2006). Nevertheless variables as distinguished in this chapter still provide a reasonable indication of expected results.

With regard to the input and output variables, several differences with previous research can be noticed. One difference being that fact that the accessibility of data when studying asking rents is much higher compared to the accessibility of data when studying the net rental income. However, the main advantage of studying the net rental income is that it provides much more reliable information when studying the office building's financial performance compared to the situation in which the asking rent has been used.

2.8 Conclusion

There are numerous pros and cons for institutional investors to dedicate their scarce financial resources to real estate. Regardless from the exact nature of the investment, both investments in direct and indirect real estate are considered to be highly complex. The underlying property is faced with a wide range of management structures and other related issues. Being an investor requires the ability to reveal and comprehend the needs and wishes of the end user of the property in question. In the end it is the tenant's and/or end user's 'willingness to pay' that directly influences the demand an investor is facing and the profits that can be made.

An investor's ability to think on the long run determines its chances to survive and enables the organisation to make a steady and continuous profit. A clear vision of the office market and the mechanisms present within this market is vital. Combined with a strategy that is aligned with the cyclical economic momentum at that time, these are necessary factors to make the correct judgement at the correct moment. As has been shown in this chapter the Dutch office market can be seen as a regional one. Due to this regional orientation specific knowledge about these regions is crucial. Within the Dutch office market the Randstad is a clear entity that can be seen separately from other office regions within the Netherlands.

Individual institutional investors pay special attention to specific niche markets that fit their organisation's strategy and risk profile. Even though they are active in different niche market, institutional investors tend to use a rather similar acquisition process and are going through several comparable phases with selection criteria. It has been discovered, that from an academic point of view different factors influencing the office building's financial performance show to be relevant compared to criteria used in practise. This is due to the fact that in practise investors largely rely upon factors that have been shown relevant in the past. Discoveries made in this theoretical framework point towards several performance indicators that can be used as decision-making criteria in the acquisition of office buildings. A distinction can be made between criteria belonging either to regional market features, location features and building features. The features that have shown to be most influential to the building's financial performance and relevant for the purpose of this research are listed in table 2.1.

Regional market features	Location features	Building features	
- Vacancy rate	- Urbanisation classification	- Age	-Free standing
- Absorption rate	- Position towards Randstad area	- LFA/GFA ratio	- Energy label
	- Number of residents	- Number of floors	- Spatial lay-out
	- Location surrounding typology	- Average LFA per floor	- Using typology
	- Distance to public transport	- Mixed use of functions	- Flexibility
	- Distance to NS railway station	- Type of façade material	
	- Number of parking places	- Shape of the building's footprint	
	- Parking norm	- Shape of the building's facade	
		- Charisma of the entrance inside	
		- Charisma of the entrance outside	
		- Heating, Cooling, Ventilation	

Table 2.1: Physical and non-physical office building features used as investment criteria. Based on (Gijselaar 2009) modified by Kuyper (2014).

Methodology

Hoofddorp, Antareslaan

3 Methodology

3.1 Introduction

This section of the report describes the methodological elements used to conduct this research. It elaborates on the statistical principals needed to perform the regression analysis when analysing the relationship between the net rental income and specific building features. Furthermore it provides an explanation on how the variables used in the statistical analysis have been derived. Explanations and justifications are given to support the choices that have been made according to the methods and data that were used.

3.2 Introduction to regression

Regression analysis is used to fit a model to an available data set and to predict the value of the dependent variable based on an independent variable. The dependent variable is unknown and it is the goal of the model to predict its value. The independent variable is known and is input for the model. In short regression analysis is a way of predicting an outcome variable (dependent) from one or several predictor variable(s) (independent and explanatory).

The most straightforward regression analysis that can be performed is known as simple regression. More complex types of regression analysis that can be performed are known as multiple regression. The difference between the two is based upon the amount of predictor variables that are being used. In the case of simple regression one predictor variable is used whereas multiple regression includes the use of two or more predictor variables. Figure 3.1 and 3.2 provide a visualization of both regression methods.

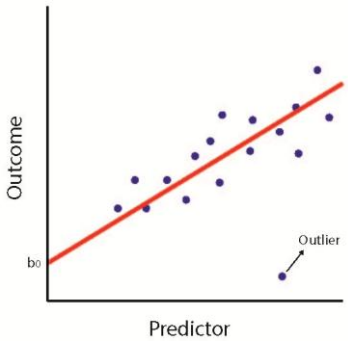


Figure 3.1: Simple regression (own work)

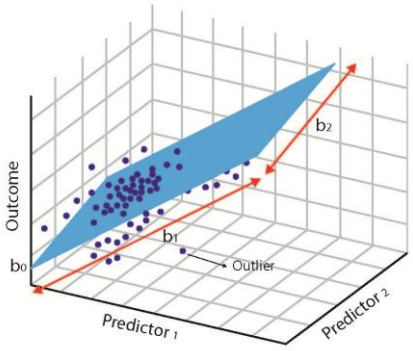


Figure 3.2: Multiple regression (own work)

Regardless from whether simple or multiple regression is used, a regression analysis can be described by using the following equation:

$$Outcome_i = (model) + error_i \qquad (1)$$

3.2.1 Simple regression versus multiple regression

Equation 1 means that the outcome of a particular investment/project/process can be predicted by whatever model is fitted to the data plus some kind of error. In simple regression analysis the model that is used is considered to be linear and is represented by the following equation:

$$Y_i = (b_0 + b_1 X_i) + \varepsilon_i \qquad (2)$$

A linear line is defined by two aspects, the slope of the line (b_1) and the point at which the line crosses the vertical axis of the graph, known as the intercept of the line (b_0). These parameters are known as regression coefficients and reflect the importance of the predictor(s) included in the model. Furthermore a residual term (ε_i) is added to the equation. This residual term represents the difference between the predicted outcome (Y_i) and the outcome that is actually obtained. The ultimate goal with regression is to find a line, as described by equation 2, that best described the data collected. Given that several values of X_i (predictor) and Y_i (outcome) have been collected the unknown parameters in the equation can be calculated.

Nevertheless it may be the case that there are more predictor variables that highly influence the outcome. As is the case in this specific research (e.g. number of floors, amount of tenants, shape etc.). Multiple regression is basically the same as simple regression except that for every extra predictor included in the model an extra coefficient has to be added as well. The outcome of a multiple regression is predicted from a combination of all the variables multiplied by their respective coefficients plus a residual term. In multiple regression the meaning of the variables included in the equation are similar to the meaning as explained in relation to equation 2. The only difference with simple regression being the fact that there are multiple predictors with different importance factors compared to just one. A multiple regression analysis is represented by the following equation:

$$Y_{it} = (b_0 + b_1 X_{1i} + b_2 X_{2i} + \ \ldots \ + b_n X_{ni}\ ) + \varepsilon_i \qquad (3)$$

When applying multiple regression to the topic of this research, in combination with several predictors as provided in the example in the previous paragraph the following equation can be derived:

$$Net\ Operating\ Income = (b_0 + b_1 Number\ of\ floors + b_2 Number\ of\ tentants + \ b_3 Shape) + \varepsilon_i \ (4)$$

3.2.2 Method of multiple regression

When constructing a complete model with several predictors it can be difficult to decide which predictors to use. These predictors should be selected with a great deal of care since the values of the regression coefficient depend upon the variables (predictors) in the model. In perfect circumstances predictors are selected based on past research (Field, 2009). In the case when new predictors are added to existing models they should be selected based on substantive theoretical importance. When performing multiple regression analysis there are three ways in which variables can be entered into a model; hierarchical regression, forced entry method and stepwise regression. This research is based upon hierarchical regression. Previous research by Gijselaar (2009) is being used and based on substantive theoretical importance variables have been added.

The known predictors from previous research have been entered into the model first in order of their importance in predicting the outcome. Consecutively the new predictors based on theoretical importance are entered hierarchically as well.

"A common situation in which cases are a contextual variable is when we take several measures over time (i.e., a repeated-measures design)" (Field, 2012). This phrase illustrates the use of panel data and the way in which measurements within this research are going to be structured.

3.2.3 Assessing the goodness of fit of the model

The fit of a model can be assessed by looking at the deviations between the model and the actual data collected. To be more specific, the vertical distance from each measurement point to the regression line is measured. These can also be referred to as residuals. Since the residuals can be both positive and negative the value needs to be squared in order to come up with a representative number. The one regression line, of all possible lines that could be drawn, with the lowest sum of residuals (SS_R) is the line of best fit. The sum of all residuals represents the accuracy of the regression line and therefore provides a clear indicator for the reliability of the regression model. If the squared differences are large, the line is not representative of the data. If the squared differences are small, the line is representative. This method is known as the method of least squares. It is a good measure when assessing the goodness of fit and is represented by the following equation:

$$deviation = \sum(observed - model)^2 \qquad (5)$$

As is clearly visible in both figure 3.1 and 3.2 there is the possibility that anomalies are present within the data set. These are usually referred to as outliers and substantially differ from the main trend of the data set. Outliers can cause a model to be biased since they affect the values of the estimated regression coefficients. Due to the presence of an outlier the gradient of the regression line can reduce or increase substantially and thereby influencing the accuracy of the regression analysis. Dealing with outliers is crucial to the goodness of fit of the regression model. However, one cannot simply ignore an outlier when it does not fit the model. Doing such a thing influences the reliability of the research as a whole. Therefore possible outliers and the way in which they are dealt with are discussed in the chapters 'Results' and 'Discussion'. The presence of such outliers is the exact reason why a sensitivity analysis (Appendix XI) has been conducted.

3.2.4 Linear Mixed Models

The previously described information is largely based upon the method of Ordinary Least Squares (OLS). The basic assumptions of OLS being: the model must be linear in the parameters, the data are a random sample of the population, the independent variables are not too strongly collinear, the independent variables are measured precisely such that measurement error is negligible, the expected value of the residuals is always zero, the residuals have constant variance (homogeneous variance) and the residuals are normally distributed (Burke & Term, 2010).

This study however makes use of panel data (hierarchical & longitudinal data) which violates the previously stated OLS principles. Therefore a repeated measurement design is chosen using a linear mixed model (LMM). The following paragraph will briefly describe the basic principles of linear mixed-effects models.

The linear mixed model provides the possibility to fit linear mixed effects models to data obtained from normally distributed samples. The unique capabilities of linear mixed models being that it can handle correlated data and unequal variances. Correlated data is very common in situations in which repeated measurements are collected. A linear mixed model extends such repeated measurements into general linear models (GLM) and thereby it allows an unequal number of repetitions. Furthermore the linear mixed model is more capable of dealing with complex situations in which measurements are nested in a hierarchy. The mixed procedure, for example, can process data obtained from a sample of building features selected from a sample of buildings in a geographical district (SPSS Inc, 2008). Especially this characteristic is what makes the use of a linear mixed model highly valuable for this study.
Additionally the linear mixed model solves problems caused by the method of ordinary least squares since it provides the tools necessary to estimated fixed and random effects into one single model. Finally the linear mixed model is modelled using a random intercept. A random intercept enables the models for each study group to be in a different locations. In this study a random intercept is used on a building level. By doing so the model enables each building to have its own 'starting point' and its own geometric space within the model.

Based on these basic principles of linear mixed modelling the next paragraph will elaborate on the collection of the data and the selection of the dependent and independent variables (outcome & predictors).

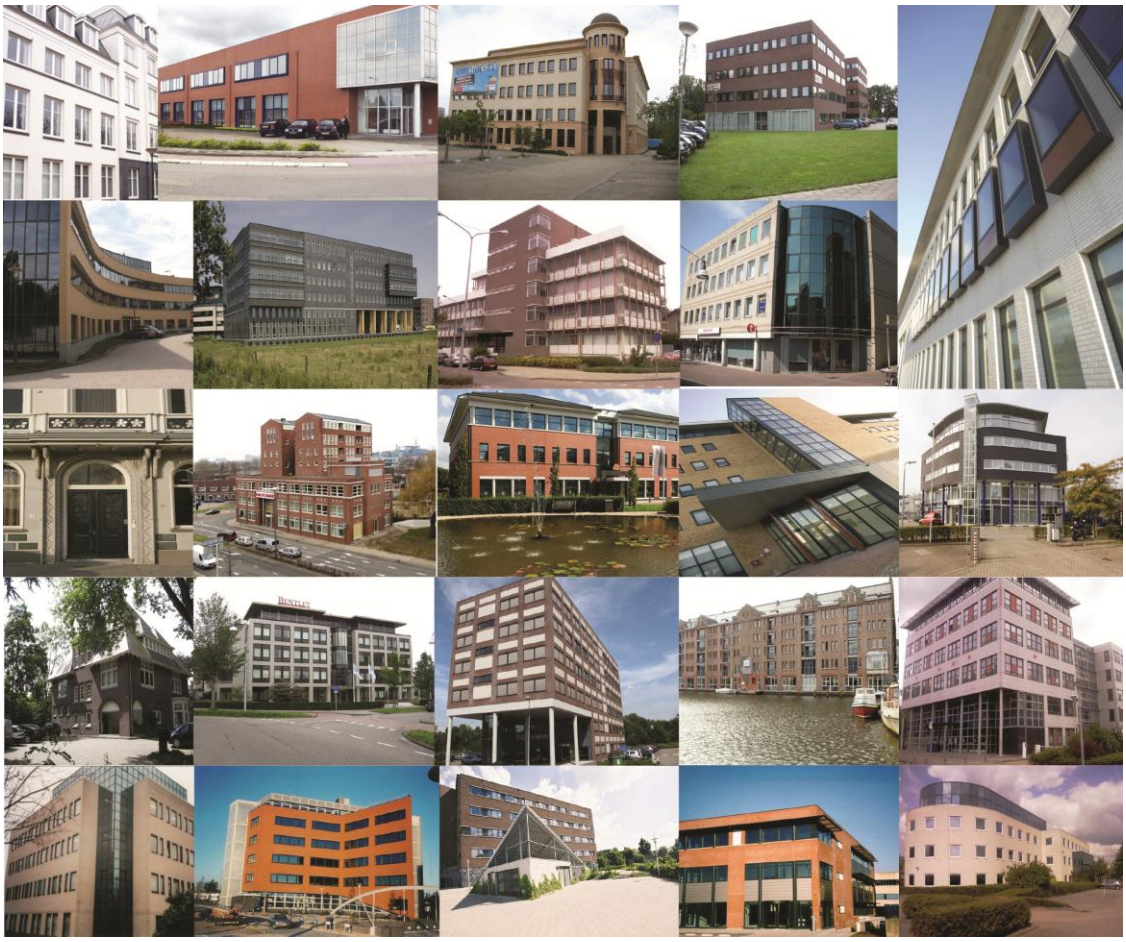


Figure 3.3 Impression of office building typologies included in the database (own work).

3.3 Data collection

This paragraph elaborates on the variables that are used within this research in order to describe the physical and non-physical building characteristics. It will provide an explanation on the way in which all different variables are going to be measured and processed. Figure 3.4 provides a schematic overview of the variables and their relation towards each other. Figure 3.5 provides an overview of the way in which the variables add up towards the final result of this research.

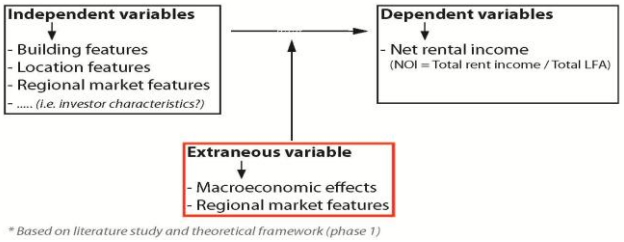


Fig. 3.4. Relation variables (own work).

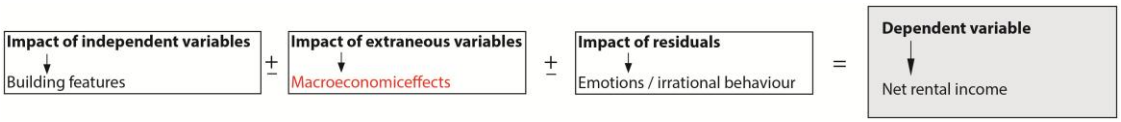


Fig. 3.5. Variables adding up (own work).

In order to make solid statements regarding investment choices in commercial real estate (offices) an extensive database of office buildings was needed. A statistical model that is to yield significant results had to consist of at least 50 individual properties. Such properties had to be measured over at least 25 individual measurements in time. Taking this as a starting point detailed information regarding the financial performance and building properties had to be collected for each case. Using the net rental income of office properties proved to be a challenge since this type of sensitive business information is not publically available. Nevertheless, the institutional real estate investor NSI was willing to provide such information.

This study has been conducted using a timeframe of 14 years. The first measurements date back until the first quarter of 2000 (going further back in time proved to be impossible since previous data was inconsistent or did not meet the required quality for data collection). The last measurements included in this study are based upon the third quarter of 2013. All office buildings that are, or have been part of, the portfolio of NSI during this period were possible entries for the database. However, several constraints were made to preserve the quality of the database. First of all at least 75% of the property had to have an office function. For example a storage facility of 5000 m^2 with an office of 1000 m^2 connected to it was excluded. Secondly the duration of which the property was part of the portfolio was used as a constraint. The property had to be part of the portfolio for at least two years (8 quarters). Finally properties that were acquired as a result of a multi-property transaction and directly discarded afterwards did also not qualify.

Taking into account the constraints as described in the previous paragraph the portfolio of NSI yielded 177 offices that qualified for analysis in the period 2000 Q1 – 2013 Q3. With regard to the period 2000 Q1 – 2009 Q3 data collected by previous research (Gijselaar, 2009) was used. Data that has been collected for the period 2009 Q4 -2013 Q3 has been added in exactly the same format. By doing so both dataset were highly comparable and the reliability of this study improved significantly. The dataset was highly diversified and consisted of properties from 892 m^2 till 22283 m^2 and book values ranging from €0.5 million up to €30 million. The properties are located at both A^-, B^+ and B locations in 68 different cities and/or villages. Besides the highly differentiated office portfolio the size of the cities varied from

large, medium to small as well. Figure 3.6 provides an overview of NSI's current office portfolio spread throughout the Netherlands.

As previously described the information for each individual office building in the dataset was collected for 55 consecutive quarters in the period 2000 (Q1) to 2013 (Q3). However, due to numerous acquisitions influencing the portfolio, the density of the dataset did not reach a complete 100%. Nevertheless this was to be expected and properties with not enough data points were excluded from the database. If only cases with a 100% density were taken into account the total number of cases would drop to 28. It could have been an option to reduce the time horizon of the measurements. However, both reducing the number of cases as well as reducing the time horizon would have a negative impact on the significant of the statistical relevance of this study. Such adjustments are unnecessary since the use of linear mixed models provides statistical solutions for missing data (Field, 2009). Hence it was chosen to preserve the 55 quarter time horizon.

Fig. 3.6. Geographical spread office portfolio NSI (own work).

3.3.1 Dependent (i.e. outcome) Variable

The ultimate goal of this research was to distinguish a set of office building features that can be used as decision-making criteria for institutional real estate investors. In turn such criteria can be used as input to improve their acquisition process. However, before a set of improved decision-making criteria can be stated, a better understanding of investment motives in general was needed.

The availability of liquid assets is a well-known driver for investments. The purpose of investing such assets is obviously to outperform the standard interest rate on a savings account (interest equivalent of a 10-year governmental bond). Within the current financial markets numerous investment opportunities are available amongst which real estate is one of them. Perusing a higher return is usually accompanied with higher levels of uncertainty. This uncertainty is more commonly referred to as risk. When investing assets the investors has to make a choice between the required rate of return on the one hand, and acceptable levels of risk the investment is exposed to on the other (Geltner et al., 2007).

From their study it can be derived that required rate of return is a target variable. In other words it is the to be predicted outcome. The extent to which investors are willing to take risk is largely influenced by the availability of information. Specific knowledge about office building characteristics and its impact on the rate of return is highly valuable. From this point of view the return on investment of office buildings can be seen as the most logical dependent variable. Nevertheless there are arguments that doubt this line of reasoning. These are being discussed in the next paragraph.

The return on investment can be divided into both direct- and indirect returns. Direct returns are based on income returns and indirect returns are based on capital growth. Both direct and indirect return add up to the total return on investment. Income returns are calculated by expressing the net income as a percentage of the total capital applied over a period of time. Capital growth is calculated as the same percentage of the total capital however all capital expenditures have been subtracted first. It has been chosen not to include such indirect return series as a dependent variable in this study. First of all the volatility of indirect return series is much higher compared to direct return series (figure 3.7). This would have a significant effect on the total return on investment series. It has been exactly this drop in capital values that has caused severe problems for numerous institutional real estate investors. Furthermore it must be said that indirect return series are largely subject to qualitative input. This is due to the fact that appraisals are used to determine the capital value of each property. One could use transaction prices to determine the capital value of the underlying assets. However, this would significantly reduce the number of data points in a dataset of 177 office over a period of 13 year. The same problem would account for appraisal values since buildings are appraised only once every few years. Taking into account the use of quarterly measurements, such as used in this study, this would result into significant data gaps and thereby substantially influence the quality of the database. Finally the appraisals are highly influenced by generic economic developments, which would create a lot of noise in the database.

