Decision-Making Criteria for the Acquisition of Office Buildings

Do building features decide?

Master Thesis
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April 2010

Real Estate & Housing | Faculty of Architecture
Delft University of Technology
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*Do building features decide?*
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Keywords
Acquisition, Decision-Making Criteria, Office Buildings, Building Features, Real Estate Investment
"Location, Location, Location"

Ellsworth Milton Statler (October 26, 1863 – April 16, 1928)
PREFACE

To finalize the master Real Estate and Housing at the faculty of Architecture of the Delft University of Technology a master thesis has to be written. The master thesis describes the findings of a research conducted in the area of Real Estate Management.

The subject of the research is the decision-making criteria for the acquisition of office buildings. The question that was asked is whether specific building features should be used in the set of decision-making criteria and as such can be decisive in the acquisition strategy of an institutional real estate investor. Furthermore, the question is what building features then should be distinguished?

To find an answer to these questions a quantitative research is conducted at a Dutch listed real estate fund, NSI. Interviews with experts in portfolio management and an extensive literature review provided a sound base to create a statistical prediction model. This model will be used to list significant building features that act as performance indicators for office buildings. Finally recommendations and advice were provided for the real estate industry.

Hopefully this report will give food for thoughts and provide for new insights.

Rodiaan Gijselaar
4 April 2010
Word of thanks...

More than a year ago I started thinking about a subject for my master thesis. Without the support of many people I would not be able to overcome this long process to finally complete this report.

At first I would like to thank my parents for being patient and supportive during my study years. The idea of being backed up by someone is always nice. I would also like to thank Mireille, my dear girlfriend, for experiencing this exiting last year with me. She was always there for me to share my feelings, for better or worse.

Furthermore I would like to thank my graduation organisation, Jo Soeter as first mentor, Clarine van Oel as second mentor and Johan Buijs as my mentor on the job at NSI. Clarine has spent so much time and effort in helping me with the statistical analysis and correcting the report. Jo on the other hand was able to challenge me till the end with his sharp criticism in the field of real estate economics. Besides I have learned so much from the real estate industry and the market during the periodic conversations with Johan. Together with Anita Bontekoning he also provided me with interesting contacts and useful necessities.

I would like to thank Anneke van der Ende (NSI), Peter van der Zande (VastNed), Bas Jochims (BPF BouwInvest), Jo Vaessen (ING Real Estate) and Daan van der Ree (NIBC) for their cooperation in the interviews.

Thanks to Ernst, Suzanne, Frans and Christa for the pleasant times in the loudest room of the office and for the support. I would also like to thank all the other colleagues of NSI for their help and sociability.

Finally I would like to thank my fellow students for all the indispensable extra strong cappuccino's and pleasant lunches and of course my friends and housemates for the necessary distractions.
ABSTRACT

INTRODUCTION
The financial crisis that has started in the US and hit economies around the world definitely has its impact on the Dutch real estate market as well. The industry finally has realized that trying times come after many years of prosperity. Potential investment opportunities will be assessed more critically. In case of office real estate investment this means that it is the building with its qualities that will be subject of debate.

Investors employ certain decision-making criteria for the acquisition of office buildings. This study tries to investigate what criteria are currently applied by the industry and what criteria might be applied in future, assuming that a change in opinion is needed. Regarding the improved level of detail to focus on, criteria that involve features of office buildings will be target in this research. The question is whether and how investors might improve their set of criteria and to what extent, assuming that upcoming years guarantee for a complex market.

Amongst others this complexity comes forward in today’s efforts to raise equity in order to finance transactions. Banks are careful with lending capital and propositions are very critically observed. However, due to difficult times for small and medium enterprises and an oversupply in the Dutch office market, tenants are more careful and critical in the aspects they assess an objects’ potential. Shrink resistance may be an important issue.

During interviews with portfolio managers and asset managers of several large Dutch institutional real estate investors the idea that investments in real estate will be much more critically evaluated, was confirmed. The market has realized that times of calculating a rate of return by using rent flow, market yields and expiration dates are over. The current financial crisis changed mindsets of institutional real estate investors so that purchase decisions are more critically being observed, and quality at building level becomes a more important issue. Despite presumed aims to focus on building quality investors still hold on to the motto ‘location location location’, resulting in the focus on disguised location qualities denominated as building qualities.

Basically an assets’ value or return for an investor is based on the tenants’ willingness to pay. The function of an office building is to support the corporate process at best and as such add value to the organisation, which is referred to as fitness for use. The physical features of an office building are of such importance to a corporate process that they influence the users’ willingness to pay and as such the performance for an investor. Therefore it is obvious that building features need to be critically assessed as investment criteria. As such the following hypothesis is stated:

The 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 test the hypothesis the following research question is used:

Which 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
In order to answer this question a statistical analysis is conducted with data of 119 office buildings in the portfolio of the Dutch listed real estate fund NSI (Nieuwe Steen Investments). The performance of the office buildings, represented by the net rental income, is recorded for a period of 10 years on a quarterly basis (2000-2009Q3). The statistical analysis is performed with a mixed linear regression model to predict the performance of an office building ascertained from a set of influencing factors. These influencing factors are entered as independent variables and can be divided in three factor groups; regional market features, location features and building features (table 0.1). In consecutive phases a final best fitting model is found that best described the effect on performance.

<table>
<thead>
<tr>
<th>Table 0.1</th>
<th>Set of possibly performance influencing factors as used in the analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Regional Market features</strong></td>
<td><strong>Location features</strong></td>
</tr>
<tr>
<td>Market supply</td>
<td>Position with respect to Randstad area</td>
</tr>
<tr>
<td>Market absorption</td>
<td>Urbanization class</td>
</tr>
<tr>
<td>Market office stock</td>
<td>Number of residents in place of location</td>
</tr>
<tr>
<td>Market office stock in use</td>
<td>Location type surroundings</td>
</tr>
<tr>
<td>Regional vacancy rate</td>
<td>Distance to NS Station</td>
</tr>
<tr>
<td>Regional prime rents</td>
<td>Distance to Highway</td>
</tr>
<tr>
<td>Regional tenant rents</td>
<td>Distance to Public Transport</td>
</tr>
<tr>
<td>GDP</td>
<td>Number of parking places</td>
</tr>
<tr>
<td>Employment volume</td>
<td>Parking norm (m² LPA per parking place)</td>
</tr>
<tr>
<td>Shape of the footprint of the building</td>
<td>Charisma entrance inside</td>
</tr>
<tr>
<td>Type of the building facade</td>
<td>Charisma entrance outside</td>
</tr>
<tr>
<td>Spatial lay-out</td>
<td></td>
</tr>
</tbody>
</table>

The data collection was based on theory that came from academic knowledge and personal experience. This theory is matched with rational and factual proceedings as found in literature and interviews with professionals in portfolio management. As a result of this, improvements could be made to the theoretical preparation that took precedence of the eventual statistical analysis. As such it was possible to conduct targeted research that not only aimed at finding a relationship between office buildings.