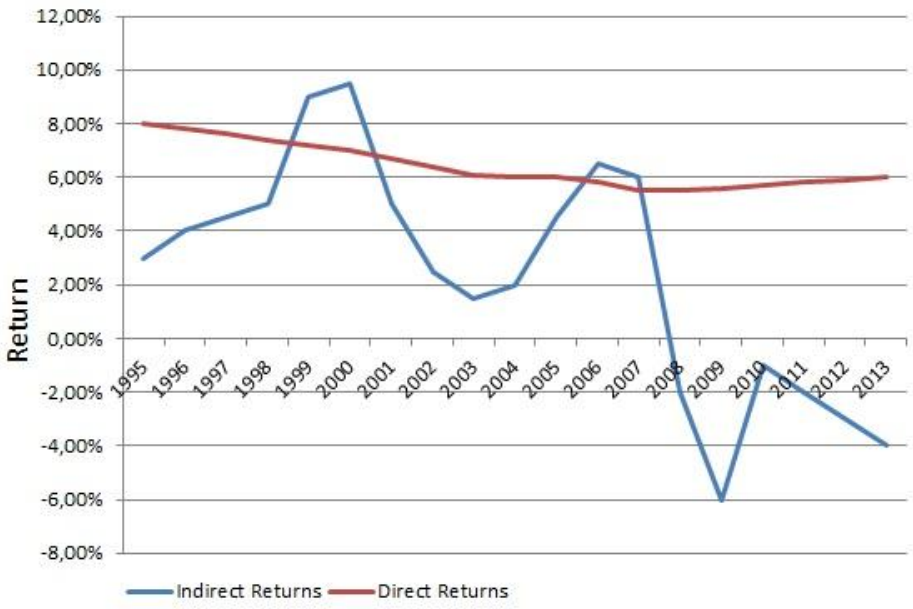


Fig. 3.7. Direct and indirect return series for the Dutch office market (ROZ/IPD)

Due to the previously described characteristics of indirect return series it has been chosen to use the net rental income as a dependent variable for this study. Simply said the net rental income is highly comparable to direct returns, besides the fact that directs returns are calculated as a percentage of the capital value. Since it was especially this capital value that turned out to be controversial, it turned out that using the net rental income was most adequate. Furthermore the use of the net rental income has been used in similar previous studies (Gijselaar, 2009). In order to make both studies comparable the use of the net rental income was considered to be a logical choice as well.

Nevertheless there are numerous dependent variables that can be used, as has been pointed out in the literature study. For example studies by Ozus (2009), Glascock, Jahanian & Sirmans (1990), Dunse & Jones, (1998) and Oven & Pekdemir (2006) have used asking rents of office units within an entire office building as a dependent variable. Other studies have combined individual office rents into one average asking rent for the entire office building (Clapp, 1980; Gat, 1998; Hough & Kratz, 1983). Obviously the asking rents is a reflection of the financial performance of an office building. Nevertheless it does not take into account certain elements such as incentives and vacancy rates. These elements have a significant impact on the building's financial performance and therefore the use of asking rents is disputable. At first sight a property might seem attractive due to a high asking rent. However, this rent can be kept artificially high by agreeing on incentives such as rent free periods and/or maintenance activities. Although in such a case the book value of the property seems high, the underlying value actually is much lower. By using the net rental income such hidden pitfalls can be avoided. Furthermore the net rental income is characterised by another advantage. When using the net rental income the building's operating costs are taken into consideration as well. For example regular or large scale maintenance expenses are discounted into the net rental income. Due to the 14-year time frame of this study maintenance investments can be considered as an important criteria and should therefore be taken into account.

Subtracting the operating expenses, management fees, rent free periods and other (cash) incentives from the quarterly gross rental income yields the net rental income as displayed in table 3.1. The managements fees of 3% represent the labour costs charged by NSI to manage each property. Previously (2000 – 2009) the operational expenses used to be registered on a yearly base. Whereas the rental income was reported on a quarterly base. Since quarterly based time measurements are highly valuable to statistical research it was chosen to divide these operational expenses by four to make them suitable for quarterly time series (Gijselaar, 2009). By spreading the operational expenses over four individual quarters little smoothing effects could arise. However, this was not considered to be disproportionally.

Contractual Rental Income
Rent Free –
Gross Rental Income
Costs of Bad Debts
Operating Expenses
Fixed costs
Insurance Expenses
Scheduled maintenance
Unscheduled maintenance
Marketing costs
New rental costs
Preparation for letting
Service charges
Management Fees
Net rental Income

Table 3.1 Net Rental Income definition NSI.

The net rental income per office building was divided by the lettable floor area of each property. By doing so the financial performance of a wide variety of office buildings became comparable. Finally all rental incomes have been corrected for inflation to reduce the impact of general economic influences over time. The inflation rates are based upon CBS publication regarding the Dutch economy as a whole (Appendix I). As a results equal rental income time series were obtained that showed to be comparable.

Below some brief explanatory notes are provided on the various accounting headings as stated in table 3.1.

- Contractual Rental Income: quarterly rental income as agreed upon in the rental contract.
- Rent Free: The cash equivalent of the rent free period in each quarter.
- Gross Rental Income: actual monetary sum that is wired to the bank account of NSI.
- Costs of Bad Debts: provisions made due to (possible) payment defaults of a tenant.
- Fixed Costs: constant costs that return each quarter.
- Insurance Expenses: a premium paid by NSI for the building's insurance.
- Scheduled Maintenance: preventive maintenance activities that are performed on a periodical base to preserve or restore the building's physical condition.
- Unscheduled Maintenance: corrective maintenance activities that are performed 'directly' in the case of damages and/or malfunctions.
- Marketing Costs: costs that are made to promote the real estate stock of NSI.
- New Rental Costs: costs that are made in the process of a transaction.
- Preparation for Letting: costs that are made to prepare the property for a new rental contract.
- Service Charges: service costs that are charged to the tenant. In case of vacancy these costs have to be taken care of by the owner (NSI).
- Management Fees: labour costs of NSI charged to the tenant.

Finally it can be concluded that the overall quality of the database was high. This is due to the combination of an extended time frame and the availability of numerous cases. The time frame of 14 years, 55 quarters, enabled this study to include the influence of multiple economic market cycles (i.e. internet bubble, financial crisis). Exactly this ability to study long term effects is what distinguished this study from others. In total 177 cases have been studied which significantly increased the relevance of this study. As a result of both the time frame and number of cases, it was possible the generate representative outcomes for the Dutch office market.

Variable Name	Label	Measure
NIM2year-quarter	Net Rental Income in (Year) (Quarter)	Scale

Table 3.2 Dependent variable as used during data analysis in SPSS.

3.3.2 Independent (explanatory, predictor) variables

This paragraph elaborates on the independent variables that have been included in this study and the steps that have been taken to construct the final model. As has been explained in the previous paragraph there are numerous variables that might predict the net rental income in a regression analysis. Obviously only as long as the number of cases included in the study is sufficient. Due to the large number of variables that could be relevant a selection was made beforehand. This selection was based upon the hypothesis (§1.2) that the net rental income of an office building is determined by both economical and location features as well as specific building characteristics of each individual property. Information gained from literature studies and interviews with professionals in the field of real estate investments was used to make sure all potential relevant variables were included.

The hypothesis puts forward that both economic, location and building features have an impact on the specific net rental income of an office building. In order to study the impact of such variables, and make the model more comprehensive, these variables have been divided into factor groups. Within the real estate industry it is a general (outdated) assumption that

location is supposed to be the most important predictor for real estate investments. Therefore all variables related to the location of an office building have been grouped into the factor group location.
The second factor group were regional market features and included variables such as regional vacancy rates and regional market absorption. Although one might argue that such variables are location related it was chosen to create a separate factor group. This was due to the large geographical dispersion of office buildings within the real estate portfolio of NSI. Still a clear distinction between both factor groups exist due to physical location features on the one hand and more (macro) economic factors on the other.
Finally a third factor group, resembling the very core of this study, was made. The factor group building features included all aspects that could be distinguished at the office building level.

Figure 3.8 Factor groups influencing the net rental Income of an office building.

As shown in figure 3.8 this study has taken the point of view in which the net rental income of an office building can be explained by three different factor groups. Nevertheless there will always be 'change because of change' and as such a residual has been added to the model. In mathematical terms this residual reflects an error that is present within all statistical models. In the 'real world' this error equals the impact of variables beyond the ones that have been included as input variables (§3.2, equation 1). The previously described aspects that influence a building's net rental income are represented by the following formula in regression modelling.

$$Net\ Operating\ Income = (b_0 + b_1 Number\ of\ floors + b_2 Number\ of\ tentants + b_3 Shape) + \varepsilon_i \quad (4)$$

The following paragraphs will provide an in depth explanation of the variables that have been included in the model, their definitions and the way in which they have been coded.

3.3.2.1 Regional Market Features

Regional market features have been incorporated in this study because by doing so historical developments are included in the model. They are reflected by the regional market features factor group. Due to cyclical economic development market condition vary over time. Therefore all regional market features were modelled as repeated measure. To enhance the model's overall quality the same quarterly time interval as used for the net rental income was used. Information regarding the regional market features was derived from publicly published documents by DTZ Zadelhoff. These broker reports are published based on a yearly interval. As mentioned before the rental income figures were reported on a quarterly base. Therefore the annual measurements by DTZ have been interpolated to a quarterly interval. The change of market features on a quarterly interval are generally not considered to be highly significant. In practise it is unlikely to add substantial noise to the database.

As has been illustrated before (fig 3.6) the geographical dispersion of office buildings (in the portfolio of NSI) throughout the Netherlands was high. In order to obtain relevant market information for each region the offices were linked to various agglomerations as defined by DTZ (table 3.2). It turned out to be such that not all office buildings could be grouped in one

of the defined categories. For these properties it has been chosen to calculate a weighted average between the two nearest agglomerations. For example the absorption rate of office space in Delft was determined by calculating the average absorption rate of office space of Rotterdam and The Hague Area.

Variable Name	Label	Values	Measure
ABSM2year-quarter	Absorption of office space (m^2) in the regional market in (Year) (Quarter).	None	scale
VAC_RATyear-quarter	Vacancy rate (factor) of office space in the regional market in (Year) (Quarter).	None	scale
DTZ_REG	Classification according to the use of DTZ Zadelhoff.	1 = 's-Hertogenbosch and Tilburg 2 = Amsterdam and surroundings 3 = Arnhem and Nijmegen 4 = Breda and surroundings 5 = Den Haag and surroundings 6 = Ede and Veenendaal 7 = Eindhoven and surroundings 8 = Gooi and Eemland 9 = Groningen and Assen 10 = Haarlemmermeer 11 = Limburg 12 = Rotterdam and surroundings 13 = Twentse Stedenband 14 = Utrecht and surroundings 17 = Almere	Nominal
EC_CYCLEyear-quarter	Economic cyclical phase in (Year) (Quarter)	1 = Decline 2 = Negative economic cycle 3 = Recovery 4 = Positive economic cycle	Nominal
CRISISyear-quarter	Pre of after crisis period in (Year) (Quarter).	1 = Pre crisis period 2 = After crisis period	Nominal

Table 3.3 Independent Variables, Regional Market Features.

Table 3.3 provides an overview of all independent variables for the factor group regional market features that have been incorporated in this study. Nevertheless there have been multiple other regional market features that were distinguished in the literature study. For example the supply of office space, office stock, office stock in use, lowest market rent, highest market rent, gross domestic product and employment volumes. However, previous research (Gijselaar, 2009) has shown that such features had an insignificant effect on the net rental income of office buildings. Therefore it was chosen not to include such variables in this study.

ABSM2 is the absorption of office space (m^2) in the regional market. DTZ defines the absorption of office space as the take up of office space, both sold and leased, in the free market. Transactions that only happen on paper (i.e. sale and lease back) are excluded from this figure. Furthermore this figure only applies to transactions above 500 m^2. Therefore the exact figures are expected to be slightly higher. Nevertheless it is assumed that this impact on the model is insignificant and can therefore be ignored.
VAC_RAT are the average vacancy rates in the regional markets with regard to office space in existing building that are currently not in use. It is determined as the relation between the office stock in use and total available office stock.
EC_CYCLE is the translation of the national economic developments into the model. Based upon the cycling growth/decline figures as stated by the CBS four different economical stages were to be distinguished (Appendix II).

CRISIS is the variable included in the model to make a distinction between 'pre-crisis' and 'after-crisis' periods. It has been chosen to define the period before the collapse of Lehman Brothers (2008 Q4) as the pre-crisis period and the period after the collapse of Leman as the after-crisis period.

Beforehand it was impossible to state the exact impact of the regional market variable as described above. It might have been the case that while previous research concluded that these chosen regional market variables were significant, they still turned out to be insignificant. Exactly this was the purpose of this study since statements had to be made about the impact of decision-making criteria in 'pre-crisis' periods compared to 'after-crisis' periods.

3.3.2.2 Location features

Studying the office building's location can be done use different levels of abstraction. First of all the location can be studies from a physical point of view. So how does the property relate to its surroundings? What are the physical characteristics of its environment? Secondly one can increase the level of abstraction and strictly look at the geographical location within a country. Taken into account both points of view it can be said that the factor group location is very broad. Especially taking into account the theoretical connection with the previously described regional market factors. The variables used to represent the factor group location features are related to all the above levels of abstraction. Table 3.4 provides an overview of all location variables that have been taken into account in this research.

Variable Name	Label	Values	Measure
DIS_HW	Distance to highway (m^2)		Scale
DIS_NS	Distance to railway station in (m^2)		Scale
DIS_PT	Distance to any type of public transportation (m^2)		Scale
ECREG	Economic region according to COROP area classification.	**40 different categories*	Nominal
LOC_SUR	Location typology surroundings of the property.	1 = Office park 2 = Industrial zone 3 = Town centre 4 = Residential area	Nominal
NUM_RES	Number of residents in the place of the property.		Scale
PP	Number of parking places		Scale
PN	Parking norm (m^2 LFA per parking place).		Scale
RANDSTAD	Position with respect to the Randstad area.	1 = Large 4 cities 2 = Inner Randstad 3 = Peripheral Randstad 4 = Backward area	Nominal
URB_CLASS	Urbanisation classification.	1 = Very strong urbanised 2 = Strong urbanised 3 = Medium urbanised 4 = Less urbanised	Nominal

Table 3.4 Independent Variables, Location Features.

In order to classify the office buildings according to their geographical location within the Netherlands they have been assigned three different codes. First of all the location was determined in relation to the Randstad area (RANDSTAD). All properties that were not located in or near the Randstad area were grouped into the class 'backward area'.

Secondly the properties were divided into 17 different agglomerations (DTZ_REG). Finally the properties were classified according to 40 different economic COROP regions as used by the CBS for statistical research (ECREG). After running different statistical analyses, RANDSTAD

described the geographical dispersion the best way. This was due to the fact that both the COROP economic regions, as well as the DTZ agglomerations, consisted of too many sub values which reduced the predictability of the variables.

Besides the location within the Netherlands studied from a geographical point of view, the location of each property can be described as well by studying the population in each city. In order to so the number of residents (NUM_RES) have been included to map the size of each city. However, the number of inhabitants does not provide any information regarding the density of an area. Therefore the variable URB_CLASS has been included to map the extent to which an area was urbanised. This division into four different urbanisation classes is based upon the 2009 figures of the Dutch CBS. Due to the marginal number of properties located at non-urbanised areas it was chosen to incorporated these into the less urbanised class.

As briefly touched upon before there is more to location than merely geographical characteristics. Both previous research as well as experts in the field of real estate investments confirmed that properties in the city centre usually are considered financially more attractive compared to office park locations. Therefor the variable LOC_SUR has been included to make a distinction between office parks, industrial zones, city centres and residential areas.
Even though a location in the city centre is generally considered to be highly attractive, its accessibility is considered to be highly relevant as well. When studying accessibility, a distinction is made between accessibility by car (DIS_HW), accessibility by public transportation (DIS_PT) and accessibility by train (DIS_NS).

Finally accessibility by car is of not much use if there are no means available to park a vehicle. Therefore the number of parking places (PP) as well as the parking norm (PN) have been included in this study. The parking norm is defined as the amount of LFA (m^2) for each parking place.

3.3.2.3 Building features

The factor group building features is most likely the most interesting one since results gained from this groups are the most tangible ones. The variables that have been used in this study are based upon existing literature and experiences of real estate professionals. However, even though a variable might seems theoretically relevant, its practical use was largely dependent upon the availability of information and the extent to which this could be processes. A synthesis of both theoretical relevance and practical limitations has led to the following set of variables that were studied (table 3.5).

In order to reflect the property's technical status the variable AGE is included. Either the date on which the building has been build, or the moment in time on which a large scale renovation has taken place, is taken as baseline measurement for the determining the building's age. Therefore age is calculated as being the time frame between construction or renovation and 2013 Q3. The building's age is measured over a 14 year period and can therefore be seen as a repeated measurement.

ALPHA_FL represents the average lettable floor space (m2) for a single floor (NR_FL) within an individual property. Furthermore the ratio between lettable floor area and gross floor area (LFA_GFA_RATIO) has been determined for each property. This information is based upon official measurement reports prepared by external parties. These variables have been included to provide a fair comparison between the dimensions of all properties in the portfolio.

Variable Name	Label	Values	Measure
AGEyear-quarter	Age of the building in (Year) (Quarter).		Scale
ALPHA_FL	Average m^2 LFA per floor.		Scale
BUILD_TYP	Building typology.	1 = High Rise 2 = Complex 3 = Pavilion 4 = Urban 5 = Basic	Nominal
COM_MAN	Commercial Manager of the property.	*	Nominal
COOL_LBK	"Koeling luchtbehandeling kanaal en afgiftesysteem".		Nominal
ENERGY_LABEL	Energy Label of the property.	1 = A 5 = E 2 = B 6 = F 3 = C 7 = G 4 = D	Nominal
ENTR_CHAR_IN	Charisma of the building's entrance from inside.	1 = Attractive 2 = Medium Attractive 3 = Not Attractive	Ordinal
ENTR_CHAR_OUT	Charisma of the building's entrance from outside.	1 = Attractive 2 = Medium Attractive 3 = Not Attractive	Ordinal
HYBRID	If there is a mixed use of functions in the building.	1 = Yes 2 = No	Nominal
FAC_MAT	Façade material of the property.	1 = Glass 2 = Bricks 3 = Plaster 4 = Natural Stone 5 = Concrete 6 = Steel 7 = Mixed Use	Nominal
FAC_SHAPE	Shape of the building's façade.	1 = Rectangular 2 = Acute Angles 3 = Round Shapes	Nominal
FLEX	Flexibility in lay-out of the property.	1 = Not Adjustable 2 = Medium Adjustable 3 = Very Adjustable	Nominal
FREE	Free Standing.	1 = Yes 2 = No	Nominal
HEAT	Type of heating used.		Nominal
LBK	"Luchtbehandeling kanaal".		Nominal
LFA_GFA_RATIO	Lettable floor area divided by gross floor area.		Scale
LIGHT	Type of lightning used in the office.		Nominal
NR_FL	Number of floors of the property.		Scale
OFFICE_TYP	Type of office concept that is being used.	1 = Cellular office 2 = Office Garden 3 = Group office 4 = Klooster office 5 = Combi office	Nominal
SPAT_LAY	Spatial layout of the property.	1 = Domestic 2 = Spinal 3 = Deep plan	Nominal
TECH_MAN	Technical Manager of the property.	*	Nominal
USE	Using typology.	1 = Single Tenant 2 = Multi-Tenant	Nominal
VOLUME	Shape of the footprint of the building.	1 = Box 2 = L-Shape 3 = T-Shape 4 = X-Shape 5 = Multiple Rectangles 6 = Round 7 = Sharp	Nominal

Table 3.5 Independent Variables, Building Features.

*For anonymity purposes the names of individual property managers have been removed.

The type of building (BUILD_TYP) was considered to be an important determinant for the building's net rental income. Therefore five different building typologies were included in this study (figure 3.9). The first building typology was 'high-rise'. High-rise was defined as a building with, at least 9, or more floors. Although it could be argued that 'high-rise' is relative to its environment it was chosen, based upon arguments of feasibility and subjectivity, not to go along with such a definition. Secondly a 'complex' building typology was included. This is a building that consists of multiple individual blocks. Furthermore the building typology 'Pavilion' was included. A Pavilion being a small free-standing building, with a maximum of three floors, and occupied by one single tenant. Besides, offices can be characterised as 'Urban' as well. Urban offices are nested into the regular street view and can be hard to identify. Finally a 'basic' office group was identified. Basic offices did not match any of the previous typologies. Such offices are usually, 4 or 5 floors high, free-standing buildings.

Figure 3.9 Building typologies in the NSI portfolio. 1=High-rise, 2=Complex, 3=Pavilion, 4=Urban, 5=Basic (Gijselaar, 2009).

At NSI all properties were assigned specific commercial managers (COM_MAN) and technical managers (TECH_MAN). The commercial managers are the ones responsible for renting the properties, the technical managers are responsible for maintenance related aspects. Since it might the case that certain managers outperform others they have been added as variable in this study.

Sustainability has become an important building characteristic these days. It is seen as a way to enhance the organisation's entrepreneurial image. Since the office can be seen as a way to convey this image to ones clients it has been incorporated as a variable in this study. As a general norm for sustainability the building's energy label (ENERGY_LABEL) has been included. Furthermore specific characteristics, regarding the building's climate control, can distinguished. The type of heating system (HEAT) being one of them. As well as the type of lightning that is used (LIGHT), the type of ventilation the is used (LBK) and finally the type of air-conditioning that is in place (COOL_LBK).

With regard to esthetical quality the charisma of the building's entrance has been assessed. This was done for both the appearance of the entrance inside (ENTR_CHAR_IN) as well as the entrance outside (ENTR_CHAR_OUT). When assessing the entrance for the outside special attention was paid to 'attractiveness', 'accessibility' by car/foot, and the extent to which the entrance was 'inviting'. With regard to the entrance from the inside special attention was paid to criteria such as 'reception desk', 'accessibility of light', 'spaciousness' and overall comfort levels during a stay. Figure 3.11 provides a chart visualising the previously described criteria.

Figure 3.10. Spatial Layout variables. 1=Domestic, 2=Spinal, 3=Deep Plan. (Gijselaar, 2009).

The spatial layout (SPAT_LAY) provides information regarding the way in which the office has been structured. A centrally organised building with a single vertical core is a domestic office. The different rooms are centred between the core of the building and its external envelope. Contrary to the domestic office the spinal office is characterised by a single long hallway. The cellular office are squeezed between the building's façade on the one hand and the hallway on the other. Finally a deep plan is the be distinguished. In such a spatial layout there are a number of offices squeezed between the building's façade and the hallway, as well as offices who do not have any exposure to the building's exterior. The described spatial layout options are presented in figure 3.10.