RESULTS
The findings of this study can be generalized to all office buildings in the Netherlands, with the exception of offices at A+ locations. The direct performance of a Dutch office building not located at an A+ location is strongly influenced by it’s building characteristics. Location factors such as the size of the city or public transport in the vicinity certainly affect the direct performance, as...
does the level of absorption of office space by the regional market, which is a location related factor as well. However it appears that for office buildings at locations other then A* rating, the influence of the factor location is not as important as is currently presumed by the real estate market. The qualities at building level become more important as they play a much more determining role in the office building’s performance. This study demonstrates the generally known negative effect of ageing and the positive effect of the number of floors an office building as reported in earlier research. More interesting and innovative though is the importance of the attractiveness of an entrance, the possibility to meet the demands of new tenants according to layout or even the difference between a single or multi tenant office building. Building type might make a difference in direct performance as well. Where high-rise buildings or complexes have a negative influence on net rental income, pavilions and urban offices positively affect the net rental income.

It seems that building features at the detailed level of materials, shape or layout do not significantly influence performance. Brick buildings do not significantly perform better than buildings with a steel façade. Even so, buildings with round shapes do not significantly perform different from rectangular office buildings. Also the shape of the footprint seems not to be of particular influence.

**Conclusion**

It might be concluded that building features are indeed of such importance that they cannot be disregarded as clear decision-making criteria. The fact that many professionals already mention the urgency of building features and suggested that these features were already considered based on gut feelings is positive. Basically this study has accumulated all these ideas and translated them into factual performance indicators that can be used for strategy formation, also providing a clear evidence base for the kind of decision-making criteria.

Adjusting the view on the significance of location as a performance indicator for non-A* locations was not a primary goal of this thesis. The finding however is interesting and makes sense with respect to the concept of the willingness to pay of users/tenants. Primary concern for the building of a company is to support their corporate process in the best way. The office building is used as a mean and as such should be fit for the use of a tenant. Accessibility of course is important as well, but may be seen as a secondary demand.

The building features that have been proven to be significant performance indicators in this study largely focus on function. Size, layout and flexibility are important factors and positive values can add to the well functioning of an organisation.

Since less practically comparable knowledge about this subject for the Dutch office market is available, it is absolutely necessary to conduct further research. The findings of this study should be confirmed with results from new comparable studies so that conclusions can be improved and implications can be validated against.
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIC</td>
<td>Akaike's Information Criterion</td>
</tr>
<tr>
<td>AR1</td>
<td>First-order autoregressive covariance matrix</td>
</tr>
<tr>
<td>BFI</td>
<td>Banking Finance Insurance</td>
</tr>
<tr>
<td>CBD</td>
<td>Central Business District</td>
</tr>
<tr>
<td>CBS</td>
<td>Centraal Bureau voor Statistiek (Statistics Netherlands)</td>
</tr>
<tr>
<td>COROP</td>
<td>Coordinatie Commissie Regionaal Onderzoeksprogramma</td>
</tr>
<tr>
<td>CPB</td>
<td>Centraal Plan Bureau (Netherlands Bureau for Policy Analysis)</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GFA</td>
<td>Gross Floor Area</td>
</tr>
<tr>
<td>GLM</td>
<td>General Linear Model</td>
</tr>
<tr>
<td>LFA</td>
<td>Lettable Floor Area</td>
</tr>
<tr>
<td>ODB</td>
<td>Original Database</td>
</tr>
<tr>
<td>MIXED</td>
<td>Linear Mixed Effect Model</td>
</tr>
<tr>
<td>MVDB</td>
<td>Missing Value Database</td>
</tr>
<tr>
<td>NRI</td>
<td>Net Rental Income</td>
</tr>
<tr>
<td>NSI</td>
<td>Nieuwe Steen Investments</td>
</tr>
<tr>
<td>REIT</td>
<td>Real Estate Investment Trust</td>
</tr>
<tr>
<td>SD</td>
<td>Standard Deviation</td>
</tr>
<tr>
<td>SME</td>
<td>Small and Medium Enterprises</td>
</tr>
</tbody>
</table>
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1. INTRODUCTION
1. **INTRODUCTION**

This first chapter provides an introduction into the subject of this research. What is the background of this subject and why does it need research. It will emphasize the problem definition that will lead to a hypothesis. The relevance of the subject will be discussed and a research goal will be determined. Using a set of research questions the outlines of the study will be further explained.

1.1 **MOTIVATION**

The financial crisis that has started in the US and hit economies around the world definitely has its impact on the Dutch real estate market as well. The industry finally realized that trying times have come after many years of prosperity. Potential investment opportunities will be assessed more critical than before. In case of office real estate investment this means that it is the building with its qualities that will be subject of debate.

Investors employ certain decision-making criteria for the acquisition of office buildings. This study tries to investigate what criteria are currently applied by the industry and what criteria might be applied in future, assuming that a change in opinion is needed. Regarding the improved level of detail to focus on, criteria that involve features at office building level will be targeted in this research. The question is whether and how investors might improve their set of criteria and to what extent, assuming that upcoming years guarantee for a complex market.

This complexity is for instance visible in today’s efforts to raise equity to finance transactions. Banks are careful with lending capital and propositions are very critically observed. However, due to difficult times for the small and medium enterprises and an oversupply in the Dutch office market, tenants are more careful and critical in the aspects they assess an objects’ potential. Shrink resistance may be an important issue.

Previous research into decision-making criteria for the office market primarily focussed on factors that affect market rents. Hedonic pricing models researches have been conducted since the 80’s mainly in the US and the UK. A variety of factors, economic, location related or building related, were found to have significant effect on market rent. However evidence regarding the impact of building related factors on market rent is scarce and at times the results are inconsistent.

1.2 **PROBLEM DEFINITION**

The current financial crisis is a very severe one, not only comparable to the Great Depression of the thirties in the former century, but also in the world’s history, and thus having a large impact on the real estate market as well. Driven by these insecure times, the main conclusions of the “FGH Real Estate Report 2009” are that ‘after forgoing years of great prosperity, the world has turned upside down. Investments in real estate will be much more critically evaluated by investors’.

During interviews with portfolio managers and asset managers of several large Dutch institutional real estate investors this impression was confirmed. The market has realized that times of calculating a rate of return by using rent flow, market yields and expiration dates are over. The current financial crisis changed mindsets of institutional real estate investors and purchase decisions are more critically being observed, so that quality at building level becomes a more important issue. Despite presumed aims on building quality investors still hold on to the motto ‘location location location’, resulting in the focus on disguised location qualities denominated as building qualities.

Basically an assets’ value or return for an investor depends on a tenants’ willingness to pay. The function of an office building is to support the corporate process at best, adding value to the organisation, which is referred to as fitness for use. The physical features of an office building are of such importance to a corporate process that they influence the users’ willingness to pay and as the performance for an investor. Therefore it is obvious that building features should be assessed critically as investment criteria. Therefore, the following hypothesis is considered.

**Hypothesis:**

The 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**

- “Tenants have become more articulate and they have more critical aspects on which they assess an objects’ potential.”
- “I expect all parties in the Netherlands, as well as in other Western European countries, to focus on the physical aspects in the future.”
- “From excel sheets back to bricks”

(Peter van der Zande – VastNed O/I)

- “Other than at top locations other factors will play a more important role.”

(Bas Jochims - BPF Bouwinvest)

The above sayings are examples of today’s opinions in the office real estate market. It shows the awareness of real estate investors, and in particular with a focus on offices, towards a renewed policy. They expect other factors than location to be important and they expect that physical aspects of a building gain more attention. The question still remains what physical aspects to focus on and how to deal with it. This research intends to provide answers to these questions.

1.4 **OBJECTIVE**

Of course most market parties already employ certain decision making criteria regarding the physical aspects of an office building. However, in many cases decision-making relies upon gut feelings and personal experiences. Actions that proved to take effect in the past are being repeated and some rational basis lacks decision-making in here.

The objective of this study is to rationalize the role of physical office building features concerning the acquisition decision-making criteria of institutional real estate investors in the Netherlands. Therefore a quantitative research will be conducted using the office portfolio of a Dutch listed
1.5 Research Questions

This paragraph will describe the research questions that will be used to meet the objective and outline how the research questions will be answered.

1.5.1 Main research question

From the problem statement and the objective the following main research question follows:

Research question:

Which 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?

1.5.2 Sub research questions

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

A literature study and interviews with experts from institutional real estate investors in the field of real estate portfolio management were conducted to gain insight into currently applied acquisition strategies and decision-making criteria for office buildings. The answer to this sub question provided the basis to this research.

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

It is practically impossible listing all factors or features that might influence the net rental cash flow of an office building. A pre-selection of features was made to simplify this complex problem. These factors were qualified using common sense and were assessed for their ability to collect. Findings from the literature review and the interviews were used to further decide upon the physical and non-physical office building features that were used in further analyses.

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

Subsequently to the determination of a qualifying preselected set of physical and non-physical office building features, this sub question will answer the question whether there is an actual relation between these features and the net rental income of office buildings and what role physical building features have in particular. To answer this question a quantitative study will be conducted using different regression modelling techniques with the net rental income as dependent variable and selected physical and non-physical office building as independent and mediating factors.

1.6 Research Outline

Figure 1.2 shows the research outline that is based on the formulated research questions. The figure shows the steps in the process that were taken to finally arrive at an answer to the main research question and an advice to the real estate industry. It provides an overview of the research techniques and collateral actions.

The first step was to create a theoretical framework in which a stakeholder’s analysis and real estate market analysis provided the context of the subject. Preambulatory to the execution of interviews and a literature review an introduction was given into the process of office acquisitions. Since random input of variables in a statistical model is a hopeless task some filtering is indicated. The findings of the interviews with experts in the field of portfolio management and a literature review to theoretically influencing performance indicators were used to match with a personal exploration. This lead to a hypothesis of beforehand selected features that could be used in further statistical analyses.

In this phase of the study data on selected variables was collect and investigated to finally come to a definitive statistical model that intends to describe the influence on office performance by specific factors. During this phase interim results provided feedback for the search for an optimal model and as such methodology and results were mutually influencing each other.

The last step was to interpret the results of the final model. The implications of the findings will be discussed and feedback is provided by matching the results with previous findings and ideas that are employed in practice by investors. Finally this lead to an advice aimed at the office investments industry in general, but also more specific recommendations were made to NSI.

Basically it all adds up to creating a hypothesis about possible influencing factors that affect the performance of an office building. This hypothesis was adjusted using several tests, to finally built new theory on affecting building features. This new theory was matched with earlier findings concerning this subject (figure 1.1).

Figure 1.1 Basic principle of research outline
Decision-making Criteria for the Acquisition of Office Buildings

Do building features decide?

CONTEXT
Analysis of stakeholders, real estate market and acquisition process

INTERVIEWS
With experts in portfolio management to find currently applied decision-making criteria

LITERATURE STUDY
Find theoretically influencing performance indicators

DATA COLLECTION
Define and collect input variables for the model

SELECTION PROCESS
Process the available data and prepare input for final model

FINAL MODEL
Investigate definitive model dimensions that must find performance indicators

EXPLORATION
Explore first results according to collected data

PRE-SELECTION
Describe pre-selection of possible performance indicators

FINAL MODEL
Describe results of definitive model

DISCUSSION
Discuss results and implications of the statistical analysis

MATCHING
Match the results with previous studies and with practice

RECOMMENDATIONS
Define final conclusion and provide recommendations/advice

Figure 1.2 Research outline

Figure 1.2 Research outline
THEORETICAL FRAMEWORK
2. THEORETICAL FRAMEWORK

2.1 Introduction

This chapter will provide a framework for this study. This means emphasizing context, previous studies and existing knowledge. It starts with an introduction to what real estate investment implies, what stakeholders are involved and what interests they have in real estate office investments. To get an understanding of macro-economic issues that affect investments in office buildings, an explorative market analysis is conducted. Subsequently the acquisition process will be described as an introduction to the discussion of actual decision-making criteria for the acquisition of office real estate. For this discussion a dichotomy is made between rational behaviour, following from an extended literature review, and actual behaviour in practice, as a result of interviews with experts in office real estate investments. The findings that stem from these investigations were used as input to the empirical research as described in the next chapter.

2.2 Real Estate Investment

To understand and to be able to interpret the possible findings of this study it is needed to emphasize on real estate investment as a whole, including its pros and cons. This context is focussed on in the next section.

For institutional investors an efficient allocation of their equity to the different asset classes is essential, this is called diversification. Allocation can occur towards many different assets of which real estate is one. The question however is why one should invest in real estate? In the following paragraphs the advantages and disadvantages of investing in (direct) real estate will be discussed, as will be the share direct real estate should have in an investment portfolio.

2.2.1 Advantages and disadvantages

Benjamin, Sirmans and Zietz (2001) wrote an interesting article in which they reviewed the most recent findings on real estate returns. Partly based on these findings the following advantages of investing in direct real estate can be formulated.

Advantages of investing in real estate:
- Diversification potential
- High returns
- Hedging against inflation
- Stable and predictable cash flows

One reason for including direct real estate as an asset is because of its diversification potential and therefore the opportunity to decrease the portfolio risk. Real estate happens to have a low correlation with stocks and bonds according to the FGH Real Estate Report 2009 (FGH Bank N.V.) However, these figures are disputable according to various studies who (Benjamin et al., 2001) claim to have different outcomes, particularly due to dissimilarities in research period and return period (daily, quarterly or yearly returns). Another factor of importance is the source of the real estate data, because various indexes use different methods or represent only part of the market.

The efficient return/risk ratio for real estate is another advantage of real estate investments. The example of table 2.1 shows a respectable high return of 11.5% accompanied by a considerably low risk of 2.7% for real estate. Considering a risk percentage of 21.5% for stocks with a return of 13.1%, real estate is much more efficient.

<table>
<thead>
<tr>
<th></th>
<th>Direct Real Estate</th>
<th>Stocks</th>
<th>Bonds</th>
<th>Total Return</th>
<th>Risk</th>
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<td>-0.28</td>
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<td>Real Estate</td>
<td>11.5%</td>
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<td>7.3%</td>
<td>6.7%</td>
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<tr>
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</tbody>
</table>

A third advantage of investing in real estate is that the cash flow from investments is hedged due to the yearly inflation indexed rent levels, unlike stocks and bonds. However there is a diversity of opinions about this and several studies in recent years reported contradicting results (Benjamin et al., 2001). Some found real estate investments generally to be a good hedge against actual inflation in the U.S. (Hoesli, 1994, Bond and Seiler, 1998, Quan and Titman, 1997, Glascock and Davidson, 1995). Others questioned the inflation hedging ability of real estate or find limited success (Fletcher, 1995, Liu et al., 1997, Stevenson and Murray, 1999, Onder, 2000). Currently with expected inflation getting out of hand due to national debts to be redeemed by the government, the hedging effect is expected to be positive for real estate. It should however be noticed that due to contract renewals the hedging effect might be lost.