Figure 3.11 Assessing the building's entrance. Examples from the NSI portfolio.

Offices that have multiple functions are characterised as hybrid buildings (HYBRID). This variable is used to make a distinction between buildings which are solely used as office and buildings that are used for other activities. For example buildings that have retail functions on the ground floor and offices on top are marked as hybrid. The same goes for buildings who have got office space on the lower floors and apartments in the top ones.

The materials used to construct the building's façade are captured using the variable FAC_MAT. Since the type of material can have an impact on the charisma of the building it was chosen to include this variable in this study. In total 6 different types of materials were to be identified in the portfolio of NSI; glass, bricks, plaster, natural stone, concrete and steel. Some building were constructed using a mixture of materials. Therefore the variable mixed use has been incorporated as well. A mixed use of materials was specifically applicable to the part of the building in which the offices were located. This is due to the fact that entrances and staircases are often constructed using a wide range of different materials.

On top of the materials used, a variable was introduced that described the shape of the building's exterior (FAC_SHAPE). The portfolio of NSI was characterised by a wide range of shapes. Although most buildings had rectangular shapes numerous others included sharp angles and round shapes.
Closely linked to the building's façade shape was the layout of the office building's footprint (VOLUME). Different volumes would result into different levels of accessibility and besides it influenced the communication/relation between departments within the building. As such an office volume can improve the layout and the overall utility of the property. Figure 3.12 provides an overview of the different volumes that were identified in this study.

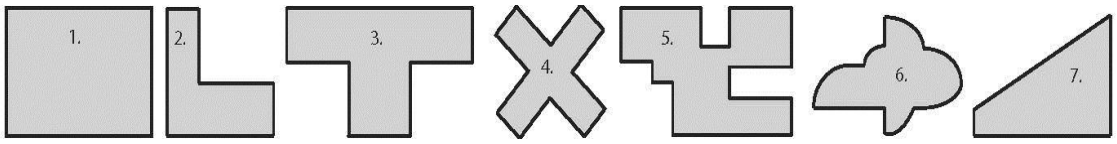


Figure 3.12 Building volumes within the NSI portfolio.
1=box, 2=L-Shape, 3=T-Shape, 4=X-Shape, 5=Multiple Rectangles, 6=Round, 7=Sharp.

Whereas volume and layout describe the current situation within an office building, it is the building flexibility that determines the extent to which a building is able to adapt (FLEX). This ability to adapt to different preferences is measured using three layers of flexibility:

1. It is nearly impossible to adjust the office building layout to changing preferences and or types of use.
2. With some effort it is possible to adjust the layout to changing preferences.
3. It is very easy to adjust the office building layout to changing preferences and/or types of use.

Whether a building is free standing or part of a bigger building block is described by the variable FREE. Some offices can be nested into the street view, as is common in city centre. Such offices are included as 'not free standing' (2 = No). Others are part of an office park or even completely on their own. Such offices are included as 'free standing' (1 = Yes).

Finally a distinction is made between office buildings that are generally used as single tenant offices or multi-tenant offices (USE_2). This using typology has been measures in the portfolio of NSI over the last 14 years. Originally three different groups were identified. Single tenant buildings, multi-tenant buildings with shared farcicalities and multi-tenant buildings without shared facilities. Shared facilities being a reception, restaurant, gym and such. Due to the low number of cases with shared facilities it has been chosen to merge these two groups together.

Data with regard to the office building's layout, typology, flexibility, type of use and charisma of the entrance was determined by employees of the asset management team of NSI (Appendix III). They are responsible for renting the properties are therefore have current knowledge about the status of each property.

3.4 Analysis

From this point on all the variables that have been studied in this research are introduced. Therefore this paragraph will describe the different steps that have been taken to conduct the statistical analysis used in this study. In a chronological way the different phases of statistical analysis are described until the final model is realised. The process, in which the effects of the previously described factors on the net rental income of an office building are investigated, consists of three different phases. A simplified overview of this process is stated in table 3.6. During the first stage of the statistical research, the extent to which the collected data is usable, is studied. Consequently a pre-selection phase has taken place in which the individual effects of different variables was tested. The results generated in this phase were used as input for the final model. Finally a final model was defined. The aim was to produce a similar model as used in previous studies (Gijselaar, 2009). By doing to it became possible to compare different studies over time and the reliability of the conclusions was maximised.

Statistical analysis phase	Label	Statistical method used
Phase 1: Exploration	Exploration of collected data	
Phase 2: Pre-selection	Individual variable analysis for static variables	General Linear Model
	Individual variable analysis for repeated measure variable	Mixed Linear Model
	First selection of variables for final model	
	Final selection of variables for final model	
Phase 3: Final model	Create random coefficient model	Mixed Linear Model
	Define final model	Mixed Linear Model

Table 3.6 Process of statistical analysis.

3.4.1 Phase 1: exploration

During the first phase of the statistical analysis a general overview is generated in which descriptive statistics describe means, standard deviations and confidence intervals for all included variables. In order to produce a complete overview of the building's average performance in relation to its physical characteristics the missing net rental income values were estimated by SPSS. The values as estimated by SPSS are based upon a matrix interpolation by performing a regression using the known net rental income figures. This was done using the missing value analysis tools in SPSS. The net rental income was taken as a quantitative and categorical variable for all 54 quarters.

After studying the distribution of the individual variables several adjustments had to be made. From paragraph 3.3.2.3 it has become clear that the distribution of certain variables was highly unequal. Since this could harm the prediction power these variables have been recoded. When recoding a variable, the criterion that at least 10 individual cases had to satisfy a variable value, was taken.

3.4.2 Phase 2: pre-selection

In the literature study numerous variables have been identified that each might influence the office building's net rental income. Since it would unlikely for all variables to have a significant impact on the net rental income a selection had to be made. The predictive powers of individual variables were studied and based upon these results a selection for the final model was made. By doing so it has been tried to minimize any biases in the model.

To map the single effects of individual variables on the building's financial performance (net rental income), a general linear regression model with net rental income as dependent variable, was performed for all static independent variables. In this case static refers to all variables that have not been measured over time (i.e. shape, material etc.). This distinction is made because the net rental income is measured over a time-frame of 55 quarters. Based upon this information the net rental income is described as a repeated measure. The analysis is performed on the entire population of 178 cases as well as on the 119 cases that have been studied in previous research (Gijselaar, 2009). By doing so the developments of a single portfolio over time were described. Furthermore the analysis has been performed based upon data before a specific date (2008 Q4) and after this date. This provided information of portfolio characteristics in different economic cycles.

As explained before there are some variables that have multiple observations per case. Such a variable is age. The building's age is dependent on time and is different for each building. The autocorrelation between the different net rental income observations is 0,80 ($p<0.05$) which means that it is best to use a mixed linear regression model to explore the relationship between age and performance. Furthermore the type III test of fixed effects was used to

describe the effect, and its significance, of for example age on the office building's financial performance (net rental income).
A first-order autoregressive (AR1) covariance matrix has been used to perform the different mixed linear models. The residual errors within one single office building are considered to be correlated. Nevertheless they are independent across the entire selection of office buildings in the model. Therefore the independent variables are included as fixed variables within this model.

3.4.3 Phase 3: final model

During the last phase of the statistical analysis procedure the input variables were determined. It was crucial that the model would fit with the collected data and was in line with previous research. The objective was to perform a regression model with the net rental income as dependent variable and a series of previously selected independent variables (predictors). A linear mixed-effect model (MIXED) was preferred over a general linear model (GLM). Since the mixed model provided the opportunity to analyse both correlated data and unequal variances. The net rental income is described as repeated measurement and has a correlation over time. Besides, a linear mixed model is capable of dealing with more complex databases. As was the case in this database due to the fact that some observation of net rental incomes were missing in certain quarters. Furthermore a mixed model can analyse data which is based upon a certain sample from the dataset. This was a significant advantage since specific set of properties in specific periods of time could be analysed in this way. Compared to a general linear model it is more appropriate to make adjustments in a mixed model. The mixed model anticipated on such problems because it provided the necessary tools to make an estimation of both fixed and random effects in one model (SPSS Inc, 2008).

Using one regression line to reflect the developments of all individual office buildings is simply not possible. Therefore the regression coefficients have to be treated as random variables in order to incorporate possible differences between office buildings. This is more commonly referred to as a random coefficient model. Such random regression coefficients are expected to be normally distributed. Considering the random coefficient model three different types are to be distinguished. Models with random intercepts, models with random slopes and models with both random intercepts and slopes.

To determine which of these three models was to be used it had to be tested whether the intercept of the regression lines of all different office buildings (178) is randomly distributed. This resulted into an approximate variance of the intercept of 83,60 ($p<0.00$). Based upon this information it could be concluded that it was best to use a random intercept. This meant that the net rental income is different across various locations. When studying the raw data this seems to be a plausible assumption. Furthermore the approximate variances of the slopes of the different office buildings turned out to be significant as well (0,00). From this it can be derived that various cases have individual time horizons. The change in net rental income over time in for example different for all properties studied. Additionally a choice had to be made between the use of Restricted Maximum Likelihood (REML) and Maximum Likelihood (ML). ML provides a description of the fit of the full model, which is required for comparing models. REML only takes into account the random parameters (SPSS Inc, 2008). Since the aim of this study was to compare the results with previous research it was chosen to use the method of Maximum Likelihood.

A clear advantage of mixed models is that results gained from the analysis can be generalised. Based upon this research this statement is valid. Since time can regarded as a fixed factor and turns out to be significant at 0.00. Therefore there is an general trend across the whole population of office buildings. Nevertheless there is one limitation. Obviously the above does not account for information that is not included in the database. Therefore offices at prima locations (A^+) are to be excluded from such conclusions.

Finally the different models that have been tried were expected to haven an Akaike value (AIC) that was as low as possible. Ultimately this resulted into a mixed model that showed to be significant for most variables and yielded an AIC value of 45869. The different variables, across the four factor groups, that have been included in the model are represented in table 3.7.

Economic Cycle	Location features	Building features	Dependent variable
TIME*TIME	NUMRES	ENTR_CHAR_IN	NIM2
	DIS_PT	BUILD_TYP	
		USE_2	
		FLEX	
		NR_FL	
		AGE	

Table 3.7 Final model variables.

In the end a mixed linear model is constructed that predicts the net rental income by making use of TIME*TIME to model the cyclical economic phases, the distance to public transport (DIS_PT), total number of inhabitants in the location of the office building (NUMRES), charisma of the entrance inside (ENTR_CHAR_IN), office building typology (BUILD_TYP), type of use (USE_2), building's flexibility (FLEX), amount of floors (NR_FL) and the building's age (AGE) as explanatory (predictor) variables. The predictor variables are described as fixed-effects. Finally the model describes a random intercept with time as repeated measurement. The final model as used in SPSS can be found in appendix VI.

3.5 Conclusion

Based upon literature studies and experiences from experts in the field of statistical research, this chapter has described the way in which the data has been collected and the choices that were made. Using the various sources of information a sound statistical analysis was performed. It turned out to be possible to perform a statistical study that went beyond finding general trends in the office building financial performance and building features. It was possible to identify unique features that had a significant impact of the net rental income. Finally the entire process has resulted into a model that was suitable from comparison and provided a genuine description of the effects of numerous building features on the building's financial performance. The results of different models that have been tried, and the choices that have been made based upon these models, are discussed in chapter 5.

Results: descriptive statistics

Amersfoort, Printerweg

4 Results: Descriptive statistics

This chapter provides in depth information regarding the results of the statistical analysis that has been performed on the dataset. At first an exploration of several variables in relation the building's financial performance is made. Special attention is paid to interesting trends and specific results are pointed out.

4.1 Exploration

This paragraph elaborates on observations made in a preliminary phase of this study. Statistical details of these results are discussed in the statistical model chapters five and six. The main goal of this chapter is to point out possible irregularities and highlight eye-catching observations. All results are discussed in relation to the dependent variable (net rental income, NIM2). At first results based upon the regional market factor group are pointed out. Consequently remarkable relations caused by the location factor groups are discussed. Finally specific building characteristics are linked to the building's financial performance.

Figure 4.1 shows the development of the average net rental income over the 14-year study period. The net rental income has been corrected for inflation (Appendix I) and all prices are based upon the 2000 Q1 price level. As is clearly visible the net rental office price per square meter is rising until 2002. From that point onwards a steady decline occurs. This is due to the effects of the internet bubble that has had its effects on the real estate market as well (Gijselaar, 2009). A similar trend is visible when studying the direct returns of the Dutch office market, as is shown in figure 3.7. Based upon this information it can be concluded that the portfolio of NSI is behaving properly according to national economic influences.
Both in 2007 as well as 2009 the graph displays a small drop followed by a swift recovery. The most logical explanation for such behaviour, is the impact of a single property which was subject to a large scale maintenance intervention in these years. Such a drop in net rental income clearly shows the effects of such interventions. Since such a real estate intervention is often accompanied by increasing vacancy ratio's and operating costs.
In 2011 a sudden increase in net rental income is identified. This peak can be explained by a single building for which unnecessary costs of bad debts had been reserved. It is common to include such costs in the balanced sheet in order to anticipate on future payment defaults by certain tenants. It turned out that reservations for bad debts over the past years were unnecessary and therefore were added to the balance sheet again. It is interesting to note that, although the average net rental income does decrease from 2002 onwards, the slope does not become steeper after the start of the financial crisis in 2007.

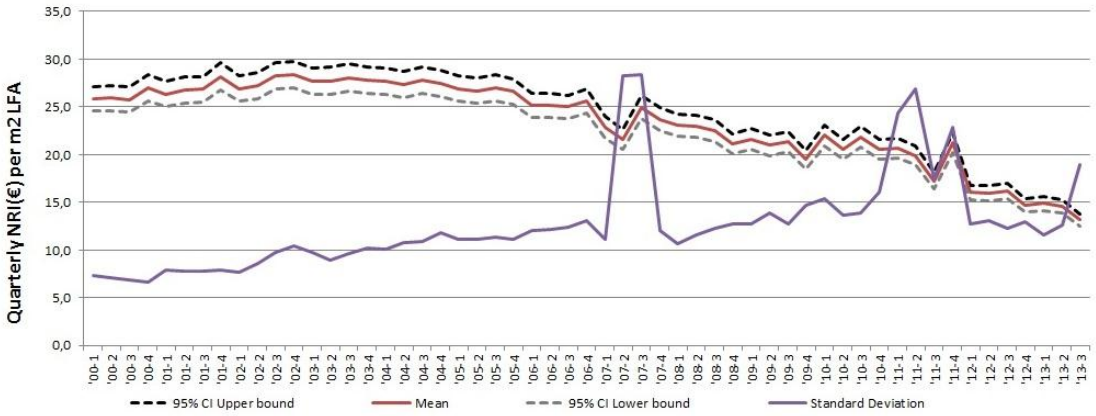


Figure 4.1 Average quarterly net rental income of the whole NSI portfolio.

Many more graphs that are displayed in this chapter will show exactly the same sudden drops and peaks. The final results have not been influenced by such peaks/drops since the analysis has used the input of separate individual properties (see for sensitivity analysis appendix XI). Finally the standard deviation shows an overall increase and an extreme peak in 2007. The upward trend of the standard deviation can be explained by the increasing number of cases in the portfolio as a whole (Gijselaar, 2009) (figure 4.2). The extreme peak in 2007 is due to the acquisition of VastNed office buildings by NSI.

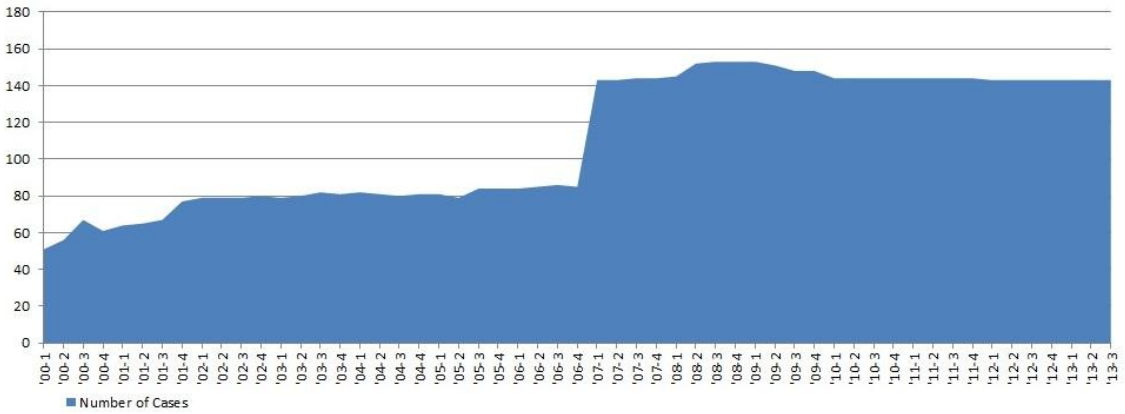


Figure 4.2 Number of measurement points in the dataset per quarter.

Regional market variables reflect the market circumstances in different locations. Beforehand it was to be expected that the average of all regional market variables, applied to the portfolio of NSI, would resemble the figures of the overall Dutch office market. This was due to the fact that the portfolio of NSI is widely dispersed throughout the Netherlands. In practise this appeared to be the case (see figure 3.6). Therefore it shows that the database that has been used is a proper reflection of the Dutch office market as a whole.

Studying the period 2002 to 2013 the average regional vacancy rates shows an overall increase (figure 4.3). In the same period the average net rental income is characterised by an overall decline. This suggests that there is a relationship between vacancy rates in the regional market and the financial performance of an office building. However, the core questions is whether the vacancy rate is being caused by poor office buildings or that vacancy rate is a predictor for the building's performance.

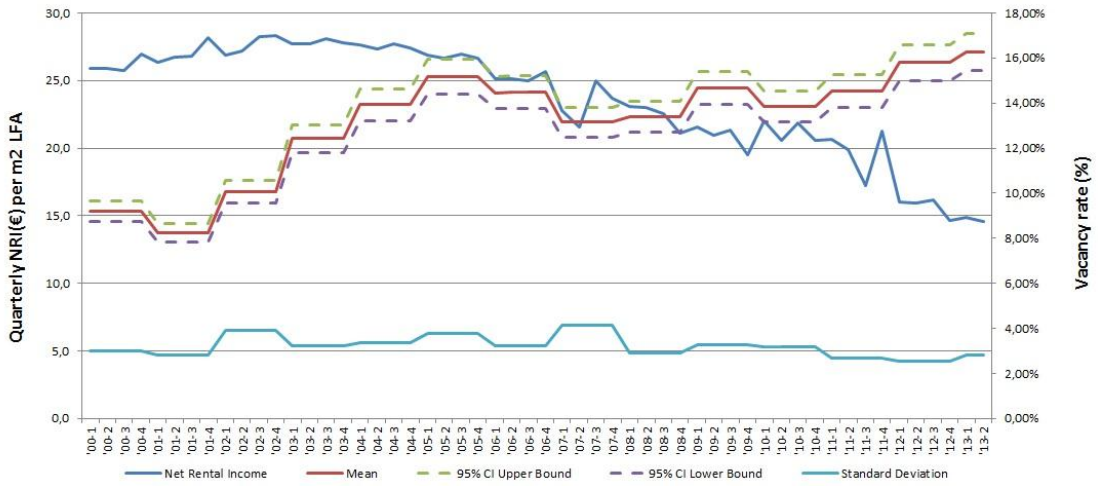


Figure 4.3 Average quarterly vacancy rate in the Dutch office market.

A remarkable development is shown in the period 2005-2008 in which the vacancy rate is dropping and the net rental income along with it. Normally one would expect rental prices to increase if the vacancy rate decreases (demand increases) (Geltner et al., 2007). The drop in both vacancy rate and NRI (fig 4.3) is in conflict with existing theories. Yet is has been reported elsewhere (Wheaton, Torto, & Evans, 1997). Based upon this information the predictive powers of regional market factors are placed within a different perspective.

The relation between the regional market factors absorption rate and net rental income is shown in figure 4.4. This analysis yields highly interesting results since it shows a (partial) negative correlation between the absorption of office space and the net rental income. In the periods 2000-2002 the overall financial performance increases while the absorption of office space decreases in that period. The opposite happens in 2003-2006 when the financial performance decreases while the absorption of office space increases sharply. Similar results are seen in a study of the cyclical behaviour of the great London office market between 1970-1995 (Wheaton et al., 1997). Finally from 2010-2013 the relation between absorption of office space and net rental income has become really weak to absent.

Figure 4.4 Average quarterly absorption rate of office space in the Dutch office market in relation the net rental income of the NSI portfolio. Corrected for inflation. Price levels of 2000 Q1.

After studying the economic predictors and the location features, their effect on the net rental income has been analysed. Based upon this information several interesting and surprising results have been found. According to real estate investments professionals (NSI employees) office properties located in the Randstad outperform office which are located in more rural areas. This is contradicted by an analysis of various location categories within the real estate portfolio of NSI (figure 4.5). Over a fourteen year period office building located in backward areas (mean 27,1; SD 4,3) have achieved a better financial performance compared to properties located in the Randstad (Mean 21,5; SD 3,5), or within the periphery of the Randstad (Mean 21,7; SD 3,8). Only office building located in one of the big four cities (Amsterdam, Utrecht, The Hague & Rotterdam) have been able to approximate this performance (Mean 24,8, SD 4,7). This confirms results that have been found in previous studies (Gijselaar, 2009) in which financial performances of respectively (Mean 28,9; SD 9,36) in backward areas, (Mean 24,9; SD 9,56) in periphery of Randstad , (Mean 24,2; SD 10,82) within Randstad and (26,5; SD 10,82) in big four were found. Furthermore is can be said that the above stated conclusions holds true, and regardless of the national economic cycle. The portfolio shows similar trends both before and after 2007.