The last positive argument for real estate investments is the stable and predictable cash flows real estate can deliver from exploitation. Due to relative long-term agreements with tenants and fixed rent levels, the direct return of real estate properties can be predicted quite accurately, although risks for vacancy and unexpected refurbishments still exist. In case of active asset liability management, as with pension funds, a stable cash flow is a requirement.

Of course like every asset class real estate has some unpleasant side effects one has to take into account.

Disadvantages of investing in real estate:
- Management high intensity
- Transaction costs
- Illiquidity
- Large unit prices
- Non-transparent market

Investments in direct real estate are highly intensive to manage, since it is just like running a company. One has to take into account the effort that must be paid to the management of the objects for which specific expertise is needed. Compared to this, investing in stocks and bonds is much less management intensive.
A second disadvantage are the transaction costs that come along with real estate property trading. For example, in the Netherlands a 6% conveyance tax has to be paid in addition to a broker's commission, notaries' costs and due-diligence costs. Internationally the height of the transaction costs varies between 6% and 10%. One might imagine this is a substantial part of the investment costs.

Illiquidity is another drawback of direct real estate investments. The process of buying and selling real estate objects can last several months, which is quite long compared to a trading time of seconds for stocks. Adequate shifting in asset allocations in an active moving market is also difficult.

In addition, for small equity investors it is hard to enter the real estate market due to high unit prices. The diversification potential for small real estate investors therefore is limited. This grounds the existence of such high amount of real estate funds that share ownership of properties.

A final disadvantage of investing in real estate is the non-transparency of the real estate market. For stocks and bonds day-to-day index data exists, promoting a free market system. On the contrary, real estate cannot produce that instant information, whereby people with knowhow can profit.

2.3 Stakeholders
Stakeholder's involvement in real estate investment is twofold and therefore can be divided into two groups. On the one hand stakeholders might be considered from a user's perspective, on the other hand stakeholders might be considered from an investor's perspective, as is described in figure 2.1. Both groups will be discussed individually and due to the topic of this study the focus will be on office real estate.

2.3.1 Investor perspective
In order to invest in real estate one needs financial means. This can be in the form of equity capital by private investors or by institutional investors (i.e. banks, insurance companies, pension funds, hedge funds or mutual funds). As previously discussed, real estate is a management, time and knowledge high intensive asset class. Direct investments in real estate come along with the need for facility and maintenance management for which in return rental income and possible capital growth can be received. If managing more then one property, portfolio management is required too. Due to the illiquidity of real estate, the large unit prices and high transaction costs, the non-transparent market and the high intensity of management required, direct real estate investments are only suitable for a small group of large private investors who are responsible for a small market share. Institutional investors are accountable for the largest share of direct real estate.

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2. REIT = Real Estate Investment Trust
The other option is to invest in shares of real estate funds with a listing on a stock exchange; the listed property companies (Public REITs). These companies also have a board and employees specialized in managing large portfolios. Furthermore, these investment vehicles obtained a special tax status, which exempts them from paying corporate taxes. In order to obtain and maintain this special status these companies need to obey several criteria. They must pay out almost all their profits to stockholders, evenly spread ownership and limit their activities to real estate investing.

Whether the investments are direct in real estate properties or indirect, via shares and public stocks, property portfolios have to be managed. Decisions have to be made about compilation and strategies have to be created to run these portfolios. From an investor perspective, the most important stakeholders for this study are the portfolio managers, who can be employees of property companies or consultants from real estate investment management agencies.

Figure 2.2 shows an overview of national and international, listed and non-listed property companies.

### 2.3.2 Tenant perspective

From figure 2.2 it is obvious that the investor perspective represents the supply side, whereas the user perspective represents demands. The performance of a real estate portfolio is dependent on the level of supply en demand. Since this study is about office buildings, only the office demand market will be discussed. An investor with office building properties offers office space in return for rent. The demand for office space, however, is dependent on market fluctuations, which can differ from one market sector to another. Various market sectors pass through different market cycles. The amount of workforce needed by firms strongly correlates with up and down market sentiment, which can be expressed in terms of employee demand. The demand for employees determines the demand for workplaces, which subsequently determines the demand for office space.

Summarized it can simply be stated that a portfolio manager needs to anticipate on changing demands for various types of office space and different types of office buildings, depending on the market cycles of the different market sectors, to achieve a proper supply and thus an acceptable balance between risk and return.

### 2.4 Dutch office market

#### 2.4.1 Cyclical market

The cyclical nature of economy includes periods of slowdown and acceleration. Various cycles can be distinguished from a historic perspective. Recognizing economic cycles and property cycles might help investors to put expectations on the property market into perspective (Jones Lang LaSalle, 2009). In his book "Trends and Cycles", Jaap van Duin (2008) distinguished several cycle types of different lengths. The Kitchen cycle, of 3 to 5 years, focuses on inventory investments (i.e. end products or semi-finished goods). The Juglar and Kuznets cycles (7 to 11 years and 15 to 25 years) are more interesting to property market dynamics. The Kuznets cycle is also known as the building cycle.

A ‘long wave’ theory is the much-discussed Kondratieff cycle, which refers to a sine curve cycle in the modern capitalist world economy (figure 2.4). It has a classification of four separate periods or seasons; a period of prosperity, recession, depression and again improvement. Five waves have been determined thus far. Currently the economy is in depression phase of this fifth wave, and the question is for how long it will last. Afterwards the depression there will be a period of improvement that might herald a new wave.

![Figure 2.4](image-url)
The property market is also subject to various cycles, all affecting demand, supply and rents. DiPasquale and Wheaton (1996) developed the four quadrant model (figure 2.5) to explain the cyclical movements in the property market. The model illustrates the interrelationships between the space market, the asset market and the construction & development market, and describes an equilibrium state. The model shows that change in a single market influences all markets. Since the asset market quadrant can be seen as a description of the capital market it is clear that property market fluctuations can be attributed to fluctuations in the general economy and the financial market.

The property market is underpinned by the market mechanism of supply and demand, but with a delayed response. A description of one market cycle in real estate put out in time is given by Mueller (1999) and describes the four phases of recovery, expansion, hyper supply and finally recession (figure 2.6). This whole process is also known as the ‘pork cycle’. The question in this current study is to what extent the market cycles of different office submarkets influenced the dataset.

2.4.2 National review

This paragraph will discuss the market cycle theory applied to real market figures in the Netherlands over the last 15 years. When looking at economic indicators like growth of Gross Domestic Product (GDP), employment growth and consumer confidence index a sinusoid trend can be noticed during the period 1995-2009 (figure 2.7). The figure also shows that employment growth in the Netherlands lags behind GDP-growth with about a year. This seems reasonable, since redundancy responds with a certain delay to market tendencies.

In figure 2.8, a similar cyclical movement can be noticed for returns in the different real estate sectors between 1995 and 2008. The performance of the office market for example runs the same course as the employment growth in figure 2.7, just with a delay of about two years. It can be determined that the performance of the office sector reacts on the change in employment growth, which again reacts on the change in GDP-growth, both with delay.

The waving trend can also be noticed in the supply of office space in the Netherlands over the period 1995-2010 (figure 2.9), though with an increasing trend. The trough in GDP-growth as reached in 2002-2003 is also affecting the office space take up, and this explains why the same dip can be noticed. Furthermore this graph firmly shows the problem of oversupply in...
Decision-making Criteria for the Acquisition of Office Buildings
Do building features decide?

2. THEORETICAL FRAMEWORK

2.4.3 Regional interference

Using several office market indicators this chapter tries to describe the regional market differences in the Netherlands. These differences are important to understand in order to compare offices across the country. Figure 2.10 clearly shows the gap between market rents for offices in the West compared to other parts of the country. The influence of the Randstad is evidently overwhelming. Best of the rest, with a more stable line, is the South, probably due to the influence of the 'Brabantine City Row'.

Figure 2.11 and figure 2.12 show the supply and take up of office space separately for the Netherlands, the Randstad, the region outside the Randstad and for Amsterdam being an

3. Brabantse Stedenrij: Amongst others Den Bosch, Breda, Tilburg and Eindhoven
important submarket. The regional markets show far more stable figures compared to the Randstad. For example during the top of the market a strong peak in supply in 2005 can be noticed for the Randstad and Amsterdam, which does not apply to the regional markets. The same trend, yet delayed, is present in the market take up of the demand side.

The increasing trend of oversupply from 2003 onwards is also visible in figure 2.13 from the low values of the shortage indicator\(^4\) during that period. It is interesting to note that this is true for all regions in the Netherlands. Although the oversupply in the Randstad might be a bit more problematic than in regional areas, overall the same trend can be noticed. In contrast, during the period 1995-2001 the dissimilarities in shortage were much larger.

\[\text{Figure 2.13 Shortage indicator for office market}\]

To summarize, it can be concluded that there are substantial market differences between several regions in the Netherlands. Most striking however is the stronger volatility of the Randstad market compared to the rest of the country, which therefore should not be neglected.

2.5 ACQUISITION PROCESS

A corporate investment strategy is first of all dependent on the structure of an organization and its legal status, furthermore it is risk driven. The motives of a pension fund for example are primarily driven by the realization of the social security for its members, while an open or closed end fund is responsible for the share of its profits to the shareholders. Different responsibilities come along with certain levels of risk averseness, what rate of return is aimed at and what risk profile serves that aim, which is also dependent on the current market situation. “The perception of risk of an investor today will be different compared to five years ago” (Ree van der, 2009). Examples of investment strategies or styles according to the risk profile are core funds, value-added funds and opportunity funds (Brounen et al., 2007) (figure 2.14). Though, the opinions differ on that matter with respect to the bandwidth, which might be too wide. Some argue to add ‘value’ as a class or above that even a fifth class (Keeris, 2009).

The combination of demand for return and accompanied risk profile determines a company’s investment policy. Once decided to invest in real estate, often the choice is made to diversify asset types. Within real estate investments this can be categorized as investments in offices, retail, housing or industrial buildings. Regarding the office market, as is the focus in this study, policies can be translated to investments in specified markets. Examples are growing markets or established marketable office markets in large cities called A+ locations. Part of the policy can focus on building size or value. In table 2.2 an overview is provided of the strategy and policy of the five interviewed investors as an example.

\[\text{Table 2.2 Example of investment strategy of real estate investors (source: Interviews with the companies’ portfolio managers)}\]

Following from and according to such corporate strategies pre-selections are made consisting of objects that are potential acquisitions. In this stage selections are based on information that is available for everyone. Local economical circumstances and the locations surroundings are important, but also the building’s charisma. Furthermore the current status of rent contracts is important, as the length of legitimacy of contracts largely influences the value of an object. However office buildings with expiring contracts might also be considered as opportunities if new tenants are available, though this is more a strategic point of view.

After this pre-selection stage due diligence research is performed. Amongst others this means that cash flow models are used to study the feasibility and that the buildings are checked for their technical status. Possible defects must be detected and assessed as part of the feasibility study. With positive findings the negotiation process can be started. Finally propositions have to be approved by the investment committee of the company.
The decision-making criteria as searched for in this study are particularly used in the pre-selection stage and the following paragraphs will elaborate on these.

### 2.6 DECISION-MAKING CRITERIA

Obtaining information on office performance is a significant issue for both practitioners (investors) and academics. Investors use them directly in demand sensitivity analyses, while academics are more interested in the relative significance of these variables and their effect on the variation in office performance. Investors usually overview information that tends to support previous successful decisions, while filter out information that caused previous failures (Oven and Pekdemir, 2006). Academics however, are often dependent on the availability and quality of information that can be collected to conduct proper quantitative analyses.

Therefore both rational decision-making criteria, which are theoretically derived by academics, as practical applied decision-making criteria, which are applied by investors, have been studied. This dichotomy in information, gathered from literature and interviews with experts in the field of portfolio management, will be used to match and correct the proposition of input variables that will be used in this research.

#### 2.6.1 Rational behaviour

Since this study focuses on office investments the scope of the extended literature review will be limited to factors that solely concern office buildings. Here, lots of studies focussed on hedonic pricing models. A hedonic model of prices is one that decomposes the price of an item into separate components that determine the price. These types of studies are very useful for studying influencing factors in office performance.

‘In all markets quality and revenues are considered to be connected’ (Koppels, 2007), thus for real estate this means that the quality of a building influences the price and revenues of that property. In this way, qualities might be explained as characteristics or features that are typical for a building, such as location or physical features. Since an office property is a heterogeneous good, a vector of characteristics or attributes might define it, according to Dunse and Jones (1998). They tried to identify the significant determinants of rental values of office properties in Glasgow with hedonic regression analysis. Hedonic regression analysis is a technique that might be applied to a series of property values, together with their associated characteristics, to identify and quantify the significant determinants of value.

In recent years various studies used hedonic regression to test and find determinants or features that determine the rent level or transaction prices of office buildings. Below a historical review is provided of these studies (table 2.3).

Clapp (1980) modeled the influence of location to rent by taking the asking rent for an entire office building in the Los Angeles metropolitan area as dependent variable with a sample of 105 high-rise buildings. Independent variables selected and found to be statistically significant to the asking rent are the physical factors size, age, and number of floors. Other significant location factors were whether or not an office had internal parking, whether or not it had a prestigious address, as well as annual property tax, air quality, amount of office space within a two-block radius, distance by road to the nearest motorway junction and average commuting time for employees. The sample however is rather limited with only high-rise buildings.

Hough and Kratz (1983) investigated the value of “good” architecture in the Chicago CBD area. They studied the average asking rent of 139 office buildings and discovered that a considerable rent premium is paid for “good” new architecture, but not for “good” old architecture. The results also yielded information about the distance from a central point within the CBD, public parking, age, size, number of floors, and availability of a conference centre. However, it is not clear whether there is a relation between de external characteristics of the architecture and the internal characteristics of the building.

With the Champaign-Urbana, Illinois, as study area, Cannaday and Kang (1984) created a multiple regression model for calculating the average annual asking rent for an entire building. To identify the significant determinants of the asking rent they selected and found to be statistically significant to the asking rent are the physical factors size, age, number of floors, internal parking, age, min. lease term in years, crow-fly distance to CBD and to shopping centre, avg. commuting time for employees, banks in the vicinity, accessibility to social facilities in the building, rental office - specialty shops in the vicinity, and the total number of office buildings in the immediate vicinity. Although the sample size is small (29 office buildings) and the number of variables tested is very large, the model identifies the effects of location and physical characteristics on rent, again using the whole building as unit of observation. Though the sample size of 24 office buildings is very small, independent variables that are found to be statistically significant were age, minimum lease term in years, the “crow-fly” distance to the CBD, the “crow-fly” distance to a shopping centre, average unit size, and the average number of units per floor.