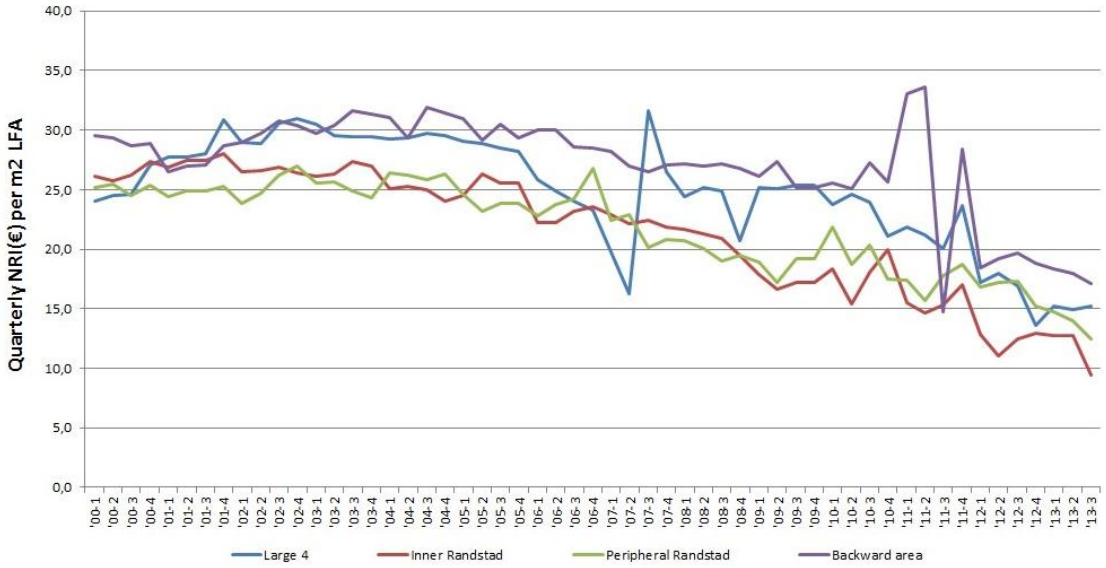


Figure 4.5. Average net rental income according to position towards the Randstad. Corrected for inflation. Price levels of 2000 Q1.

Considering the extent to which a region is urbanised seems to be irrelevant to the net rental income until 2007. However, from 2007 onwards, office buildings in less urbanised area consequently outperform other urbanisation classes (figure 4.6). The preceding study (Gijselaar, 2009) has identified this trend but was unable to make any definitive statements due to its limited time frame.

During this point in history the first signs of the financial crisis started to appear. The data suggests that less urbanised areas are less vulnerable to such a crisis. Especially considering that the difference in performance has only enlarged after the financial crisis has begun. Therefore it can be argued that the extent to which a region is urbanised is a clear decision-making criteria in after-crisis periods whereas it is not in pre-crisis periods. This is consistent with previously discussed results (fig 4.5) since less urbanised areas usually are located in backward areas as well.

Figure 4.6 Average net rental income according to level of urbanisation. Corrected for inflation. Prices levels of 2000 Q1.

Figure 4.7 provides an overview of the financial performance of office buildings according to the location in which they are situated. It was to be expected that office buildings located at office parks (Mean 24,2, SD 5,4) would outperform offices situated at industrial sites (Mean 21,7; SD 4,2). Furthermore it is widely accepted that industrial areas lack the quality (both geographically and aesthetically) to compete location in a town/city centre (Mean 23,2; SD 3,7). This confirms the preceding study by Gijselaar (2009) which yielded similar results regarding location surrounding features.

Regardless of the average financial performance over the 14 years' time frame, a turning point in 2007 is to be distinguished. Around this time existing trends seem to change. Whereas the performance of office parks (Mean 29,3; SD 1,3) is similar to the performance of residential areas (Mean 29,9; SD 1,7) before 2008, this all changes after 2008. From 2008 onwards office parks achieve a financial performance of (Mean 19,4; SD 3,4) compared to (Mean 24,2; SD 4,4) in residential areas. This suggests that office buildings at both office parks and residential area are equal weighted investment criteria in pre-crisis periods. Whereas in after-crisis periods offices in residential areas are to be preferred above other location typologies.

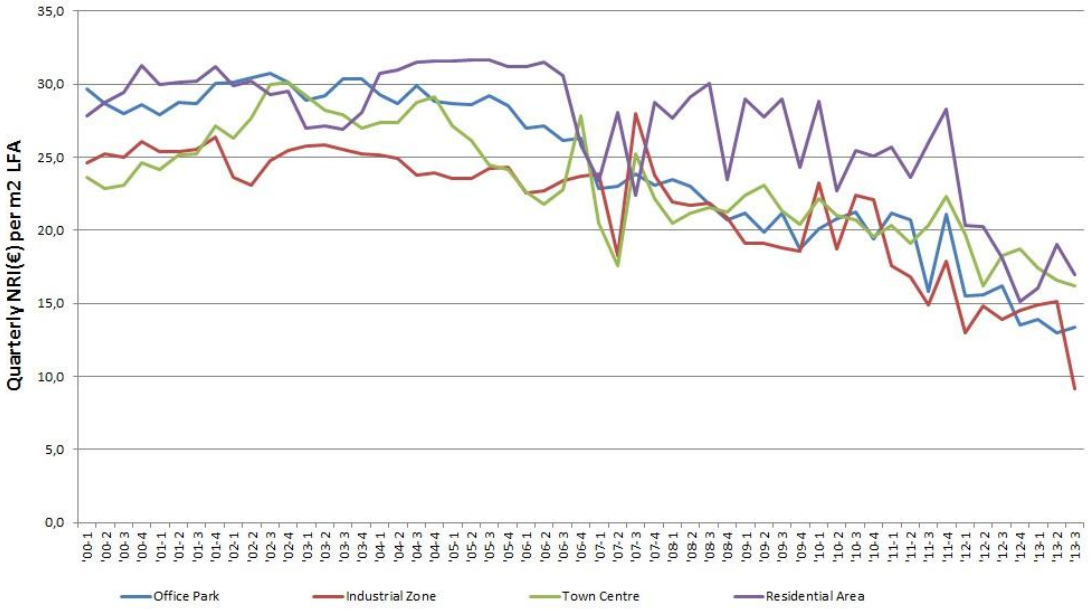


Figure 4.7 Average net rental income according to type of surrounding. Corrected for inflation. Prices levels of 2000 Q1.

The building's age is generally considered to have a negative impact on the overall performance of an office building. This is subscribed by an analysis of the average age of NSI's real estate portfolio in relation to both its gross- and net rental income (figure 4.8). The average age of the portfolio is displayed over a period of 55 consecutive quarters. From 2002 onwards the portfolio is continuously aging. This can be explained based upon the small number of disinvestments, in Dutch office properties, during the period of this study. Yet, it is remarkable that the acquisition of 42 VastNed offices in 2011 did not have a significant impact on the average age of the portfolio.

Whereas the average age shows an increasing pattern, the average net rental income shows a declining pattern. Both lines are clearly inversely correlated. Until 2002 the average age decreases with increasing net rental income. From 2002 onwards the average age increases and the average net rental income decreases. Based upon this information it is viable to accept a negative correlation between both variables. Therefore it can be seen as an

important criterion for the building's financial performance. Unlike other variables the impact age is similar in both pre-crisis and after-crisis periods.

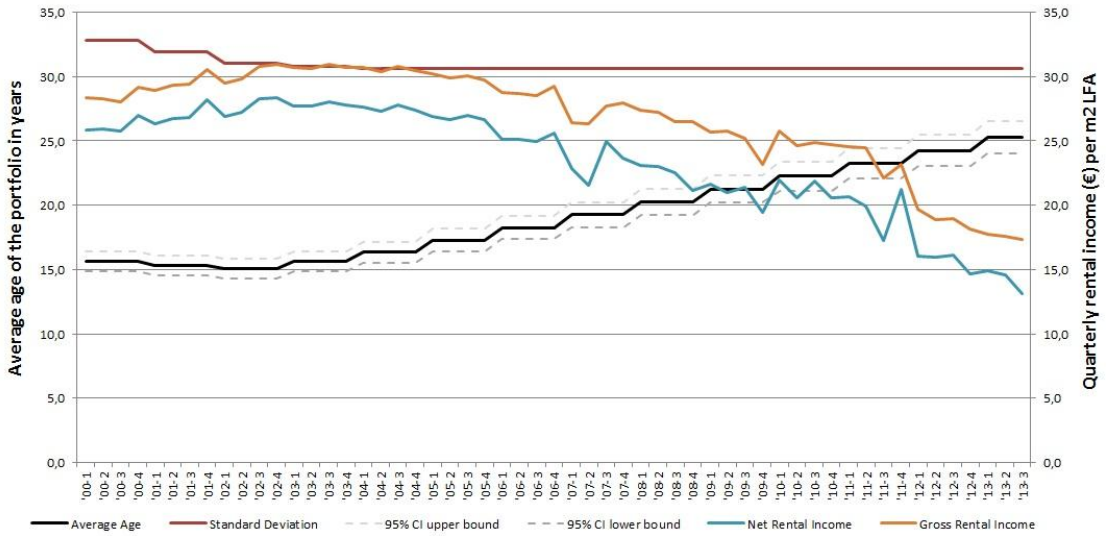


Figure 4.8 Average age of NSI's real estate portfolio.

Until recently NSI's real estate strategy was to focus on multi-tenant properties and disinvest in (small) single tenant offices. Such a strategy was based upon the assumption that small single tenant offices were characterised by relatively high management costs. However, an analysis of their portfolio in 2009 showed that single tenant offices (Mean 27,6; SD 10,6) were to outperform multi-tenant offices (Mean 24,4; SD 10,1) over a ten year period (Gijselaar, 2009). Based upon these results the real estate strategy of NSI was placed within a different perspective. Finally this has made the management of NSI decide to revise their strategy and incorporate type of use in the acquisition process.

Performing a similar analysis over a 14 year time frame (figure 4.9) justifies this change in perspective. Currently single tenant offices (Mean 25,9; SD 3,8) still deliver a better financial performance compared to multi-tenant office buildings (Mean 21,5; SD 4,9). Considering the consistency of these results it seems plausible that other factors, besides the management costs are involved and counter the impact of such management costs. One hypothesis might be that single tenant offices are characterised by lower vacancy rates as a result of high tenant loyalties. Since the single tenant offices in the database are rather small this might attract such tenants. The type of use demonstrated to be an important building feature with regard to building's financial performance. Nevertheless it cannot be used as building feature to distinguish between various economic cycles.

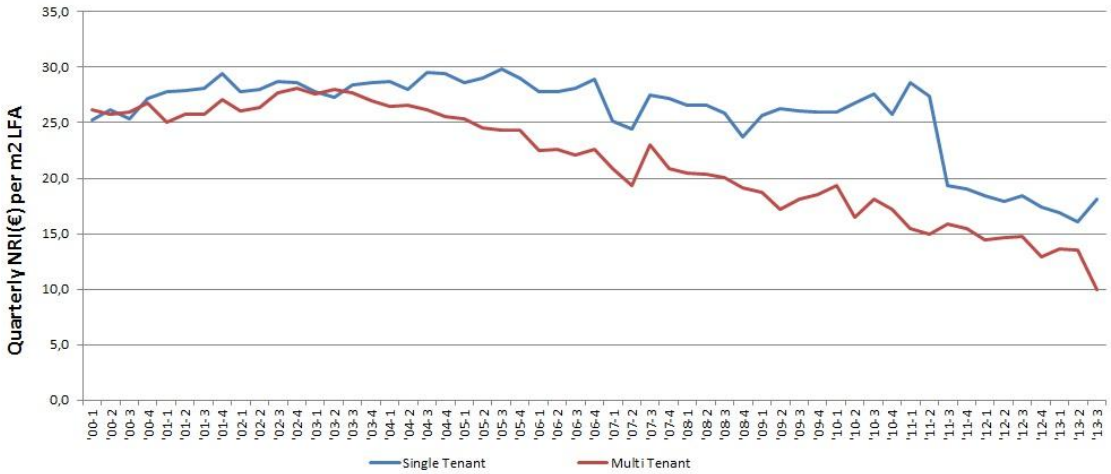


Figure 4.9 Average net rental income according type of use. Corrected for inflation. Prices levels of 2000 Q1.

Considering the building typology (figure 4.10) urban offices generate, on average, the highest net rental income (Mean 29,7; SD,2). Basic (Mean 23,9; SD 4,2) and pavilion (Mean 22,9; SD 4,1) office building typologies show the most continuous performance whereas high-rise properties (Mean 25,9; SD 7,2) have a higher volatility. Finally complex offices (Mean 20,3; SD 3,8) are underperforming during the entire study period. Since high-rise properties show such a high volatility this suggest that these properties are more responsive towards general market developments. Both during the internet bubble as well as the financial crisis high-rise buildings showed a quick drop followed by a swift recovery. Another explanation might be the fact that such offices are usually located at the top of the market and therefore have a higher exposure to market developments.

Although urban office types outperform high-rise offices, this has not always been the case. Until 2007 both types showed a rather similar performance whereas after 2007 this difference has increased. This implicates that financial performance of urban and high-rise offices in pre-crisis periods are comparable. However, in after-crisis periods urban offices types should be preferred over high-rise properties.

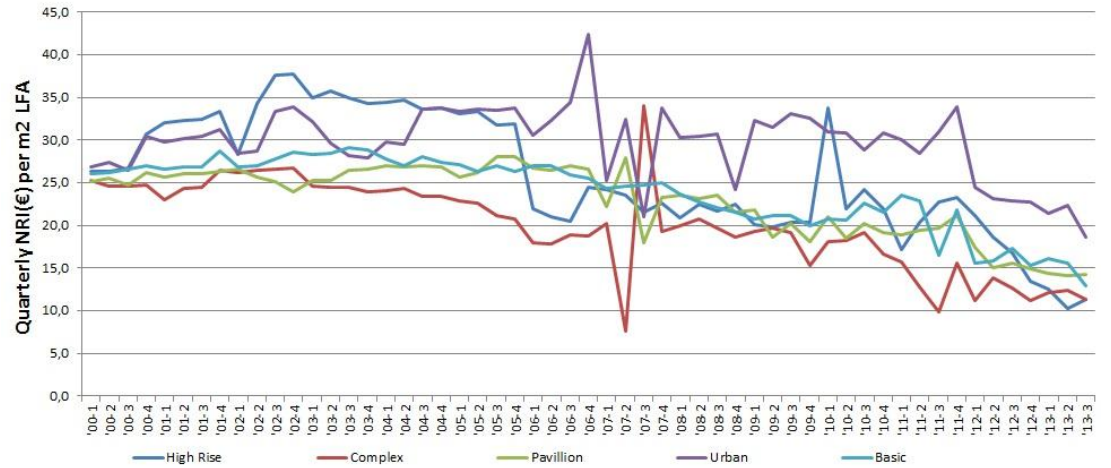


Figure 4.10 Average net rental income according to building typology. Corrected for inflation. Prices levels of 2000 Q1.

Additional research came up with surprising results regarding the flexibility of office buildings. Properties with layouts that are adjustable with some effort (Mean 27,5; SD 4,5) performed better compared to offices with easily adjustable layouts (Mean 21,8; SD4,4). As was to be expected, office with barely adjustable layouts performed worst (Mean 22,5; SD 5,9). This could be explained based upon the performance of single tenant properties. Single tenant properties are overall the best performing ones and the majority of these buildings has a medium flexible layout. Appendix X provides an overview of these correlation coefficients between different building features.

Figure 4.11 Average net rental income according to adjustability of the office building's layout. Corrected for inflation. Prices levels of 2000 Q1.

Finally the charisma of the entrance from the inside as well as the outside has been assessed. Although both variables are correlated (Appendix X), only the entrance from the inside proved to have a clear impact on the building's financial performance. If one is to ask a real estate investor to choose one building aspect for renovation he/she is most likely to choose the building's inside entrance. This is confirmed by figure 4.12.

This trend is visible over the entire measurement period and does not seem to be influenced by changes in the portfolio. Based upon this information, conclusions drawn by Gijselaar (2009) regarding the building's entrance seem to be justified. Furthermore it also holds true in both pre-crisis and after-crisis periods.

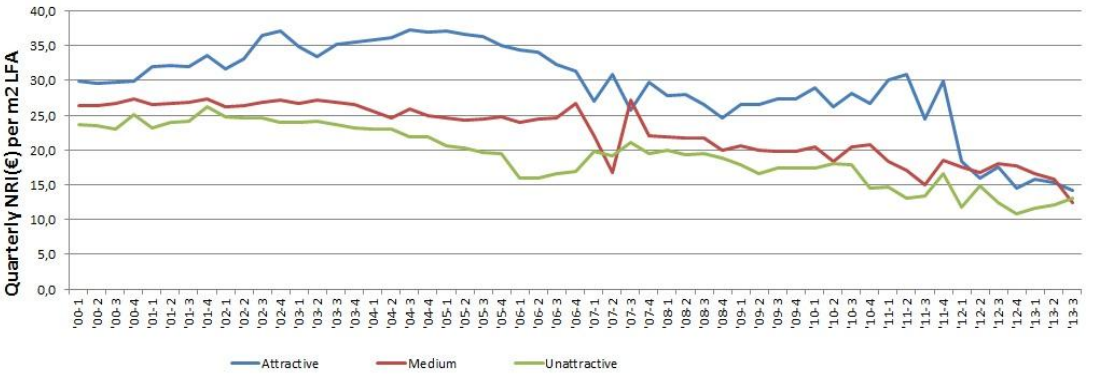


Figure 4.12 Average net rental income according to the charisma of the entrance from inside. Corrected for inflation. Prices levels of 2000 Q1.

4.2 Conclusion

Some of the results that have been derived using descriptive statistics, performed on the commercial real estate portfolio of NSI, were to be expected. Others were surprising, unexpected or even confusing and above all interesting.

Exploring the dataset based upon macro-economic factors yielded a mixed overview. At some moments in time the net rental income responded to changes in the absorption of office space and vacancy rate as was expected. Nevertheless at some moments in time an opposite effect was visible. Although this seemed to be surprising it was not unheard of. Previous studies have come up with similar effects.

Provoking trends are visible regarding the office building's surroundings. It turned out that office buildings located in backward areas achieve a better financial performance compared to other location typologies. This is consistent with similar trends showing a better financial performance of office buildings in less urbanised areas compared to very strong urbanised areas. Especially the fact that this effects does not appear in pre-crisis periods, whereas it does appear in after-crisis periods seems to be an important element for an investors acquisition strategy. The same accounts for offices which are situated in residential areas. Such offices show a similar performance to office park offices in pre-crisis periods. Whereas they outperformed office park offices in after-crisis periods.

On a building level, a clear distinction regarding the portfolio's financial performance is made between single and multi-tenant properties. Throughout the entire period of this study, single tenant offices have outperformed multi-tenant offices. This phenomena still remains visible when specific building sets are excluded from the exploration. Furthermore features such as the building typology, flexibility and entrance showed to have a clear effect on the building's financial performance. Urban offices outperform other building types (high-rise, complex, pavilion, basic). Whereas in pre-crisis periods the difference between urban and high-rise properties is minimal. The different becomes substantial in after-crisis periods. Medium flexible offices yield the highest net rental income. Nevertheless the difference with easy adjustable offices is rather small. Only the barely adjustable offices show a steady underperformance. This indicates that flexibility is only relevant to a certain extent. Other factors such as a monumental appearance are possibly highly influential. Finally it shows that offices with attractive entrances from the inside performed best over the entire period of study.

Further statistical research has to point out the exact significance of the trends that have been found. The next chapter will describe different statistical models based upon various analytical techniques. Finally chapter six will present the final repeated measurement model (LMM).

Results: statistical models

Meppel, Blankenstein

5 Results: different types of statistical models

This chapter will discuss multiple statistical models, and variations upon such models, that have been used to analyse the dataset. The findings as presented in this chapter are used to underpin the decisions that are made regarding the final model.

5.1. Hedonic pricing model

There are different methods of analysing the value of real estate objects. One method of performing such an analysis is by using hedonic pricing models. When using hedonic pricing models the value for each object is based upon several building characteristics. In hedonic pricing models an extra division according to the geographical location is made. The results of the analysis as described in this chapter are based upon a geographical division according to either DTZ or COROP regions. Such an additional division in different locations is for example not present when using repeated measurements. The fact that the data is available on a building level would justify measurements on a building level as well.

Furthermore there is a difference between using the method of restricted likelihood (REML) and the method of maximum likelihood (ML). Using ML is preferable over REML since ML is more suitable for comparing different models (SPSS Inc, 2008). The scripts that has been used to perform the analysis as described in this paragraph can be found in Appendix IV.

However, performing a hedonic pricing analysis with either DTZ or COROP regions results into an instable model (iterations have been doubled to 200). The model does not converge and becomes redundant according to the index. This is illustrated by table 5.1. Therefore it has been chosen not to include this model as final model.

Estimates of Covariance Paramters[a]

Parameter	Estimate	Std. Er.	Wald Z	Sig.	95% CI	95% CI
					Lower Bound	Upper Bound
Repeated Measures						
AR1 diagonal	150,241	3,175	47,321	,000	144,145	156,594
AR1 rho	0,303	0,135	22,449	,000	0,276	0,329
Intercept [subject = ID]						
Variance	0,186	5,280	0,35	,972	1,26E025	2,74E23
Intercept [subject = DTZ_REG * ID]						
Variance	38,609[b]	,000	.	.	.	.

a. Dependent Variable: Net Income per m2.

b. This covariance parameter is redundant. The test statistics and confidence interval cannot be computed

Table 5.1. Estimates of Covariance Parameters according to hedonic pricing model (Appendix IV)

Furthermore it has been tried to include the net rental income based upon a logarithmic scale (table 5.2) in a repeated measurement model (Appendix IV). Performing such an analysis resulted less adequate results compared to a repeated measurement model as described in chapter six. Especially the more economic features such as the absorption of office space in the regional market and the number of residents are undefined in such a model. However, regarding the building characteristics this model does not show substantial differences with the model as described in chapter six.

Type III Tests of Fixed Effects[a]

Factor Group	Source	Numerator df	Denominator df	F	Sig.
	Intercept	1	237,917	135836,95	,000
	TIME	1	1098,824	53,821	,000
Regional Market	VAC_RAT	1	1224,469	,128	,000
	ABSM2	1	.	.	.
Location	DIS_PT	0	5761,224	32,196	,896
	NUMRES	1	.	.	.
Building Features	ENTR_CHAR_IN	0	167,168	,017	,000
	BUILD_TYP	2	163,127	17,529	,002
	USE_2	4	165,189	4,586	,002
	FLEX	1	179,453	10,249	,015
	NR_FL	2	170,244	4,300	,471
	AGE	1	158,118	,522	,001

a. Dependent Variable: Net Income per m2.

Table 5.2 Repeated Model with logarithmic scale to explain the level of the net rental income (Appendix IV).

The previous paragraph has shown that incorporating a geographical correction in a hedonic pricing model did not results into a stable model. Therefore it has been tried to include the DTZ area classification as a random effect in a repeated model (Appendix IV). Time was set to be continuous (no dummy), the net rental income was included on a normal scale and a VC Covtype was used. Such a model resulted into similar results, regarding the significance of the included variables, as were achieved in the final model (chapter 6). However, the AIC value of the final model (45831) turned out to be better compared to the AIC value of this model (46349 REML & 46367 ML). Performing a similar analysis with time as either quarter- or year dummies did not results into a better model. An error warning regarding the model's matrixes is shown and an higher AIC value (46393 resp. 46351) is achieved.

Finally the same model has been performed, with a lag applied to the net rental income over time. This could be seen as a relevant option since their always is a certain delay in the real estate market. Each quarter has been shifted two quarters forward in time. This model did result into a slightly better fit (AIC = 43581). However, the models parameters are substantially less significant using such a time lag (table 5.3). Especially the economical ones (ABSM2, VAC_RAT). The significance of building features remains unchanged compared to the final model. The disadvantage of using the lagged function is that the models are not comparable in terms of underlying data. Due to the lagged function of half a year, the first data points for all offices were set to system missing. Because of this it was chosen not to include a time lag in the final model.

Type III Tests of Fixed Effects[a]

Factor Group	Source	Numerator df	Denominator df	F	Sig.
	Intercept	1	199,259	212,211	,000
	TIME	1	1947,058	91,691	,000
Regional Market	VAC_RAT	1	5552,014	2,114	,146
	ABSM2	1	3533,390	,235	,628
Location	DIS_PT	1	166,216	,607	,437
	NUMRES	1	186,304	2,652	,105
Building Features	ENTR_CHAR_IN	2	164,253	21,494	,000
	BUILD_TYP	4	166,353	4,897	,001
	USE_2	1	171,367	9,725	,002
	FLEX	2	167,822	3,274	,040
	NR_FL	1	162,634	1,345	,248
	AGE	1	179,772	12,121	,001

Table 5.3 Repeated Model with time lag applied to net rental income (Appendix IV).

5.2 Statistical model based on Gijselaar (2009)

Since this study builds upon a study Gijselaar (2009), it has been tried to apply a similar model to the dataset. The scripts that has been used to perform the analysis as described in this paragraph can be found in Appendix V. Tables 5.4 and 5.5 provide an overview of the statistical results based upon this model.

Type III Tests of Fixed Effects[a]

Factor Group	Source	Numerator df	Denominator df	F	Sig.
	Intercept	1	184,006	235,391	,000
	TIME	1	1431,176	273,413	,000
Regional Market	VAC_RAT	1	5719,168	7,779	,005
	ABSM2	1	3193,425	8,550	,003
Location	DIS_PT	1	167,508	,435	,510
	NUMRES	1	186,736	6,070	,015
Building Features	ENTR_CHAR_IN	2	163,888	20,704	,000
	BUILD_TYP	4	165,837	5,157	,001
	USE_2	1	170,764	11,278	,001
	FLEX	2	168,054	3,450	,034
	NR_FL	1	161,428	,909	,342
	AGE	1	187,517	12,635	,000

a. Dependent Variable: Net Income per m2.

Table 5.4 Model factors that explain the level of the net rental income (Appendix V).

Estimates of Fixed Effects[a]

Parameter	Estimate	Std. Error	Sig.	95% CI	95% CI
				Lower Bound	Upper Bound
Intercept	25,42	2,18	,000	21,12	29,72
TIME	-,295	,018	,000	-,33	-,26
VAC_RAT	,319	,115	,005	,09	,54
ABSM2	-3,02E-005	1,03E-005	,003	-5,05E-005	-9,96E-006
DIS_PT	-,001	,002	,510	-,005	,0025
NUMRES	5,77E-006	2,34E-006	,015	1,15E-006	1,04E-005
ENTR_CHAR_I =Attractive	8,99	1,440	,000	6,15	11,84
ENTR_CHAR_IN=Medium	2,47	1,324	,064	-,149	5,08
ENTR_CHAR_IN=Unattractive	0[b]	0	.	.	.
BUILD_TYP = High-rise	-,798	3,049	,794	-6,819	5,22
BUILD_TYP = Complex	-2,004	1,444	,167	-4,854	,85
BUILD_TYP = Pavilion	,638	1,472	,665	-2,269	3,54
BUILD_TYP = Urban	8,61	2,282	,000	4,104	13,11
BUILD_TYP = Basic	0[b]	0	.	.	.
USE_2 = Single Tenant	4,14	1,233	,001	1,706	6,57
USE_2 = Multi-Tenant	0[b]	0	.	.	.
FLEX= Not Adjustable	-2,032	2,004	,312	-5,988	1,92
FLEX= Medium Adjustable	2,51	1,334	,061	-,119	5,15
FLEX= Very Adjustable	0[b]	0	.	.	.
NR_FL	,356	,374	,342	-,381	1,09
AGE	-,079	,022	,000	-,123	-,04

a. Dependent Variable: Net Income per m2.

b. This parameter is set to zero because it is redundant.

Table 5.5 Estimates of fixed effects and impact on the net rental income (Appendix V).

Performing a similar analysis as has been done by Gijselaar (2009) results into an overall fairly significant model. However, it should be notified that the behaviour of the included regional market variables (VAC_RAT & ABSM2) is far from normal. These variables are included, together with TIME, to model the economic trend. However, the strange behaviour of both VAC_RAT and ABMS2 can be explained by the negative effect of TIME.

Furthermore the model estimates regarding these variables suggest a positive correlation with vacancy rate (VAC_RAT) and a negative correlation with the absorption rate (ABSM2). This would imply an increase in net rental income if the vacancy rate increases, and a drop in net rental income if the absorption rate increases. According to general economic theories an opposite relationship was to be expected (Wheaton, 1987). Since this does not reflect normal market behaviour it has been decided not to include these regional market features in the final model. Instead the overall economic trend is included in the final model by using a 2nd order polynomial for time (TIME*TIME).

5.3 Conclusion

Based on the reasons as will be discussed in this paragraph, it can be said that none of the models that have been performed in this chapter came up with satisfying results. At first a standard hedonic pricing model has been tried which did not converge and became redundant according to the index.

Consequently a logarithmic scale has been applied to a repeated measurement model. Whereas specific building characteristics have remained significant (similar to the final model), using such a scale made it impossible for the model to define economic variables.

Furthermore two repeated measurement models have been created, with geographical regions as random effect, and time as either continuous or with quarterly and yearly dummies. Again this model yielded a higher AIC value and less significant results, particularly regarding the economic parameters in the model. Additionally the net rental income has been lagged over time in these models. Since their always is a certain delay in the real estate market such a modification might be justified. Nevertheless this did not yield satisfying results. Although this model had a slightly better fit compared to the other models that have been tried, it mainly affected the influences of the included economic variables and not profoundly the outcomes of the building characteristics. Since a lagged function requires to discard data that were intentionally collected, it was decided not to use such a lagged function in the final model.

Finally a statistical model based upon a study by Gijselaar (2009) has been performed. The output of this model showed an odd behaviour of the regional market features (VAC_RAT & ABSM2). Due to this theoretical conflict it has been decided not to include these variables in the final model. Instead it is chosen to include a 2nd order polynomial for time (TIME*TIME), to describe the cyclical economic effects.

Overall is seems that the building features remain fairly unaffected by changes in the different models as presented in this chapter. These features are rather similar in both hedonic as well as repeated measurement models. Since repeated models are characterised by less ‘artificial’ modifications compared to hedonic models this might favour such models. Combining the results of the different models with the arguments as previously described, it is fair to reject the use of the model variations that have been presented in this chapter. The final model as used in this study is described in the next chapter.

Results: final model

Groningen, Žernikepark

6 Results: final model

The final model (Appendix VI), is a model in which certain factors show to have significant explanatory effect on the level of the net rental income. This model was chosen because different (hedonic) models using logarithmic scales and regional (correction) factors yielded less, or none, significant results. Therefore it turned out to be a logical choice to use a linear mixed model using repeated measurements.

6.1 Whole measurement period model

The reasons why certain properties yield higher profits compared to other properties can be attributed to the variables as shown in table 6.1 (only if sig. < 0,05). This table provides an overview of both location- and building features, that have demonstrated to have an impact on the net rental income.

Type III Tests of Fixed Effects[a]

Factor Group	Source	Numerator df	Denominator df	F	Sig.
	Intercept	1	213,886	181,414	,000
	TIME	1	1447,237	1,048	,306
	TIME*TIME	1	1410,654	14,264	,000
Location	DIS_PT	1	168,824	,250	,618
	NUMRES	1	166,772	2,896	,091
Building Features	ENTR_CHAR_IN	2	165,208	20,890	,000
	BUILD_TYP	4	167,240	5,297	,000
	USE_2	1	172,314	10,703	,001
	FLEX	2	169,399	3,510	,032
	NR_FL	1	162,814	,856	,356
	AGE	1	189,936	11,554	,001

a. Dependent Variable: Net Income per m2.

Table 6.1 Final model factors that explain the level of the net rental income (Appendix VI).

The significant effects of the building's age (F=11,55; df=189,94; p=0,001) confirms knowledge in existing literature and therefore enhances the reliability of the database and the results of this model. However, the significant effects of the number of residents (F=2,90; df=166,72; p=0,091) the charisma of the entrance's inside (F=20,89; df=166,77; p=0,000), the building type (F=5,30; df=167,24; p=0,000), the type of use (F=10,70; df=172,31; p=0,001) and the flexibility (F=3,51; df=169,40; p=0,032) on the building's financial performance are most interesting. Such factors are not considered to be highly influential according to other theories (Öven & Pekdemir, 2006) on office building performance indicators. This might be due to a different population as already has been mentioned by Gijselaar (2009). There is an abundance of studies using upper market locations, whereas this portfolio is to be characterised as all other office locations. Nevertheless they confirm recent findings by Gijselaar (2009) and therefore their relevance is enhanced.

Comparing these results with previous findings (Gijselaar, 2009) both confirms as well as rejects the significant effects of certain features on the level of the net rental income. Whereas the distance to public transportation (DIS_PT) and number of floors (NR_FL) showed to be significant in that study, they are insignificant in this study. Therefore it can be said the distance to public transportation and the number of floors are unsuitable for predicting the net rental income on the long run. The significance of all other factors (NUMRES, ENTR_CHAR_IN, BUILD_TYPE, USE_2, FLEX & AGE) was yet again confirmed by this

study. These factors can therefore be regarded as reliable performance indicators for the financial performance of office buildings.

At this point it is known which factors have a significant effect on the building's net rental income. However, it is important to know the extent to which these effects occur. Table 6.2 provides an overview of the exact correlation effects of the model as presented in this chapter.

Estimates of Fixed Effects[a]

Parameter	Estimate	Std. Error	Sig.	95% CI	95% CI
				Lower Bound	Upper Bound
Intercept	22,265	2,23	,000	17,876	26,659
TIME	-,064	,063	,306	-,188	,059
TIME*TIME	-,0038	,001	,000	-,006	-,002
DIS_PT	-,000953	,00191	,618	-,005	,003
NUMRES	3,84E-006	2,26E-006	,091	-6,15E-007	8,301E-006
ENTR_CHAR_I =Attractive	8,98	1,434	,000	6,148	11,812
ENTR_CHAR_IN=Medium	2,4022	1,32	,070	-,202	5,006
ENTR_CHAR_IN=Unattractive	0[b]	0	.	.	.
BUILD_TYP = High-rise	-,643	3,037	,832	-6,640	5,353
BUILD_TYP = Complex	-2,062	1,438	,153	-4,901	,777257
BUILD_TYP = Pavilion	,485	1,467	,741	-2,410	3,380
BUILD_TYP = Urban	8,683	2,273	,000	4,196	13,169
BUILD_TYP = Basic	0[b]	0	.	.	.
USE_2 = Single Tenant	4,017	1,228	,001	1,593	6,440
USE_2 = Multi-Tenant	0[b]	0	.	.	.
FLEX= Not Adjustable	-1,786	1,995	,372	-5,724	2,153
FLEX= Medium Adjustable	2,649	1,329	,048	,026	5,272
FLEX= Very Adjustable	0[b]	0	.	.	.
NR_FL	,3445	,372	,356	-,391	1,080
AGE	-,0753	,0222	,001	-,119	-,032

a. Dependent Variable: Net Income per m2.

b. This parameter is set to zero because it is redundant.

Table 6.2 Estimates of fixed effects and impact on the net rental income (Appendix VI).

When exploring the building features, the final model has shown the importance of an attractive building entrance. This confirms the observations that were made using descriptive statistics. The more charismatic the building's entrance from inside is, the higher the impact on the net rental income becomes. Both high-rise and complex building typologies have a negative impact on the building's financial performance. Other building typologies, such as pavilion (medium) and urban (strong), are linked with a better financial performance. Compared to multi-tenant offices, single tenant offices have a strong positive impact on the financial performance. Obviously the building's age has a strong impact on the net rental income. Surprisingly highly adjustable buildings do not have a positive impact on the net rental income. Only medium adjustable buildings have a positive influence on the financial performance. As was to be expected not adjustable buildings have a negative impact on the net rental income. This suggests that tenants demand a certain amount of flexibility, however that for example the building's monumental/elegant appearance is preferred above maximal flexibility.

Using equation 4 (chapter 3), in combination with the results as stated in table 6.2, the following equation can be derived. This equation represents a regression model that is capable of predicting the net rental income of non A^+ office buildings.

Net Rental Income = 24,286[a] - 0,001(Distance to public transport)$_i$ + 0,00000384(Number of residents)$_i$ + 8,98(Charisma entrance inside = attractive)$_i$ + 2,4(Charisma of entrance inside = medium attractive)$_i$ + 0b(Charisma entrance inside = unattractive)$_i$ – 0,643(Building typology = high-rise)$_i$ – 2,062(Building typology = complex)$_i$ + 0,485(Building typology = pavilion)$_i$ + 8,68(Building typology = Urban)$_i$ + 0b(Building typology = Basic)$_i$ + 4,02(Use typology = single tenant)$_i$ + 0b(Use typology = multi-tenant)$_i$ – 1,786(Flexibility = not adjustable)$_i$ + 2,649(Flexibility = medium adjustable)$_i$ + 0b(Flexibility = very adjustable)$_i$ + 0,345(Number of floors)$_i$ – 0,075(Age)$_i$ + ε_i

a. B^0 constant. Based upon the Grand means of the entire morel (Appendix IX).
b. This parameter is zero because it is redundant.

6.2 Pre-crisis model

In order to distinguish specific relevant 'pre-crisis' features an analysis has been performed over the 'pre-crisis' period only. This has resulted into outcomes as displayed in table 6.3 and table 6.4. Especially the building features show an interesting change. In general such features are less significant compared to the analysis performed over the whole study period.

Although the impact of the charisma of the building's entrance inside (F=24,43; df=159,850; p=0,000) has remained unchanged, other features such as the building typology (F=2,66; df=164,752; p=0,034), the using typology (F=3,64; df=179,633; p=0,058) and the building's flexibility (F=2,45; df=162,444; p=0,090) have become less significant. Nevertheless it seems that the number of floor (F=2,85; df=158,496; p=0,093) is more significant in pre-crisis periods only. Finally location features such as the distance to public transport (F=2,22; df=155,81; p=0,138) and number of inhabitants (F=1,75; df=166,83; p=0,188) are more important compared to the 'after-crisis' model. This indicates that there is a different impact of location features and respectively building features depending on the economic circumstances.

Type III Tests of Fixed Effects[a]

Factor Group	Source	Numerator df	Denominator df	F	Sig.
	Intercept	1	185,146	174,266	,000
	TIME	1	1235,767	,480	,489
	TIME*TIME	1	1249,615	5,661	,017
Location	DIS_PT	1	155,810	2,219	,138
	NUMRES	1	166,833	1,747	,188
Building Features	ENTR_CHAR_IN	2	159,850	24,427	,000
	BUILD_TYP	4	164,752	2,663	,034
	USE_2	1	179,633	3,644	,058
	FLEX	2	162,444	2,447	,090
	NR_FL	1	158,496	2,849	,093
	AGE	1	154,189	11,643	,001

a. Dependent Variable: Net Income per m2.
Table 6.3 Model factors that explain the level of the net rental income until 2008 (Appendix VI).

Estimates of Fixed Effects[a]

Parameter	Estimate	Std. Error	Sig.	95% CI	95% CI
				Lower Bound	Upper Bound
Intercept	22,144	2,242	,000	17,720	26,568
TIME	-,058	,083	,489	-,222	,106
TIME*TIME	-,005	,002	,017	-,009	-,0008
DIS_PT	-,0029	,002	,138	-,007	,0009
NUMRES	3,1239E-006	2,362E-006	,188	-1,541E-006	7,786E-006
ENTR_CHAR_I =Attractive	10,013	1,495	,000	7,061	12,965
ENTR_CHAR_IN=Medium	2,290	1,364	,095	-,402	4,983
ENTR_CHAR_IN=Unattractive	0[b]	0	.	.	.
BUILD_TYP = High-rise	-2,024	3,160	,523	-8,264	4,216
BUILD_TYP = Complex	-1,004	1,497	,504	-3,961	1,953
BUILD_TYP = Pavilion	,860	1,505	,569	-2,112	3,831
BUILD_TYP = Urban	6,596	2,366	,006	1,924	11,267
BUILD_TYP = Basic	0[b]	0	.	.	.
USE_2 = Single Tenant	2,466	1,291	,058	-,082	5,015
USE_2 = Multi-Tenant	0[b]	0	.	.	.
FLEX= Not Adjustable	-,279	2,032	,891	-4,292	3,735
FLEX= Medium Adjustable	2,752	1,389	,049	,011	5,494
FLEX= Very Adjustable	0[b]	0	.	.	.
NR_FL	,659	,390	,093	-,112	1,430
AGE	-,076	,022	,001	-,118	-,032

a. Dependent Variable: Net Income per m2.

b. This parameter is set to zero because it is redundant.

Table 6.4 Estimates of fixed effects and impact on the net rental income (Appendix VI).

6.3 Post-crisis Model

Performing a similar analysis over the 'post-crisis' period yielded results as shown in table 6.5 and 6.6. This analysis shows a change in both location- and building factors. Location features such as the number of residents (df=143,93; p=0,193) and the distance to public transport (df=147,78; p=0,359) have become less significant for the net rental income. Whereas these did have a significant impact when performing a measurement over the whole study period.

Specific building characteristics such as the charisma of the building's entrance inside (df=146,44; p=0,000), the building typology (df=14,23; p=0,003) and the using typology (df=142,62; p=0,000) have remained to be significant in this after-crisis measurement period. This indicates that the impact of these building features is more important in after-crisis periods compared to pre-crisis periods. Furthermore it enhances the overall impact of building features on the building's financial performance since such features remain significant in both pre- as well as after-crisis periods.

Type III Tests of Fixed Effects[a]

Factor Group	Source	Numerator df	Denominator df	F	Sig.
	Intercept	1	718,298	,444	,505
	TIME	1	696,794	3,272	,071
	TIME*TIME	1	696,066	4,810	,029
Location	DIS_PT	1	147,783	,845	,359
	NUMRES	1	143,931	1,714	,193
Building Features	ENTR_CHAR_IN	2	146,439	9,133	,000
	BUILD_TYP	4	145,232	4,292	,003
	USE_2	1	142,825	15,235	,000
	FLEX	2	151,754	1,618	,202
	NR_FL	1	142,199	,026	,872
	AGE	1	146,841	,006	,938

a. Dependent Variable: Net Income per m2.

Table 6.5 Model factors that explain the level of the net rental income from 2008 onward (Appendix VI).

Estimates of Fixed Effects[a]

Parameter	Estimate	Std. Error	Sig.	95% CI	95% CI
				Lower Bound	Upper Bound
Intercept	-26,912	26,608	,312	-79,150	25,326
TIME	2,105	1,164	,071	-,180	4,390
TIME*TIME	-,028	,0126	,029	-,053	-,003
DIS_PT	,003	,003	,359	-,003	,008
NUMRES	4,03E-006	3,078E-006	,193	-2,054E-006	1,011E-005
ENTR_CHAR_I =Attractive	8,121	1,984	,000	4,200	12,041
ENTR_CHAR_IN=Medium	2,062	1,850	,267	-1,595	5,719
ENTR_CHAR_IN=Unattractive	0[b]	0	.	.	.
BUILD_TYP = High-rise	,239	4,083	,953	-7,834	8,311
BUILD_TYP = Complex	-2,637	1,959	,180	-6,508	1,235
BUILD_TYP = Pavilion	,712	2,080	,733	-3,401	4,824
BUILD_TYP = Urban	10,484	3,128	,001	4,303	16,666
BUILD_TYP = Basic	0[b]	0	.	.	.
USE_2 = Single Tenant	6,441	1,650	,000	3,179	9,703
USE_2 = Multi-Tenant	0[b]	0	.	.	.
FLEX= Not Adjustable	-,515	2,981	,863	-6,402	5,372
FLEX= Medium Adjustable	3,005	1,806	,098	-,564	6,574
FLEX= Very Adjustable	0[b]	0	.	.	.
NR_FL	-,082	,504	,872	-1,077	,914
AGE	-,004	,051	,938	-,106	,098

a. Dependent Variable: Net Income per m2.

b. This parameter is set to zero because it is redundant.