Although the sample size is small (29 office buildings) and the number of variables tested is very large, the study of Brennan et al. (1984) is interesting. Unlike the previous discussed studies, they concentrated on actual transacted rents for individual office units. The independent variables that were found to be significant are size of the building, size of each unit, lease term, loss factor (net floor area and gross floor area ratio), internal position within the building and location with regard to some central point within the CBD.

Concerning the use of actual transacted rents Dunse and Jones (1998) argue these appear to be a better measure in the first place, because it represents the true negotiated rent for

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**Table 2.3 Hedonic pricing models of office rents, a literature review of interesting studies**

<table>
<thead>
<tr>
<th>Year</th>
<th>Authors</th>
<th>Dependent variable</th>
<th>Independent variables</th>
<th>Dataset</th>
<th>R²</th>
<th>Adj. R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>Clapp</td>
<td>Asking rent for entire office building</td>
<td>Size, age, number of floors</td>
<td>Los Angeles</td>
<td>Size, age, number of floors</td>
<td>0.72</td>
</tr>
<tr>
<td>1983</td>
<td>Hough and Kratz</td>
<td>Asking rent for entire office buildings</td>
<td>Size, age, min. lease term, crow-fly</td>
<td>Chicago CBD</td>
<td>Size, age, number of floors</td>
<td>0.88</td>
</tr>
<tr>
<td>1983</td>
<td>Cannaday and Kang</td>
<td>Asking rent for entire office buildings</td>
<td>Size, age, min. lease term, crow-fly</td>
<td>Chicago CBD</td>
<td>Size, age, number of floors</td>
<td>0.93</td>
</tr>
<tr>
<td>1983</td>
<td>Brennan et al.</td>
<td>Asking rent of individual office units</td>
<td>Size, age, min. lease term, crow-fly</td>
<td>29 office buildings in Chicago</td>
<td>Size, age, number of floors</td>
<td>0.95</td>
</tr>
<tr>
<td>1983</td>
<td>Cannaday and Kang</td>
<td>Asking rent of individual office units</td>
<td>Size, age, min. lease term, crow-fly</td>
<td>29 office buildings in Chicago</td>
<td>Size, age, number of floors</td>
<td>0.97</td>
</tr>
<tr>
<td>1999</td>
<td>Aminah Md Yusof</td>
<td>Depreciation rate</td>
<td>Size, age, min. lease term, crow-fly</td>
<td>49 office buildings in Kuala Lumpur</td>
<td>Size, age, number of floors</td>
<td>0.52</td>
</tr>
<tr>
<td>2000</td>
<td>Hough and Kratz</td>
<td>Average annual asking rent for entire building</td>
<td>Size, age, min. lease term, crow-fly</td>
<td>139 office buildings in Los Angeles</td>
<td>Size, age, number of floors</td>
<td>0.79</td>
</tr>
<tr>
<td>2000</td>
<td>Cannaday and Kang</td>
<td>Average annual asking rent for entire building</td>
<td>Size, age, min. lease term, crow-fly</td>
<td>139 office buildings in Los Angeles</td>
<td>Size, age, number of floors</td>
<td>0.79</td>
</tr>
<tr>
<td>2004</td>
<td>Hough and Kratz</td>
<td>Average annual asking rent for entire building</td>
<td>Size, age, min. lease term, crow-fly</td>
<td>139 office buildings in Los Angeles</td>
<td>Size, age, number of floors</td>
<td>0.79</td>
</tr>
<tr>
<td>2005</td>
<td>Brennan et al.</td>
<td>Asking rent of individual office units</td>
<td>Size, age, min. lease term, crow-fly</td>
<td>139 office buildings in Los Angeles</td>
<td>Size, age, number of floors</td>
<td>0.55</td>
</tr>
</tbody>
</table>
each suite. However, using these rents creates a number of pitfalls to any analysis, according to Dunse and Jones. Firstly, due to commercial confidentiality and secondly because even if a reasonable number of transacted rental observations can be obtained further difficulties arise, such as the occurrence of rent-free periods and other incentives. The question is whether these factors should be avoided in the analysis, because again from an investor point of view rent-free periods and incentives are a depreciation of the rate of return and should be included fro that reason. Using a long observation period might revoke the negative attendance of these factors. On the other hand Glascock et al. (1990) found an extremely close relationship between asked rents and actual transacted rents when examining the stability between the two variables, which implies that differences here might be ignored.

Furthermore, it has been discussed whether one has to look at the office building as a whole or divided into different units. Dunse and Jones (1998) note that when using the entire office building as the unit of observation, with the dependent variable being the average rent for the entire office building, considerable information is lost due to averaging effects, and the variation of rents within the buildings cannot be analyzed. They approve the use of individual units within the office building as observation, yet this is only interesting from a tenant’s point of view. Since an investor never possesses single units within a building, the averaging effects can be neglected. From an academic (methodological) point of view, one cannot consider single units in an office as independent units. This will introduce serious bias to eventual interpretation of results.

In 1990 Glascock et al. included market conditions into their study of 675 observations of office buildings in Baton Rouge, Louisiana, by using a time period of four years and adding vacancy levels. They found that overall market conditions had a significant impact on rents.

Overall, according to the studies of Fisher and Webb (1996), Brennan et al. (1984) and Mills (1992), location, age and size are the predominant variables explaining considerable variation in rents. Physical attributes in many cases are significant, but many are unique to the particular office market being studied. Still no clear evidence is obtained concerning specific physical aspects that influence the rent level, nor even possibly extrapolated to net rental income figures.

As mentioned earlier, Dunse and Jones (1998) performed an empirical study on the Glasgow city centre. Despite using asking rents of individual office suites as dependent variable they have a very clear description of possible principal determinants of office rent values. A distinction is made between physical accommodation features, location features and tenure rights. Below a detailed review is given of these determinants.

### Location
- **Spatial relationships:** The choice of an office also brings along a set of spatial relationships. Within a central business district (CBD), key relationships determining rental value could be distance from the most prestigious office addresses, proximity to the intercity train station, links with commuter train and bus networks, or closeness to the main shopping centre.
- **Business environment:** The CBD provides agglomeration economies by giving access to a common pool of services and labour. Despite the advances in information technology, and the subsequent changes in office practice, the CBD continues to offer agglomeration economies. In addition, the opportunity for face-to-face contacts and the close proximity of potential clients also contribute to the desire by most office users to be located within the CBD. There is also the belief that a prestige city centre address contributes to income generation for a firm. Within any CBD there is likely to be a rent pinnacle associated with a prestige location/neighbourhood from which rent declines with distance. However this basic pattern may be overlaid sometimes by a hierarchy of neighbourhoods or even a series of specialist prestige areas associated with given professions.
  - **Built environment:** The nature of the physical environment is difficult to formalise but is likely to be influenced by the general state of local buildings, other land uses, density of buildings, the existence of green space, and the general upkeep of an area. Positive scores on these characteristics are likely to coincide with prestigious areas.