Table 6.6 Estimates of fixed effects and impact on the net rental income (Appendix VI).

6.4 Continuous vs. discrete modelling

Compared to the models as discussed in chapter five, the most significant difference with the final model is the fact that TIME has been modelled as a 2nd order polynomial in the final model. Continuously modelled variables enables the model to adapt itself to for example cyclical economic movements. Since the quadratic functions allows the curve to bend. This provides an advantage over linear modelled variables which do not allow such a turning point.

Another option is to generate time dummies which enable the model to adjust itself for sudden market changes. Such sudden changes cannot be incorporated using a linear or 2nd order polynomial. Applying time dummies to the model as presented in this chapter resulted into an AIC of 45873. Since the use of a 2nd order polynomial for TIME resulted into an AIC of 45869 it was chosen not to use time dummies.

Finally it could be argued to apply a 2nd order polynomial to AGE as well. A combination of 2nd order polynomials for both TIME and AGE resulted into an AIC of 45865. Nevertheless it was chosen not to incorporate such a polynomial since 'sudden market/economic changes' do not apply to the building's age. Although the average age of the portfolio can fluctuate due to disinvestments the impact will always be gradually. Another argument for using a 2nd order polynomial for AGE could be the fact that the negative effect of age disappears if a building becomes 'historically' old. An analysis of old buildings (> 100 years) did not show an outperformance of such buildings compared to youngers ones. Therefore it was chosen not to include a 2nd order polynomial for AGE.

6.5 Goodness of fit based on R^2

Mixed models do not automatically provide a R^2 in the output. Where a R^2 of 1 is considered to be a perfect fit and $R^2 \geq 0$ for any reasonable model specification. Instead the goodness of fit is based upon criteria such as the Akaike information criterion (AIC). However, it is possible to derive a R^2 based upon available information criteria. This can be done by using the following equation (Edwards, Muller, Wolfinger, Qaqish, & Schabenberger, 2008).

$$R_{\beta}^{2} = \frac{(q-1)v^{-1}F(\widehat{\beta},\widehat{\Sigma})}{1+(q-1)v^{-1}F(\widehat{\beta},\widehat{\Sigma})} \quad (6)$$

Calculating the R square-beta is based upon the number of independent variables (q), the model's approximate denominator (V^{-1}) and the model's F value. Applying the previously described equation, to the final model as used in this study, the following R^2 is derived.

$$R_{\beta}^{2} = \frac{(8-1)213{,}886^{-1}181{,}414}{1+(8-1)213{,}886^{-1}181{,}414} = 0{,}85$$

Nevertheless a side note must be made regarding the impact of R^2 on mixed models. Its relevance in mixed models is questioned, as is illustrated by the following conclusion:

"Because philosophies about what R^2 should measure can differ in the mixed model framework, there will be no universally acceptable R^2 for mixed models" (Kramer, 2005).

Therefore the AIC value is preferred over the R^2 value for judging the model's fit.

6.6 Conclusion

It can be concluded that building features, for Dutch offices located at non A^+ locations, are a crucial element in the financial performance of such properties. Location factors, such as the number of residents, definitely influences the building's performance. The significant impact of public transportation nodes in the direct surroundings of the property does not hold up on the long run. Therefore its impact on the building's financial performance should be reconsidered.

All in all it appears that the sole arguments 'location', 'location', 'location' do not hold up for office buildings which are located outside the top locations. This study shows that building features play a decisive role in an office building's financial performance. The known negative effects of ageing, as found in previous studies, are confirmed in this study. More interesting though, is the confirmation of the impact of the attractiveness of the building's entrance, the extent of flexibility that a tenant demands, the outperformance of multi-tenant offices by single tenant offices and the clear positive impact of urban office typologies. The impact of such factors was first reported in 2009 by Gijselaar. Therefore their validity was questioned since a historical track record was missing. The fact that such factors have yet again shown to be significant, justifies their determining role in optimising the net rental income of a commercial real estate portfolio.

In after crisis periods the weight of different factor groups seems to change. The impact of location factors becomes less significant in after-crisis periods, whereas the impact of buildings features such as the building's entrance, the building's typology and its type of use, on the building's financial performance remains unquestionably high. This does not account for the building features such as flexibility, number of floors and age. These features show a diminished impact on the building's financial performance in after-crisis periods. Since previous studies were unable to perform measurements before and after a severe financial crisis this clearly adds to existing knowledge.

Finally building features at micro-level (i.e. material, shape, layout, energy) have shown to be insignificant in determining the net rental income. Although it could be argued that building with a brick façade would yield a higher profits compared to glass facades (i.e. due to its monumental appearance), it was not found to have a significant impact. The same accounts for example to round office compared to square offices which did not show to have a particular impact.

Discussion

Den Haag, Zuid Hollandlaan

7 Discussion

This study has started by stating that an investor's profits are largely dependent upon the tenant's willingness to pay. Furthermore it was said that physical office building features are such a crucial element in the perception of office buildings that they have an impact on the tenant's willingness to pay. Therefore such physical office building features have to be included in an institutional real estate investor's investment strategy. This has led to the following hypothesis:

"Pre-crisis and after-crisis building features are of such importance to the net rental income of an office building that it needs to be considered as a decision-making criterion in the acquisition strategy of an institutional real estate investor."

To come up with conclusive evidence to support this hypothesis a set of research questions had to be answered. First of all a baseline measurement regarding the current set of decision-making criteria was needed. Consequently the physical and non-physical office building features that potentially had an influence on an office building's net rental income had to be identified. After which the exact impact of the previously identified building features on the net rental income had to be determined. Finally the knowledge that has been generated is to be implement in an institutional real estate investor's acquisition strategy.

This chapter will elaborate on the results that have been achieved and provide answers to this set of research questions. In the end this will result into an answer to the main research question. Hereby keeping in mind the possible limitations of this study. Finally a tangible advise to NSI, the real estate industry in general and possibilities for further research is given.

7.1 The results

7.1.1 Decision-making criteria

It has been difficult to gather an exact overview of the current set of decision-making criteria. This is due to the difference between rational theoretical criteria on the one hand, and actual methods as used within the commercial real estate market on the other. In the end it all depend upon the scope of an investor, the level of risk they are willing to accept (i.e. pension fund vs. private equity fund) and obviously the economic circumstances.

In the end it turned out to be possible to combine all sets of criteria. Whether it was theoretically or practically, rationally or instinctively, all investment criteria were part of three different groups. It turned out that decision-making took place based upon regional market features (non-physical) and location features (physical) and building features (physical). Investment criteria are used because the impact of these criteria on the financial performance of an office building is (pretended to be) known. Therefore studying decision-making criteria is all about identifying variables that influence the performance. These variables can be categorised in the previously stated groups.

7.1.2 Net rental income

The financial performance of office buildings in this study is reflected by the net rental income of each property. Using the net rental income provides a much better indication of performance compared to indirect returns. The net rental income is derived by subtracting all operating, service and management costs from the gross rental income. By using the net

rental income important effects of vacancy and maintenance costs are directly incorporated in the financial performance. Furthermore the net rental income provided the possibility to account for possible incentives and rent-free periods. Market and/or contract rents can hide the effects of such measures. This can result into artificially high rents and a wrongful interpretation of the actual financial performance. All in all the net rental income provides a fair insight into the real financial performance of an office building and as such is highly valuable to the reliability of this research.

All quarterly net rental incomes have been corrected for inflation over the whole duration of this study. Since rental prices are usually agreed upon to have an annual increase equal to the inflation, this could theoretically have caused distortion. Therefore the price level is based upon the year 2000 Q1. By doing so it became possible to compare the financial performance of different office buildings over time.

7.1.3 Impact of physical and non-physical building features

In line with both practise and theory a combination of regional market features, location features and building features account for the major effect on the net rental income of an office building. More relevant though, is the extent to which they have effect, and the economic circumstances in which they have this effect.
A regression analysis has been used to test the hypothesis and find answers to the impact of pre-crisis and after-crisis features. The next paragraph will discuss the results as shown by this analysis. The only restriction being that these results are applicable to all offices which are not located at A^+ locations (i.e. South Axis, Amsterdam). Since the commercial office real estate portfolio of NSI did not incorporate any properties at such locations. Nevertheless the results as presented in this study are applicable to the whole Dutch office market, excluding A^+ locations (paragraph 3.4; Analysis).

Comparing the results based upon factor groups yielded surprising results. The significant effect of building features such as the building's typology, its type of use and the quality of its entrance, remained present in all models that were tried. Whereas the proportion of location effects changed. This specifically showed to be true for after-crisis periods in which most building features were more significant compared to location features. These results supported the hypothesis in which the impact of building features on the net rental income is stated.

Based on the results it can be derived that an office building is essentially acknowledged for its true purpose: supporting the business processes taking place within the property. It are exactly such office buildings that are aligned with the tenant's needs, increasing the tenant's willingness to pay, and thereby the overall financial performance of the property.

The results show the strongest financial performance of urban office types. Such offices strongly outperform other types such as pavilions and basic offices. Complex offices show an underperformance over the entire measurement period. Therefore it is safe to say that such office are to have a minor role within a real estate portfolio. Whereas the difference between urban and high-rise offices is minimal in pre-crisis periods this difference becomes substantial in after-crisis periods. It is likely that high-rise offices are located at locations with high exposure and therefore are more vulnerable to market tendencies and speculative influences.

Properties with layouts that are adjustable with some effort show a better financial performance compared to offices with easily adjustable layouts. It is likely that this result is

related to the outperformance of multi-tenant offices by single tenant offices. Single tenant offices only need the layout to be flexible regarding an 'office level'. It must be possible to change between office typologies. However, multi-tenant offices need to be flexible both regarding the 'office-level' as well as the 'building level'. Since in the end it has to be possible to divide an entire building into different individual units. Furthermore it is likely that users do demand a certain extend of flexibility but are not willing to achieve this at all costs. At some point the monumental/static appearance of the building prevails over a more artificial appearance of highly flexible buildings.

As stated in the previous paragraph, single tenant offices have shown a significant higher financial performance compared to multi-tenant offices. It is likely that this effect is related to the high performance of offices outside the Randstad area. The best performing single tenant offices are located in bigger cities outside the Randstad (i.e. Zwolle, Deventer, Ede). Furthermore the single tenant offices are relatively small. Probably tenants in these areas are less likely to relocate to achieve an higher exposure in the Randstad. Since these benefits do not weight up against higher rents. Furthermore, such smaller tenants can be considered as loyal and tend to continue the rental contract. The fact that the single tenant offices consequently outperform multi-tenant offices over a period of 14 years supports the statement that this effect is lasting.

Determining the quality of an office building is largely based upon the extent to which the building's entrance is appealing. The charisma of the entrance from inside showed to be a significant feature with regard to the net rental income. This can be explained by the fact that the building's entrance conveys the organisation's message. The first impressions of the visitor are formed when entering the building. Therefore the entrance should be attractive and make the visitor feel comfortable while waiting.
The same effects did not appear to be true regarding the charisma of the entrance from the outside. It seems that the outside merely functions as façade and is considered to be less important for the impressions of people passing by.

Age is, as was to be expected, an important building feature that is to influence the building's financial performance. The most logical explanation for this relationship is the fact that the intrinsic value of the property depreciates as a result of deterioration. As a result of the building's age it becomes more demanding in its maintenance activities. Construction technologies that used to be acceptable in the past (i.e. glazing) do not live up to the current standards anymore and have to be replaced. Other building aspects that are still acceptable have stopped working (i.e. sewer systems) and have to be replaced. In the end a combination of such maintenance activities has a significant impact on the net rental income.
Nevertheless it is possible that ageing has a positive effects due to the monumental value or architectural style of the property. Such properties are typically located in old city centres (i.e. canals Amsterdam). Unfortunately the portfolio of NSI did not incorporate a significant share of such properties. Therefore the impact of architectural styles and monumental value on the building's net rental income should be subject to further research.

Characteristics regarding the office's environmental performance turned out to be too insignificant to formulate any statements regarding the impact of sustainability on the net rental income. Both the building's energy label as well as specific climate control system (i.e. ventilation/heating systems) did not significantly influence the financial performance. This can be explained considering the fact that attention for the building's sustainability is rather young. Therefore the impact on the portfolio is not yet visible. It probably takes a few years for sustainability factors to have a visible impact on the financial performance of an office building.

Finally, it showed to be such that the building features as discussed in this chapter have an unmistakable impact on the net rental income in both pre-crisis as well as after-crisis periods. Furthermore it turned out that the performance of offices at office parks was similar to the performance of office in urban regions in pre-crisis periods. In after-crisis periods urban office types significantly outperformed offices at office parks. The same accounts for offices in less urbanised areas which outperformed offices in highly urbanised area in after-crisis periods. An explanation for these developments might be that more backward areas are less exposed to market turmoil. Prices do not significantly rise in cases of shortage and therefore are less inclined to drop when economic tendencies change. This is reinforced by the fact that impact of building features, such as building typology and entrance, increases in after-crisis periods compared to pre-crisis periods.

7.1.4 Implementations into an asset acquisition strategy

Ultimately the sub-question has to be answered in which the results are translated into a tangible advice to the real estate industry. What are the implications of the results and how can they be implemented into an institutional real estate investor's acquisition strategy?

Based upon the results of the analysis and the quality of the dataset, it can be concluded that both in pre-crisis as well as after crisis periods building features should have a central role in the decision-making process. As stated before this only applies to properties which are located outside A^+ locations.

Combining the numerous findings of this research results into an optimal office building based upon the following characteristics. The building is to have an attractive entrance. Whereas it should be recognisable from the outside (medium attractive), it is very important that the inside provides a comfortable environment for visitors. The building should be adjustable, however not necessarily highly flexible. This is due to the fact that a single tenant will be renting the building. This building is situated in one of the bigger cities outside the Randstad area. To illustrate the difference in financial performance two office buildings (Fig. 7.1) from the portfolio of NSI have been chosen with totally different characteristics. One building has the characteristics of an optimal office building whereas the other has completely opposite characteristics (Table 7.1).

Building characteristics	**Horapark, Ede**	**Hanzeweg, Gouda**
		
Average Quarterly Net Rental Income (€/m^2)	31,1	10,9
Number of Residents	108.763	71.235
Relation towards the Randstad	Outside Randstad	Inner Randstad
Charisma of the entrance from inside	Attractive	Unattractive
Building typology	Basic	Complex
Type of use	Single tenant	Multi-tenant
Adjustability of layout	Medium adjustable	Very adjustable
Age (years, in 2013)	10	27

Table 7.1. Financial performance of offices with opposite building characteristics.

Fig 7.1 Quarterly net rental income of office buildings with good vs. poor building characteristics.

Obviously the impact of building features does not mean that location factors have become redundant. This study simply shows that there must be an increasing awareness of the importance of building features. Decision-making criteria should go beyond the building's location and has to focus on the intrinsic building quality as well. Such criteria can after all be used to optimise an acquisition strategy in both booming as well as stagnating economic cycles.

7.1.5 Link with existing insights

Due to the type of data that has been used in this study, and the geographical dispersion of the office properties, it is difficult to make a direct comparison with classical studies of the real estate market. Since such studies tend to focus on one big city or an agglomeration of offices within one region. Nevertheless certain parallels with such studies can be drawn. Similar conclusions regarding the impact of age on the financial performance are found.

A similar study was conducted by Gijselaar (2009) which is suitable for comparison. The impact of building characteristics that was found in that study is confirmed in this research. Similar conclusions regarding the impact of the building's entrance, building's typology and type of use can be drawn. Nevertheless the importance of distance to transportation and number of floors that was found in that study is rejected in this research.

It was said that real estate investors tend to base their decision-making criteria upon their gut feeling. This indicated that a certain awareness of the impact of building characteristics was present. Even though a sound rational base for these decisions was lacking. From that perspective this research significantly adds knowledge to existing insights and expectations. Finally most studies focus on A^+ locations and therefore a lot of information is available regarding such properties. However, relative little information was available regarding the impact of offices outside A^+ locations. It seems that the importance of such locations is underestimated and therefore this study provides both provoking and new conclusions.

7.2 Restrictions and limitations

As is the case in all academic studies they are bound by restrictions and limitations. Due to the lack of data, time reservations and the lack of transparency certain aspects were impossible to do research for. This paragraph points out the restrictions and limitations of this study.

The fact that NSI does not own any properties at A^+ locations has been touched upon before. Therefore the results of this research are only applicable to Dutch office buildings outside A^+ locations.

Furthermore the portfolio of NSI consists of a number of buildings that were acquired during one single transaction (VastNed). Such buildings are usually tend to have similar building characteristics. Although an analysis of such properties confirmed their diversity it might still have had an impact on the financial performance of office buildings in that category.

Due to the large diversity of the dataset is has been difficult to find extensive literature to confirm the results. Only one comparable study, that directly related to this research, was performed in the past (Gijselaar, 2009). Although the size of the dataset was high, and therefore its quality, the lack of multiple direct comparable scientific papers has a diminishing effect on the conclusions. The effects of suitability have been studied however no conclusive statements could be made. This is due to the combination of scarce information and a rather 'young' focus on sustainability. It probably takes more time before the effects of sustainability are truly visible in a real estate portfolio.

Consequently it was chosen to incorporate certain variables on a quarterly base (i.e. AGE, ABSM2 and VAC_RAT). This has been done to align the data with the quarterly measurements of the net rental income and to make the data comparable with previous research (Gijselaar, 2009). However, it must be noted that strictly seen these variables are reported on an annual (AGE) or semi-annual (ABSM2, VAC_RAT) bases. Therefore they have been divided by respectively four and two to fit the quarterly measurements. Since, this is strictly seen incorrect, it is advised not to report these variables on a quarterly bases in future studies.

Finally the way in which certain variables have been measured is subject to subjectivity (i.e. CHAR_ENTR_IN). The assessment of such variables is based upon the professional judgement of two real estate managers. Although they are seen as experts their judgement is still made based upon their 'best estimate' and therefore the quality of the data might be reduced.

7.3 Recommendations for further research

Based upon the results of this study several recommendations can be made. This paragraph will elaborate on both recommendations for further research as well as specific recommendations to NSI.

First of all it is recommended for NSI to repeat this study every three to five years. Rental contracts will expire (Fig 7.2) and market circumstances are ever changing. The impact of economic features on the building's financial performance can be questioned if rental contracts are fixed for a long period of time. After all, the rental contract remains valid regardless of economic changes.

However, if a similar study is performed over an extensive period of time, the impact of (excessive) expiring contract or economic bubbles is incorporated. Building features that remain significant during periods of economic turmoil and other changes in its environment can truly be considered as performance indicators.

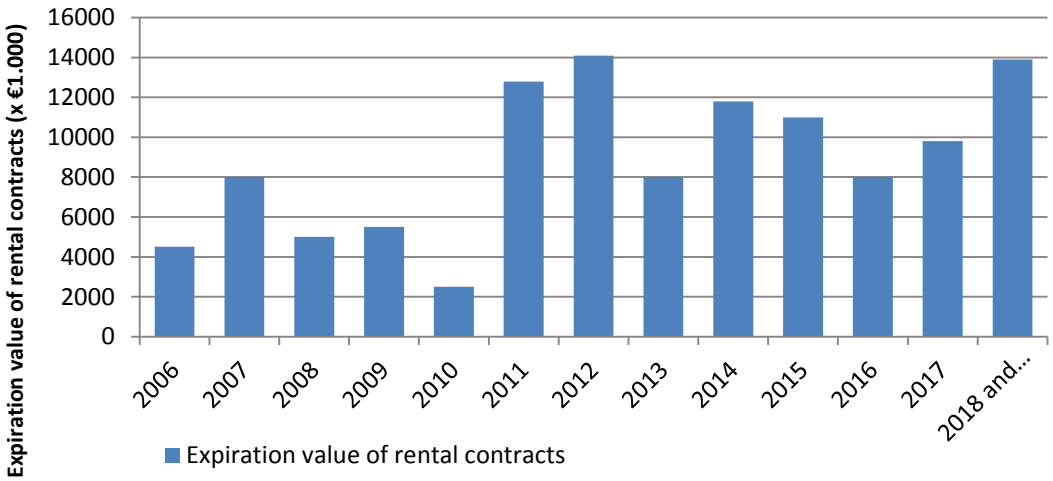
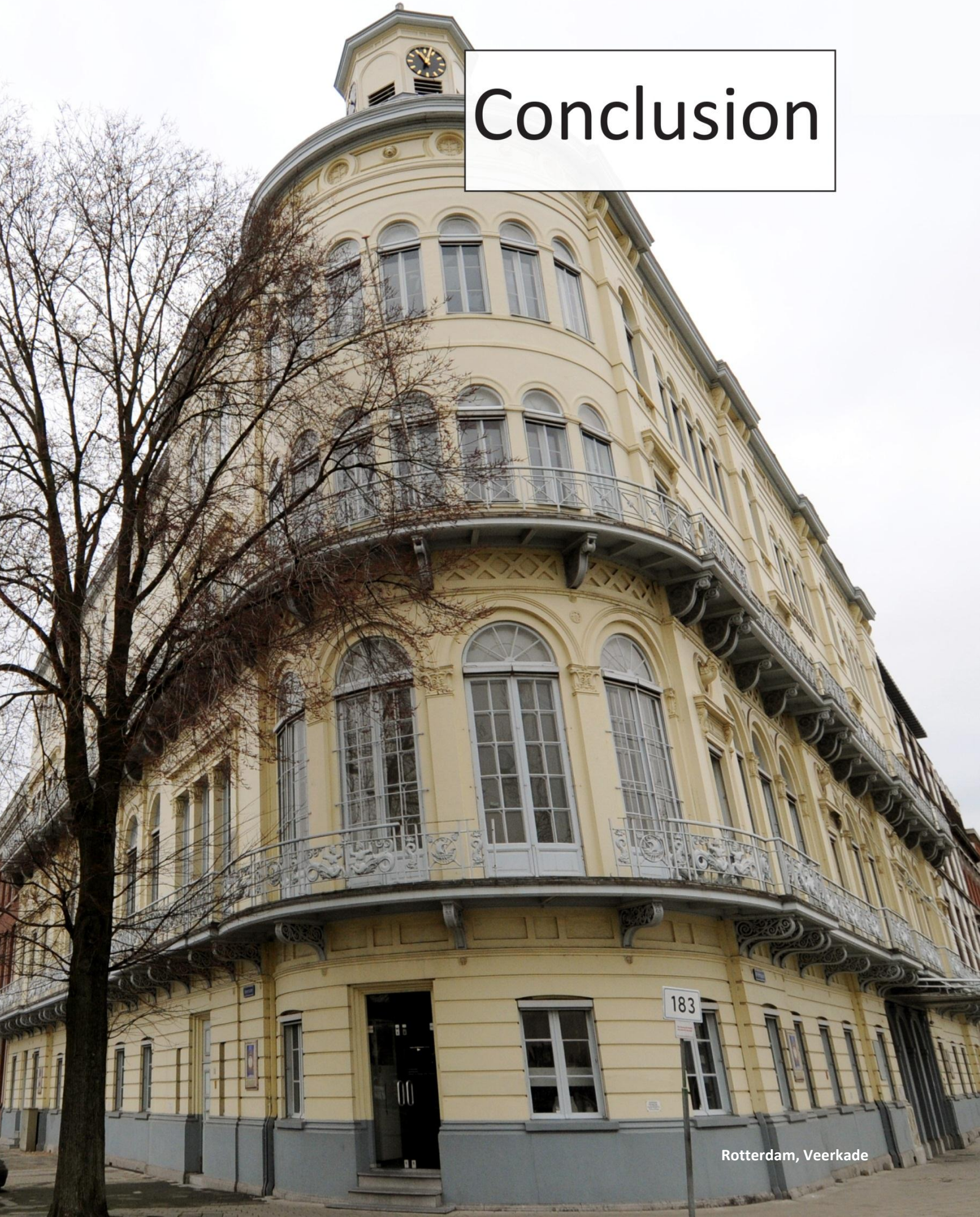


Figure 7.2 Expiration value of office rental contracts (Nieuwe Steen Investments, 2013).

Consequently the exact impact of building features on office buildings at A^+ locations remains unknown. Therefore it would be interesting for further research to incorporate such office locations in a similar study.

Furthermore the impact of sustainability on an office building's financial performance was considered insignificant. However, the continuing social debate regarding sustainability would suggest otherwise. In a couple of years additional research into this topic is needed. By that time, the effects of sustainability on a real estate portfolio should have become visible.

Conclusion



Rotterdam, Veerkade

8 Conclusion

The goal of this research was to provide rational grounds to the function of office building features, at a property level, within an institutional real estate investor's acquisition strategy. By doing so a tangible advice to the real estate industry could be given. Therefore the hypothesis was formulated in which the building features were expected to have such an important role in the financial performance of an office building, that they should be part of the investor's real estate strategy.

In the end it can be concluded that both pre-crisis and after-crisis office building features are of such importance to the building's financial performance that they have to be incorporated into the decision-making process. Many real estate professionals already had a certain awareness that such building factors existed. However, frequently decision-making took place based upon their gut feeling. This research confirmed these presumptions. It provides tangible features that can be used to optimise the building's financial performance and improve the decision-making process.

Questioning the importance of location, as an indicator for the financial performance of a property was not the main goal of this study. Nevertheless the results showed a clear distinction between performance in cities and in backward areas. This is interesting in relation to the user's willingness to pay. It enhances the fact that an office building is primarily meant to support the tenant in exercising its business. Therefore the building should enhance this process and by doing so increase the tenant's willingness to pay.

The building characteristics that have shown to be the most relevant indicators for the financial performance of an office building all related to its physical nature (i.e. entrance, building type). Nevertheless, non-physical factors such as the using typology were found to have a positive impact as well. It turned out that such building features remained significant regardless of the economic environment. Where the significance of these building features is even slightly bigger in after-crisis periods compared to pre-crisis periods.

A rather limited amount of comparable studies is available regarding the Dutch office market. It is crucial that similar studies are performed on different real estate portfolios. The results of this research have to be tested against such studies to improve the conclusions that are drawn and to enhance the implications for real estate industry.

9 Reflection

During my academic career in Delft I have always had a keen interest in finance. This graduation topic has given me the opportunity to combine my personal interest with a real estate perspective. A research angle that is often being patronised by the faculty of Architecture. However, it provides the possibly to bridge the gap between academic research and corporate demands.

As such I eagerly kicked off in analysing existing studies and scanning the market. Soon it became clear that I wanted the research to yield tangible results and clearly build upon existing studies. Although this might have narrowed my vision, it provided me with the necessary energy and persevering attitude to sink my teeth into it.

Performing a quantitative study on this topic proved to be a challenging task. Classified data regarding the financial performance of office buildings, in combination with a wide range of technical details was needed. Eventually NSI was willing to provide the necessary support in composing my database. The most significant misconception I came across is the availability and uniformity of data. It took numerous visits to different departments within NSI to gather the required data. Furthermore many hours of restructuring and revising excel sheets were needed to reassure the uniformity of the data. Nevertheless it turned out to be worth going the extra mile, since it yielded many surprising and interesting findings.

I would recommend all students to search for a graduation project outside the direct universities' scope. Performing your master thesis within a corporate environment is highly educational from both a personal and professional point of view. The combination of professional and academic feedback is immensely valuable to the quality of one's report. Furthermore a piece of advice to all students would be to start writing immediately. Obviously the analysis is the most interesting and satisfying aspect of a graduation project. Nevertheless, all findings and the decision that have been made need to be written down in a comprehensive manner. The easiest way to achieve this is to put it on paper the moment that you come across such findings.

This graduation project has been instructive in many ways. I have explored the real estate investment industry and analysed the Dutch office market. Conversations with colleagues at NSI have been a huge contribution to this. Finally this graduation project provided me with the opportunity to look behind the scenes. I could have had no better orientation regarding my future participation on the labour market.

Personally I have experienced the graduation process to be intensive yet satisfying. I have grown on a personal as well as academic level. Throughout the last semester I have come across many challenges and have succeeded in coping with them. Beforehand I was determined to stick to my graduation planning and deliver a high-quality report. Personally I can conclude that I am satisfied with the targets that I had formulated. Hopefully many following students are triggered by this research and can experience a similar graduation project.

10 List of figures and tables

Figures

Tables

11 Definitions and abbreviations

CBS
Centraal Bureau voor Statistiek – Central Office for Statistical Data in the Netherlands.

Closed-end fund
A closed-end fund is a collective investment scheme with a limited number of shares.

Correlation coefficient
Statistical measure of the correlation strength between two variables or datasets. The coefficient varies between -1 and +1 with -1 indicating a purely negative correlation (one set of data is the exact negative proportion of the other set) and +1 indicating a purely positive correlation. The weaker the relationship is between the two sets of data, the closer the coefficient will be to zero.

Dependent variable / Independent variable
In an experiment, the independent variable is the variable that is varied or manipulated by the researcher, and the dependent variable is the response that is measured. An independent variable is the presumed cause, whereas the dependent variable is the presumed effect.

Direct return
A percentage value for the total return that is created by an operation's income from property, a fund or an account. In case of real estate the direct returns are reflected by the properties rental income.

Diversification
Including a variety of securities with different risk, reward, time-frames and correlation statistics in one single portfolio.

Hedge
In finance, a hedge is a position established in one market in an attempt to offset exposure to price fluctuations in some opposite position in another market with the goal of minimizing one's exposure to unwanted risk.

Hedonic regression model
In economics, hedonic regression, also hedonic demand theory is a revealed preference method of estimating demand or value. It decomposes the item being researched into its constituent characteristics, and obtains estimates of the contributory value of each characteristic.

Indirect Real Estate
Investing in real estate without actually investing in the asset. Indirect investment can be done in many ways and varieties, including securities, funds, or private equity. Most investors interested in indirect investment would do so through a company or advisor who has experience in this type of investing (a so called portfolio manager).

Indirect return
The increase in an asset's market price, also called capital appreciation or gain.

Lag
A valuation error caused by valuers using 'old' comparables that fail to mirror market conditions, at the time of valuation.

Listed-fund
In an experiment, the independent variable is the variable that is varied or manipulated by the researcher, and the dependent variable is the response that is measured. An independent variable is the presumed cause, whereas the dependent variable is the presumed effect.

Open-end fund
An open-end(ed) fund is a collective investment scheme, which can issue and redeem shares at any time. An investor will generally purchase shares in the fund directly from the fund itself rather than from the existing shareholders. It contrasts with a closed-end fund, which typically issues all the shares it will issue at the outset, with such shares usually being tradable between investors thereafter.

P-value
The p-value is a measure for the significance of a regression variable. As part of the regression output, it represents the probability that the regression coefficient for the variable in question is actually 0 (insignificant in a regression model). Ideally, the p-value is to be as close to 0 as possible to ensure coefficient/variable significance. As part of a t-test, the p-value is the probability that the null hypothesis is true; the null hypothesis is usually rejected if the p-value is lower than 0.05 (less than 5% chance the null hypothesis is true).

Smoothing
In the context of appraisal-based property series this is an under-measurement of 'true' variance. Or bias of time series second moments toward zero.

Standard deviation
The square root of the variance. A measure of dispersion of a set of data from its mean.

Total return
This is the sum of the income return and the capital growth. Total return is generally considered a better measure of an investment's return than income return alone.

Value-add fund
Value-added or opportunity-style investment funds seek to acquire portfolios of commercial properties with the potential for significant value creation over a shorter-term time horizon. Objectives may include "value-added" opportunities for capital appreciation and income potential in markets with higher volatility, lower barriers to entry and high growth potential for the more risk-tolerant investor.

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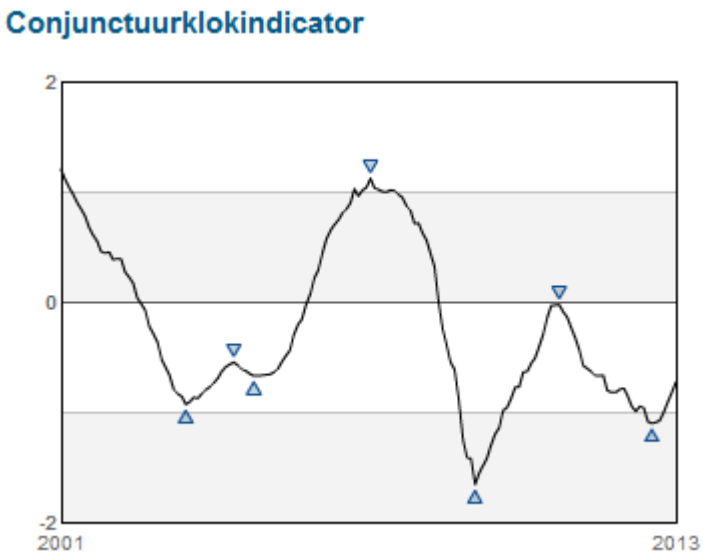
- www.jll.com
- www.ingrealestate.com

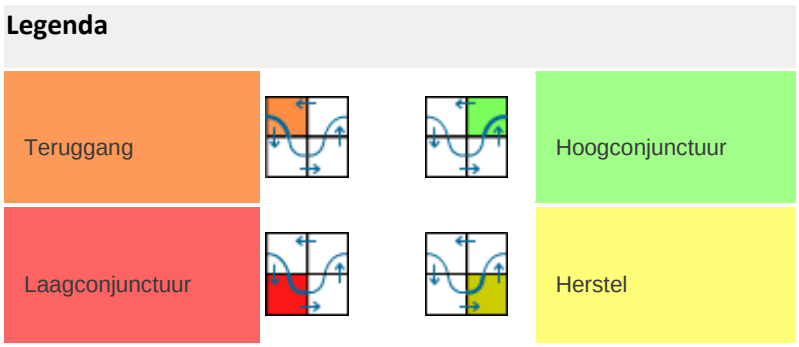
14 Appendices

14.1 Appendix I: Dutch inflation rates

Year:	Inflation percentage:
2000	2.6%
2001	4.5%
2002	3.4%
2003	2.1%
2004	1.2%
2005	1.7%
2006	1.1%
2007	1.6%
2008	2.5%
2009	1.2%
2010	1.3%
2011	2.3%
2012	2.5%

14.2 Appendix II: Dutch economic growth and decline phases





14.3 Appendix III: Survey office building features

Enquête Kantoor gebouw eigenschappen

Complex ID:
Naam:
Adres:
Stad:
Commercieel Manager:
Technisch Manager:

A. Gevelmateriaal	1. Glas 2. Baksteen 3. Pleisterwerk 4. Natuursteen 5. Beton 6. Metaal 7. Verschillende materialen
B. Gebouwtype	1. Hoogbouw (meer dan 8 verdiepingen) 2. Complex (meerdere bouwdelen in laagbouw) 3. Paviljoen (klein kantoor met maximaal 3 verdiepingen) 4. Stedelijk (ingebouwd in straatbeeld) 5. Standaard (niet gelijk aan de andere types)
C. Vorm	1. Rechthoekig 2. Scherpe hoeken 3. Ronde vormen
D. Kantoorconcept	1. Cellenkantoor 2. Kantoortuin 3. Groepskantoor 4. Kloosterkantoor 5. Combikantoor
E. Lay-out	1. Huiselijk 2. Lineair 3. Diepe plattegrond 4. Complex
K. Flexibiliteit	1. De kantoor plattegrond is bijna niet aan te passen. 2. De kantoor plattegrond is met moeite aan te passen. 3. De kantoor plattegrond is gemakkelijk aan te passen.
F. Uitstraling entree buitenkant (buitenkant)	1. Aantrekkelijk 2. ….. 3. Onaantrekkelijk
G. Uitstraling entree (binnenkant)	1. Aantrekkelijk 2. ….. 3. Onaantrekkelijk
H. Verhuur	1. Single tenant 2. Multi tenant met gedeelde faciliteiten 3. Multi tenant zonder gedeelde faciliteiten
I. Andere functies in het gebouw behalve kantoor	1. Ja 2. Nee
J. Omgeving locatie	1. Kantorenpark 2. Industrieterrein 3. Stadscentrum 4. Woonwijk

14.4 Appendix IV: SPSS script of hedonic pricing model

```
MIXED NIM2 BY ENTR_CHAR_IN BUILD_TYP USE_2 FLEX WITH TIME ABSm2X DIS_PT NUMRES
NR_FL AGE VAC_RAT
/CRITERIA=CIN(95) MXITER(200) MXSTEP(10) SCORING(1) SINGULAR(0.000000000001)
HCONVERGE(0,
 ABSOLUTE) LCONVERGE(0, ABSOLUTE) PCONVERGE(0.000001, ABSOLUTE)
 /FIXED=TIME ABSm2X DIS_PT NUMRES NR_FL AGE ENTR_CHAR_IN BUILD_TYP USE_2 FLEX |
SSTYPE(3)
 /METHOD=REML
 /PRINT=LMATRIX SOLUTION TESTCOV
 /RANDOM=INTERCEPT | SUBJECT(ID) COVTYPE(ID)
 /RANDOM=INTERCEPT | SUBJECT(DTZ_REG*ID) COVTYPE(ID)
 /REPEATED=TIME | SUBJECT(DTZ_REG*ID) COVTYPE(AR1).
```

14.5 Appendix V: SPSS script of a similar model as Gijselaar (2009)

```
MIXED NIm2 BY ENTR_CHAR_IN BUILD_TYP USE_2 FLEX WITH TIME VAC_RAT ABSm2 DIS_PT
NUMRES NR_FL AGE
 /CRITERIA=CIN(95) MXITER(100) MXSTEP(10) SCORING(1) SINGULAR(0.000000000001)
HCONVERGE(0, ABSOLUTE) LCONVERGE(0, ABSOLUTE) PCONVERGE(0.000001, ABSOLUTE)
 /FIXED=TIME VAC_RAT ABSm2 DIS_PT NUMRES ENTR_CHAR_IN BUILD_TYP USE_2 FLEX
NR_FL AGE | SSTYPE(3)
 /METHOD=ML
 /PRINT=LMATRIX SOLUTION TESTCOV
 /RANDOM=INTERCEPT | SUBJECT(ID) COVTYPE(ID)
 /REPEATED=TIME | SUBJECT(ID) COVTYPE(AR1)
 /EMMEANS=TABLES(OVERALL)
 /EMMEANS=TABLES(ENTR_CHAR_IN) COMPARE ADJ(LSD).
```

14.6 Appendix VI: SPSS script of final model

```
MIXED NIm2 BY ENTR_CHAR_IN BUILD_TYP USE_2 FLEX WITH TIME VAC_RAT ABSm2 DIS_PT
NUMRES NR_FL AGE
  /CRITERIA=CIN(95) MXITER(100) MXSTEP(10) SCORING(1) SINGULAR(0.000000000001)
HCONVERGE(0, ABSOLUTE) LCONVERGE(0, ABSOLUTE) PCONVERGE(0.000001, ABSOLUTE)
  /FIXED=TIME TIME*TIME DIS_PT NUMRES ENTR_CHAR_IN BUILD_TYP USE_2 FLEX NR_FL
AGE | SSTYPE(3)
 /METHOD=ML
 /PRINT=LMATRIX SOLUTION TESTCOV
 /RANDOM=INTERCEPT | SUBJECT(ID) COVTYPE(ID)
 /REPEATED=TIME | SUBJECT(ID) COVTYPE(AR1)
 /EMMEANS=TABLES(OVERALL)
 /EMMEANS=TABLES(ENTR_CHAR_IN) COMPARE ADJ(LSD).
```

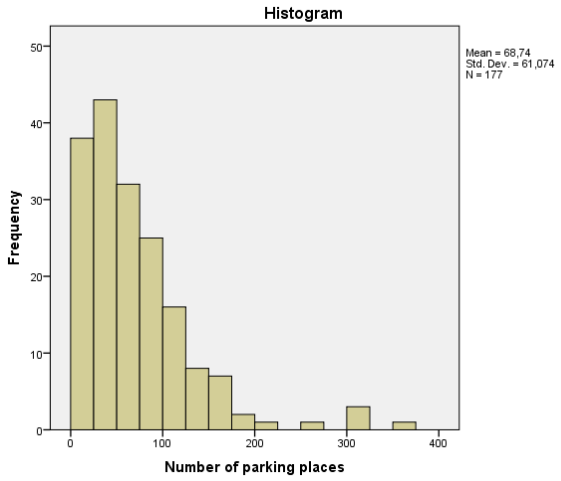
14.7 Appendix VII: Descriptive statistics of location features

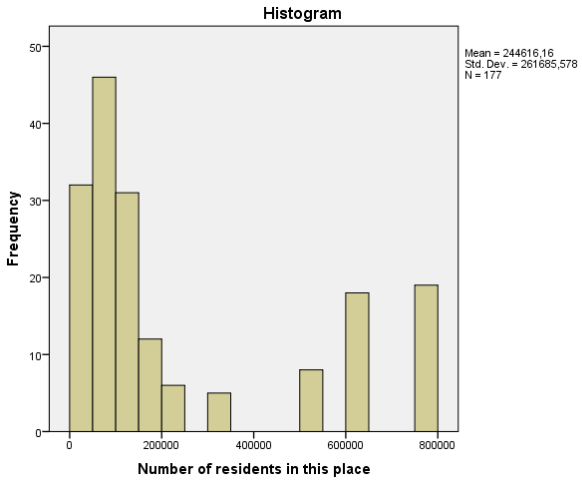
Frequency tables of location variables

RANDSTAD		Frequency	Percent
	Large 4	50	28,1
	Inner randstad	53	29,8
	Peripheral randstad	46	25,8
	Backward area	28	15,7
	Total	177	99,4
Missing	System	1	,6
Total		178	100,0

URB_CLASS		Frequency	Percent
	Very strong urbanised	62	34,8
	Strong urbanised	69	38,8
	Medium urbanised	35	19,7
	Less urbanised	11	6,2
	Total	177	99,4
Missing	System	1	,6
Total		178	100,0

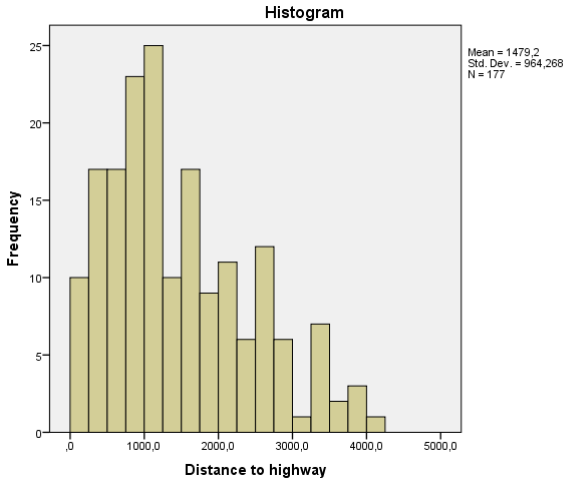
LOC_SUR		Frequency	Percent
	Office Park	84	47,2
	Industrial Zone	49	27,5
	Town Centre	29	16,3
	Residential Area	15	8,4
	Total	177	99,4
Missing	System	1	,6
Total		178	100,0