### Physical accommodation
- **Capacity:** At its most basic level, this is the floor area of the office, although it will also be influenced by any constraints, for example a cellular layout, the building’s structure places on design and layout. It should be thought of as adding ceiling height in this perspective. Modern offices normally provide the greatest flexibility in this regard by the provision of large floor plates.
  - **Internal accessibility:** The significance of which floor an office suite is on is likely to be affected by the availability and the quality of a lift. Basements may also not be popular because of natural lighting difficulties. The existence of a reception area is usually an attractive feature.
  - **Internal services:** The quality of office space is not easy to define. There is a considerable range of potential internal services, which add value although to different degrees. These include air conditioning/heating, raised floors to enable computer and telephone cables, security systems, lighting, internal sound insulation, cooking, toilet and washing facilities and carpeting. The British Council for Offices (1994) prescribes detailed ideal specifications for which a potential occupier is likely to pay a premium.
  - **Physical structure:** The cladding and standard of the exterior and structure are important, both to the image the occupier is trying to hold, as to subsequent repair and maintenance expenditure. Double-glazing also improves the internal working environment. A major influence is the age of the building, or example pre-war buildings are mainly of solid construction with a large number of load-bearing walls. In the case of older offices, whether they have been refurbished is a key attribute. The provision of internal car parking spaces is an added attraction to an occupier.

### Tenure rights
Traditionally commercial property has been let on a standard institutional 25-year lease; which provides for over five-year rent reviews only, with the tenant responsible for repairs and maintenance. Any variation in these conditions will lead to recalculation of the market rent. This classification of office characteristics provides a framework for the subsequent empirical analysis. However, this review also indirectly demonstrates the importance of age as a crucial factor. For countries such as the Netherlands, France and Switzerland this number is smaller.
2. THEORETICAL FRAMEWORK

Determinant of many of these characteristics, especially physical structure. Hence, in the empirical analysis, age is included in its own right. Variables relating to the built environment are not included directly in the analysis below but there is likely a close relationship with business environment variables in practice.

With the aforementioned determinants in mind, Dunse and Jones (1998) emphasised the importance of age and location as principal determinants of office rents. Although their model only explained 60% of the price variation, it is important to acknowledge that individual locations within a CBD make a difference that bring along large price variations when comparing across office districts.

Gat (1998) stressed the importance of face-to-face activity within an office building for the office productivity, which subsequently leads to an improvement of a companies income prospect and thus influences the willingness to pay for an accommodation. According to Gat, building size and possibly height enhance face-to-face activity, since within-building movement, especially vertical via elevator, is the fastest mode of face-to-face activity. The latter might be disputed, because one might argue that most of the times horizontal movement is faster and more easily accessible, and therefore more supportive to face-to-face activity.

Regardless of building size and height, quality of physical amenities also contribute to physical quality (Gat, 1998). Just like any other type of production capital, so does office space age over time, gradually becoming physically and functionally obsolete. The study of Yusof (2000) in the city of Kuala Lumpur revealed that building obsolescence largely attributes to the impact of depreciation. However, age alone is not a reliable estimator of quality. As time goes by, various design innovations are tried. Some of them become timeless, whereas others are just passing fads. During some eras (e.g., the oil shortage years), energy cost cutting was the motto, resulting, say, in complete sealing of facades, while the rents of energy inefficient buildings were discounted. Later, discovery of the “sick building syndrome” made sealed buildings undesirable (Kundsin, 1988). During the 1950s and 1960s, the International style was king, and functional, non-ornamented facades were in mode (Wolfe, 1982). That changed with post modernism and de-constructivism, as builders and their clients were paying premium prices for bold visual expression. Thus, the youth of a building (negative age) may indicate only a rough idea of its quality (Gat, 1998).

Internal spatial arrangement, including internal circulation, flexibility of space dividers, depth of leasing span and availability of external view affect employee wellbeing and facilitate or inhibit the great of work. The type of finishing, internal as well as external, has great influence upon the wear and tear of a building, and hence on the degree of its user-friendliness and the costs of maintenance (Gat, 1998).

More recently Ryan (2005) examined the importance of access to light rail transit and highway systems in estimating office property rents in the San Diego area. Although functioning of these systems might differ compared to the Dutch traffic systems, overall conclusions about the relationship between the location of an office building and the connection with transportation systems can be compared. Results indicated that access to highways is a significant factor in estimating office property rents and access to light rail systems is not, which might possibly be explained due to differences in living density between the Netherlands and the US.

The above studies incorporated models that were developed for cities at different locations in the world, however an accumulation exists primarily for the US, followed by work from the UK. Few studies have been performed in cities on the mainland of Europe (D’Arcy et al., 1996, D’Arcy et al., 1997, Gardiner and Henneberry, 1989, Gardiner and Henneberry, 1991, Hendershott et al., 2002, Öven and Pekdemir, 2006, Naqui-Chouket et al., 2007, Ozus, 2009). The explanatory powers of the early models are greatly variable, ranging from 0.27 to 0.97 (Gardiner and Henneberry, 1991, Pollakowski et al., 1992). The models have been trying to attribute the behaviour of office rent value to econometric (D’Arcy et al., 1996, Gardiner and Henneberry, 1988, Hekman, 1985), location and physical building variables (Brennan et al., 1984, Sivitanidou, 1996). Even some work suggested variables regarding the contract data (Wheaton and Torts, 1994, Webb and Tae, 2000, Bollinger et al., 1998).

After compiling an extensive literature review about research on office rent predictions since the 1980’s, Öven and Pekdemir (2006) derive at selection of 64 variables that presume to be viable office rent determinants, which they categorize in four distinct groups, namely econometric, location, contract and building features. The following paragraphs will emphasize on the most important variables in the different groups based on the findings and conclusions compared to the literature, referring to the case study in Istanbul, performed by Öven and Pekdemir (2006).

2.6.1.1 Economical features

Vacancy Rate

It turns out that the importance of vacancy rate is indisputable with any rent model and independent of any spatial variations (Hendershott et al., 2002, Rosen, 1984, Shilling et al., 1987, Sivitanidou, 1997, Wheaton and Torts, 1988). Glascock et al. (1990) concluded that the vacancy rate is statistically significant regardless of the location and class type of the office, which is confirmed by Öven and Pekdemir (2006). The latter also agreed with Hekman’s (1985) work that the influence of the vacancy rate appears to be strong with a large city, however it is not exactly mentioned what is meant by a large city.

Office Building Output

Öven and Pekdemir (2006) define office building output as the annual volume of office construction investment in the region. This econometric variable can act as a proxy for the office market, but seems to be justified as significant only for growing cities according to Sivitanides (1997) and as confirmed by Öven and Pekdemir (2006). Tsilascos et al. (1998) found the supply side office building output variable to be less significant than demand side indicators like gross domestic product and sector employment.

Gross Domestic Product (GDP)

Considering the office market of Istanbul, GDP turned out to be an insignificant variable (Öven and Pekdemir, 2006). Indeed D’Arcy et al. (1996) already found that the influence of GDP only

6. The total list of used variables by Öven and Pekdemir (2006) can be found in appendix B.1
holds strong for cities with office stocks larger than 3 million square meter. Compared to the Dutch office market only the four large cities (Amsterdam, Rotterdam, Utrecht and The Hague) meet these requirements. It should however be mentioned that the above studies solely focus on single office markets, at a national level this might be different.

**BFI Sector Employment**
Sector employment is another demand side indicator and consists of the number of employees in the banking, finance and insurance (BFI) sector (Tsolacos et al., 1998).

**Absorption Rate**
The last demand side variable is the absorption rate, that is the average unlet duration of an office in the region (Sivitanides, 1997, Wheaton and Torto, 1994). Wheaton and Torto and Sivitanides have contradicting outcomes, with the former finding the lagged absorption rate to be more significant than vacancy rate, whereas Sivitanides concluded that the vacancy rate is more sensitive in explaining rental changes than the absorption rate.