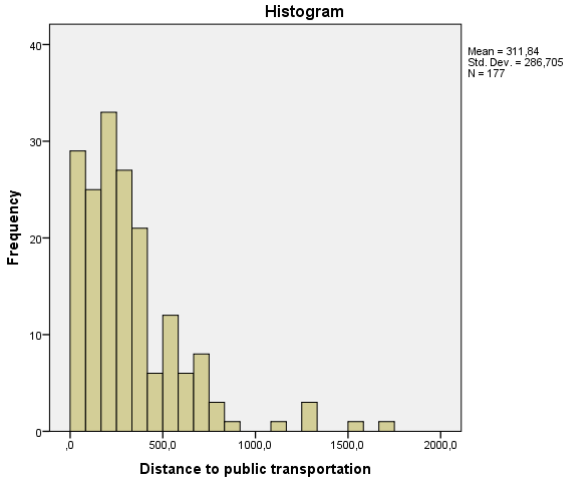


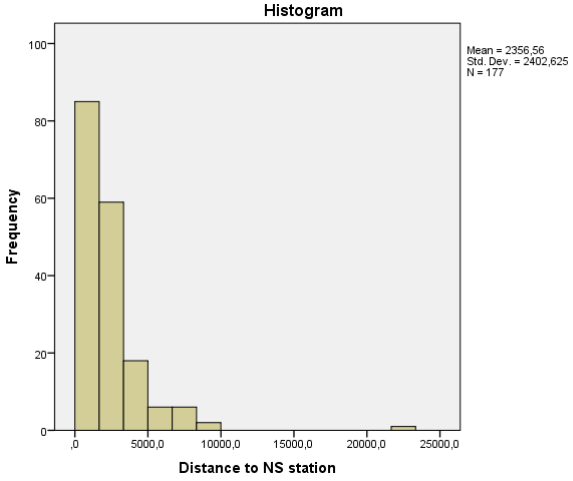


Descriptive Statistics

	N	Minimum	Maximum	Sum	Mean	Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
PP	177	0	365	12167	68,74	61,074	3730,080	2,018	,183	5,758	,363
PN	137	18	2695	12603	91,99	231,374	53533,831	10,645	,207	120,058	,411
NUMRES	177	9024	790110	43297061	244616,16	261685,578	68479341799,195	1,132	,183	-,320	,363
DIS_PT	177	,0	1700,0	55196,0	311,842	286,7052	82199,850	1,926	,183	5,458	,363
DIS_HW	177	61,0	4213,0	261819,0	1479,203	964,2684	929813,561	,739	,183	-,252	,363
DIS_NS	177	147,0	23038,0	417111,0	2356,559	2402,6248	5772606,100	4,280	,183	30,998	,363
Valid N (listwise)	137										







14.8 Appendix VIII: Descriptive statistics of building features

Frequency tables of building variables

BUILD_TYPE		Frequency	Percent
	High Rise	12	6,7
	Complex	40	22,5
	Pavilion	41	23,0
	Urban	18	10,1
	Basic	66	37,1
	Total	177	99,4
Missing	System	1	,6
Total		178	100,0

ENTR_CHAR_IN		Frequency	Percent
	Attractive	48	27,0
	Medium Atr.	68	38,2
	Unattractive	59	33,1
	Total	175	98,3
	-9	2	1,1
Missing	System	1	,6
	Total	3	1,7
Total		178	100,0

ENTR_CHAR_OUT		Frequency	Percent
	Attractive	59	33,1
	Medium Atr.	53	29,8
	Unattractive	63	35,4
	Total	175	98,3
	-9	2	1,1
Missing	System	1	,6
	Total	3	1,7
Total		178	100,0

HYBRID		Frequency	Percent
	Yes	27	15,2
	No	150	84,3
	Total	177	99,4
Missing	System	1	,6
Total		178	100,0

USE_2		Frequency	Percent
Valid	Single Tenant	74	41,6
	Multi Tenant	100	56,2
	Total	175	98,3
Missing	-9	2	1,1
	System	1	,6
	Total	3	1,7
Total		178	100,0

FAC_MAT		Frequency	Percent
Valid	Glass	13	7,3
	Bricks	93	52,2
	Plaster	3	1,7
	Natural Stone	10	5,6
	Concrete	17	9,6
	Steel	21	11,8
	Mixed Use	20	11,2
	Total	177	99,4
Missing	System	1	,6
Total		178	100,0

FAC_SHAPE		Frequency	Percent
Valid	Rectangular	145	81,5
	Acute Angles	17	9,6
	Round Shapes	15	8,4
	Total	177	99,4
Missing	System	1	,6
Total		178	100,0

VOLUME		Frequency	Percent
Valid	Box	80	44,9
	L-Shape	30	16,9
	T-Shape	7	3,9
	X-Shape	2	1,1
	Multiple Rectangles	37	20,8
	Round	8	4,5
	Sharp	13	7,3
	Total	177	99,4
Missing	System	1	,6
Total		178	100,0

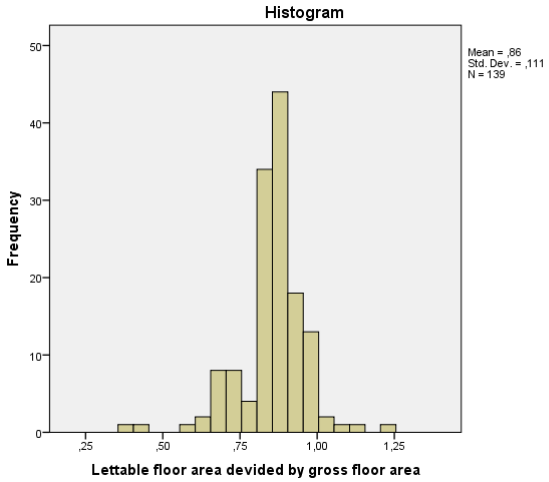
FLEXIBILITY		Frequency	Percent
	Not Adjustable	21	11,8
	Medium Adjustable	53	29,8
	Very Adjustable	101	56,7
	Total	175	98,3
	-9	2	1,1
Missing	System	1	,6
	Total	3	1,7
Total		178	100,0

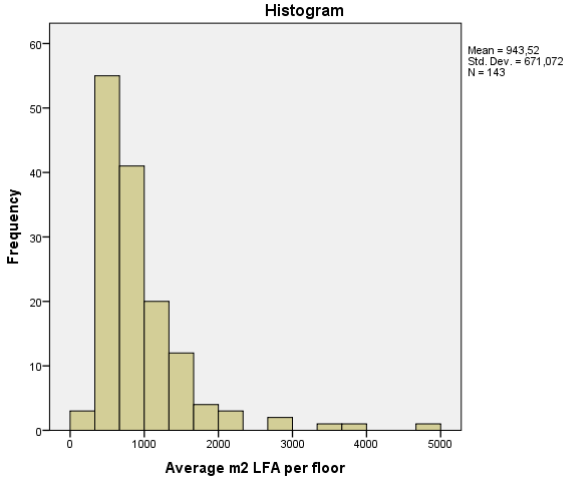
SPAT_LAY		Frequency	Percent
	Domestic	53	29,8
	Spinal	87	48,9
Valid	Deep Plan	22	12,4
	Complex	13	7,3
	Total	175	98,3
	-9	2	1,1
Missing	System	1	,6
	Total	3	1,7
Total		178	100,0

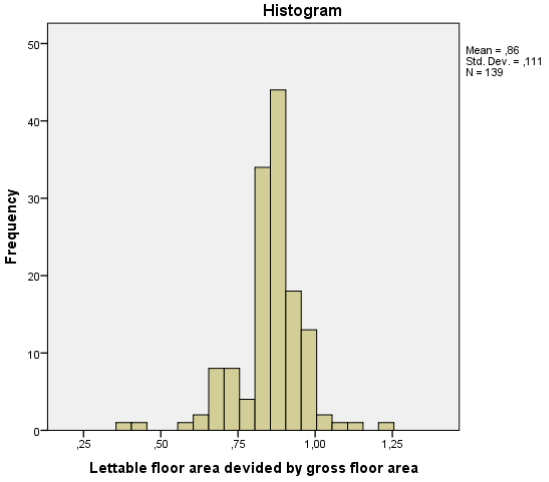
FREE		Frequency	Percent
	Yes	144	80,9
Valid	No	33	18,5
	Total	177	99,4
Missing	System	1	,6
Total		178	100,0

Descriptive Statistics

	N	Minimum	Maximum	Sum	Mean	Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
NR_FL	177	1	21	766	4,33	2,196	4,824	3,435	,183	20,259	,363
Average m2 LFA per floor	143	198	4885	134924	943,52	671,072	450337,237	2,920	,203	11,567	,403
LFA / GFA ratio	139	,38	1,23	119,50	,8597	,11132	,012	-,914	,206	4,004	,408
Valid N (listwise)	139										







14.9 Appendix IX: Results final model

Model Dimension[a]

		Number of Levels	Covariance Structure	Number of Parameters	Subject Variables	Number of Subjects
Fixed Effects	Intercept	1		1		
	TIME	1		1		
	TIME * TIME	1		1		
	DIS_PT	1		1		
	NUMRES	1		1		
	ENTR_CHAR_IN	3		2		
	BUILD_TYP	5		4		
	USE_2	2		1		
	FLEX	3		2		
	NR_FL	1		1		
	AGE	1		1		
Random Effects	Intercept	1	Identity	1	ID	
Repeated Effects	TIME	55	First-Order Autoregressive	2	ID	173
Total		76		19		

a. Dependent Variable: Net Income per m2 of the property.

Estimates of Covariance Parameters[a]

Parameter		Estimate	Std. Error	Wald Z	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Repeated Measures	AR1 diagonal	149,820987	3,159126	47,425	,000	143,755416	156,142487
	AR1 rho	,300811	,013492	22,296	,000	,274142	,327017
Intercept [subject = ID]	Variance	38,300381	5,190169	7,379	,000	29,366682	49,951818

a. Dependent Variable: Net Income per m2 of the property.

Estimates[a]

Mean	Std. Error	df	95% Confidence Interval	
			Lower Bound	Upper Bound
24,286[b]	,886	192,521	22,538	26,034

a. Dependent Variable: Net Income per m2 of the property.

b. Covariates appearing in the model are evaluated at the following values: TIME = 32,64, DIS_PT = 313,989, NUMRES = 238954,90, NR_FL = 4,34, AGE = 17,93.

Estimates of Fixed Effects[a]

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	22,264826	2,229247	212,080	9,988	,000	17,870506	26,659146
TIME	-,064438	,062940	1447,237	-1,024	,306	-,187901	,059026
TIME * TIME	-,003776	,001000	1410,654	-3,777	,000	-,005737	-,001815
DIS_PT	-,000953	,001907	168,824	-,500	,618	-,004718	,002811
NUMRES	3,843E-006	2,258E-006	166,772	1,702	,091	-6,158E-007	8,301E-006
[ENTR_CHAR_IN=1]	8,979973	1,434406	165,403	6,260	,000	6,147868	11,812079
[ENTR_CHAR_IN=2]	2,402188	1,319066	168,060	1,821	,070	-,201887	5,006262
[ENTR_CHAR_IN=3]	0[b]	0	.	.	.	.	.
[BUILD_TYP=1]	-,643433	3,037024	165,287	-,212	,832	-6,639795	5,352929
[BUILD_TYP=2]	-2,061756	1,437878	164,986	-1,434	,153	-4,900770	,777257
[BUILD_TYP=3]	,485139	1,466546	167,456	,331	,741	-2,410163	3,380442
[BUILD_TYP=4]	8,682604	2,272615	170,119	3,821	,000	4,196445	13,168762
[BUILD_TYP=5]	0[b]	0	.	.	.	.	.
[USE_2=1]	4,016843	1,227801	172,314	3,272	,001	1,593377	6,440308
[USE_2=2]	0[b]	0	.	.	.	.	.
[FLEX=1]	-1,785691	1,994726	166,165	-,895	,372	-5,723965	2,152584
[FLEX=2]	2,649016	1,328871	174,099	1,993	,048	,026246	5,271786
[FLEX=3]	0[b]	0	.	.	.	.	.
NR_FL	,344490	,372267	162,814	,925	,356	-,390604	1,079584
AGE	-,075314	,022157	189,936	-3,399	,001	-,119018	-,031609

a. Dependent Variable: Net Income per m2 of the property.

b. This parameter is set to zero because it is redundant.

14.10 Appendix X: Correlation coefficients between building features

Correlations

Spearman's rho		Building typology	Charisma of the building's entrance from inside	Charisma of the building's entrance from outside	Facade material of the property	Free standing	Flexibility in lay-out of the property	Shape of the building's facade	Spatial layout of the property	Shape of the footprint of the building	USE_2
BUILD_TYPE	Correlation Coefficient	1,000	-,135**	-,112**	-,065**	-,083**	-,033**	-,091**	-,031**	,043**	-,049**
	Sig. (2-tailed)	.	,000	,000	,000	,000	,001	,000	,002	,000	,000
	N	9735	9625	9625	9735	9735	9625	9735	9625	9735	9625
CHAR_IN	Correlation Coefficient	-,135**	1,000	,835**	,106**	,114**	-,032**	-,152**	-,031**	-,065**	,039**
	Sig. (2-tailed)	,000	.	,000	,000	,000	,002	,000	,003	,000	,000
	N	9625	9625	9625	9625	9625	9570	9625	9625	9625	9625
CHAR_OUT	Correlation Coefficient	-,112**	,835**	1,000	,045**	,111**	,042**	-,137**	-,080**	-,074**	,066**
	Sig. (2-tailed)	,000	,000	.	,000	,000	,000	,000	,000	,000	,000
	N	9625	9625	9625	9625	9625	9570	9625	9625	9625	9625
FAC_MAT	Correlation Coefficient	-,065**	,106**	,045**	1,000	-,109**	,138**	,129**	,035**	,029**	,110**
	Sig. (2-tailed)	,000	,000	,000	.	,000	,000	,000	,001	,004	,000
	N	9735	9625	9625	9735	9735	9625	9735	9625	9735	9625
FREE	Correlation Coefficient	-,083**	,114**	,111**	-,109**	1,000	-,127**	-,148**	,004	-,274**	-,044**
	Sig. (2-tailed)	,000	,000	,000	,000	.	,000	,000	,697	,000	,000
	N	9735	9625	9625	9735	9735	9625	9735	9625	9735	9625
FLEX	Correlation Coefficient	-,033**	-,032**	,042**	,138**	-,127**	1,000	-,037**	,031**	,115**	,465**
	Sig. (2-tailed)	,001	,002	,000	,000	,000	.	,000	,003	,000	,000
	N	9625	9570	9570	9625	9625	9625	9625	9570	9625	9570
FAC_SHAPE	Correlation Coefficient	-,091**	-,152**	-,137**	,129**	-,148**	-,037**	1,000	,031**	,293**	,008
	Sig. (2-tailed)	,000	,000	,000	,000	,000	,000	.	,002	,000	,437
	N	9735	9625	9625	9735	9735	9625	9735	9625	9735	9625
SPAT_LAY	Correlation Coefficient	-,031**	-,031**	-,080**	,035**	,004	,031**	,031**	1,000	,060**	,009
	Sig. (2-tailed)	,002	,003	,000	,001	,697	,003	,002	.	,000	,393
	N	9625	9625	9625	9625	9625	9570	9625	9625	9625	9625
VOLUME	Correlation Coefficient	,043**	-,065**	-,074**	,029**	-,274**	,115**	,293**	,060**	1,000	,063**
	Sig. (2-tailed)	,000	,000	,000	,004	,000	,000	,000	,000	.	,000
	N	9735	9625	9625	9735	9735	9625	9735	9625	9735	9625
USE_2	Correlation Coefficient	-,049**	,039**	,066**	,110**	-,044**	,465**	,008	,009	,063**	1,000
	Sig. (2-tailed)	,000	,000	,000	,000	,000	,000	,437	,393	,000	.
	N	9625	9625	9625	9625	9625	9570	9625	9625	9625	9625

** Correlation is significant at the 0,01 level (2-tailed).

14.11 Appendix XI: Sensitivity analysis

Results without "De Laraissestraat"

Type III Tests of Fixed Effects[a]

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	212,844	181,068	,000
TIME	1	1351,105	2,217	,137
TIME * TIME	1	1315,433	11,813	,001
DIS_PT	1	165,003	,032	,859
NUMRES	1	162,992	1,973	,162
ENTR_CHAR_IN	2	161,172	18,435	,000
BUILD_TYP	4	163,315	4,134	,003
USE_2	1	168,767	10,742	,001
FLEX	2	165,684	5,481	,005
NR_FL	1	158,452	1,714	,192
AGE	1	187,671	13,131	,000

a. Dependent Variable: Net Income per m2 of the property.

Results without "AGE > 250"

Type III Tests of Fixed Effects[a]

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	209,888	177,754	,000
TIME	1	1467,744	,992	,319
TIME * TIME	1	1406,590	13,604	,000
DIS_PT	1	167,778	,330	,566
NUMRES	1	166,224	3,312	,071
ENTR_CHAR_IN	2	163,626	19,512	,000
BUILD_TYP	4	166,128	5,453	,000
USE_2	1	171,209	10,335	,002
FLEX	2	168,077	3,628	,029
NR_FL	1	161,603	,904	,343
AGE	1	163,042	6,878	,010

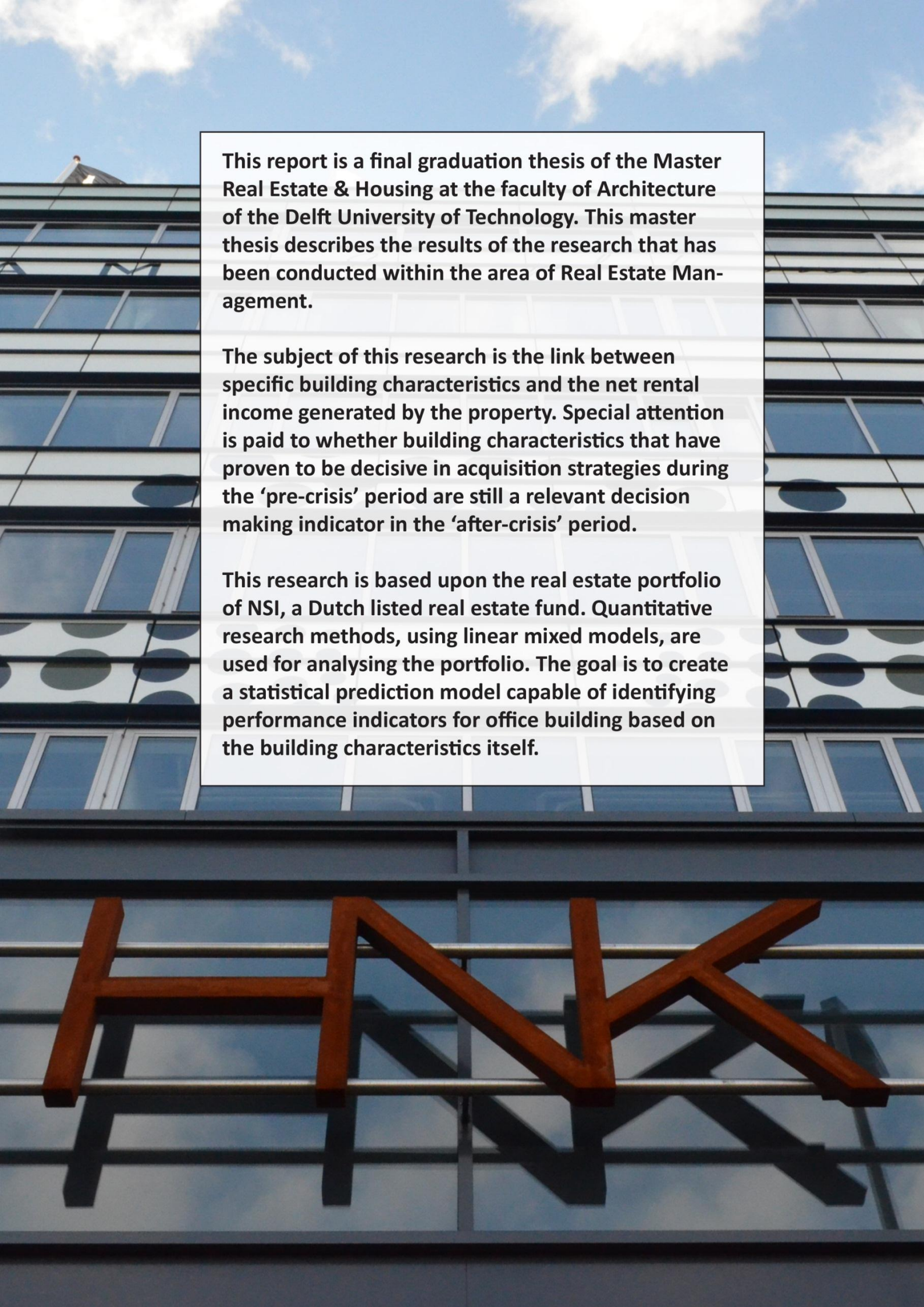
a. Dependent Variable: Net Income per m2 of the property.

Results without "De Laraissestraat and AGE > 250"

Type III Tests of Fixed Effects[a]

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	210,935	187,806	,000
TIME	1	1371,968	1,642	,200
TIME * TIME	1	1312,644	11,227	,001
DIS_PT	1	164,237	,090	,764
NUMRES	1	162,741	2,889	,091
ENTR_CHAR_IN	2	159,624	16,589	,000
BUILD_TYP	4	162,501	4,464	,002
USE_2	1	168,345	9,474	,002
FLEX	2	164,695	6,594	,002
NR_FL	1	157,469	1,581	,210
AGE	1	159,599	15,053	,000

a. Dependent Variable: Net Income per m2 of the property.



This report is a final graduation thesis of the Master Real Estate & Housing at the faculty of Architecture of the Delft University of Technology. This master thesis describes the results of the research that has been conducted within the area of Real Estate Management.

The subject of this research is the link between specific building characteristics and the net rental income generated by the property. Special attention is paid to whether building characteristics that have proven to be decisive in acquisition strategies during the 'pre-crisis' period are still a relevant decision making indicator in the 'after-crisis' period.

This research is based upon the real estate portfolio of NSI, a Dutch listed real estate fund. Quantitative research methods, using linear mixed models, are used for analysing the portfolio. The goal is to create a statistical prediction model capable of identifying performance indicators for office building based on the building characteristics itself.