**Office Stock**
The size of the office stock in a region seems to be irrelevant for the rent level according to Öven and Pekdemir (2006), although D’Arcy et al. (1996) reported that the urban hierarchy may increase the influence of the office stock.

It might be concluded that vacancy rate is the most significant econometric feature in estimating rent levels and vacancy rate seems to be independent of any spatial variations. In addition, GDP and the absorption rate are important indicators as well, whereas sizes of the office stock and office building output have the least influence.

**2.6.1.2 Location features**
Location variables like distance to a certain point in the central business district (CBD) and distance to a freeway were examined and found to be significant by a number of studies (Brennan et al., 1984, Clapp, 1988, Sivitanidou, 1996, Frew and Jud, 1988, Sivitanidou, 1995). Other location features in the literature can be roughly divided into distances to important places and transportation nodes, environmental amenities and employment information.

**Distance to important places**
In the literature location of the office building in relation to the centre of the CBD and to secondary centres in the city are considered important (Bollinger et al., 1998, Clapp, 1988, Frew and Jud, 1988, Gat, 1998, Sivitanidou, 1996, Sivitanidou, 1995, Öven and Pekdemir, 2006). The significant influence of the variables differs per city because of the heterogeneity of cities. Since these studies were performed in large US cities the question is to what extent this reflects the Dutch office market as well. However these variables do indicate the location of an office building within a city, which are thought to make a difference.

**Distance to transportation nodes**
As mentioned before, distance to a freeway (or highway) is a very significant determinant with a negative sign (Clapp, 1980, Wheaton, 1984). Opposite claims of a negative relation with proximity to a freeway are known as well. Frew and Jud (1988) and Bollinger et al. (1998) claiming noise and congestion effects associated with highway locations override access time considerations.

In the Netherlands de Graaff et al. (2007) did research to the influence of accessibility on real estate value of Dutch offices and found the distance to Schiphol Airport to be important. They concluded that doubling the distance between an office location and Schiphol Airport means 6% depreciation in real estate value. In case an office building is in the proximity of an NS station the real estate value increases with 16%, however this effect disappears if the distance is more than 1 kilometre, probably because of a maximum acceptable walking distance.

**Environmental amenities**
Location variables considering the influence of various worker amenities such as facility level were reported as relevant by Clapp (1980) and Sivitanidou (1995, 1996), but disamenities such as crime rate and air pollution rate were found not to be significant by Öven and Pekdemir (2006).

**Employment**
Öven and Pekdemir (2006) mention BFI (banking, finance and insurance) sector employees, employment growth, household income level and consumer expenditure as trivial influences for the case of Istanbul, but argued that more research is needed with more conclusive results.

**2.6.1.3 Contract features**
As stated by Brennan et al. (1984), the operational expense and the duration of free rent variables are strong attributes of the physical characteristics of the building. The study of Öven and Pekdemir (2006) indicated a positive association with the length of the lease term, indicating that a longer term yields a lower rental value. Despite the lower rental value it can still be of considerable value for an investor due to the insurance effect of a longer lease term. The work by Shilling et al. (1987), in 17 US cities, found that the variable operational expense was insignificant with a positive sign in small markets and a negative sign in larger markets. Since the Dutch market is not particularly a very large market by US standards, the revealed positive sign of this variable can be justified. Öven and Pekdemir (2006) argue that the influence of most contract variables on office rents may be highly volatile because they are strongly interrelated.

**2.6.1.4 Building features**

**Physical aspects**
Öven and Pekdemir (2006) found the following physical building variables to be influential for the rent level in the Istanbul office market. Ranked from highly influential to influential these are the building age, the percentage of unused space in the office, the total floor area, the number of floors and the percentage of common space in the building. A number of authors also report age as highly significant (Sivitanidou, 1995, Bollinger et al., 1998, Clapp, 1980, Sivitanidou, 1996, Slade, 2000, Wheaton, 1984, Ozus, 2009), while others claim it has either a negligible or no significance (Brennan et al., 1984, Frew and Jud, 1988, Gat, 1998, Mills, 1992). Clapp (1980) reported that age and the number of floors were the most important building variables,
however it was also concluded that the influence of these variables might be subject to different perceptions in different office markets to allow for a general conclusion. Ozus (2009) found the numbers of floors the most significant variable. Slade (2000) examined the market cycle for three distinct stages; decline, trough and recovery in Phoenix. The influence of the number of floors and the age was particularly more pronounced during the market decline, while the influence of average floor area was more pronounced during the recovery period. Brennan et al. (1984) found the percentage of unused space in the office building to be moderately important, with more unused space indicating more inefficiency.

Architectural quality
Since architectural quality is a subjective feature, it is disputable what statistical significance means, however some studies made an attempt. Gat (1998) stated that one additional architectural point added over 5% rent increase. This was also highlighted by Yusof (2000) who attributed the obsolescence of a building to the depreciation rate, as did Ozus (2009) who mentioned buildings aesthetics as an important factor of rent levels.

Building amenities
In the study of the Istanbul market (Öven and Pekdemir, 2006) building amenities such as the presence of a restaurant in the building, or a bank, a health club, a day care facility, a conference room or a shop, were found to be important for the rent level. Although it sounds viable, no other studies, besides Ozus (2009) who mentions social facilities within the building, refer to such amenities and the question is whether these variables indeed influence the return for an investor.

2.6.1.5 Remarks
Before drawing a conclusion, some remarks have to be made in relation to the literature. Anticipating on the use of the dependent variable for this research (as described in paragraph3.3.2), most previous studies focussed on the realisation of the asking rent, though some included the actual transacted rent too, but with contracts as dependant variable. As such the influence on investors return is not directly explored. The current research will use net rental income, thus including exploitation costs and management costs, since the aim is exploring the decision criteria of investors. Obviously this will lead to a difference in results compared to the literature and in that perspective the results of the literature are only indicative. table 2.4 provides an overview of the pros and cons for the use of different target variables.

Table 2.4 Pros and cons of different used dependent variables in literature compared to dependent variable of this research

<table>
<thead>
<tr>
<th>Literature</th>
<th>“Asking rent”</th>
<th>“Transacted rent”</th>
<th>“Not Transacted rent”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility of data</td>
<td>+</td>
<td>+/-</td>
<td>+</td>
</tr>
<tr>
<td>Sensitivity of data*</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Value of information according to performance</td>
<td>-</td>
<td>+/-</td>
<td>+</td>
</tr>
</tbody>
</table>

* + in this case means very sensitive

2.6.2 Practical behaviour
In different phases of the acquisition process, criteria are employed to make pre-selections of potential objects to be added to the portfolio. Depending on corporate strategy and market situation the value of various influencing factors are determined. As stated before, strategic investment pressure in a buyers market, for example, causes less opportunity for critical and detailed selection criteria. The question still stands whether this is really something one must agree with. It used to be practice in the past, but institutional investors are currently changing their minds on this subject. During the crisis of the late 80’s, that ended the real estate boom, till 2007, with a small dip caused by the dot-com bubble in 1997-2001, prices for real estate have been structurally overvalued. According to Peter van der Zande (head acquisition and sales department VastNed O/I), rate of return was simply calculated using rent flow, market yields and expiration dates. The current financial crisis has changed minds of institutional real estate investors and purchase decisions are more critically observed.

Another point of discussion is the difference in data set, since a large part of the literature describes studies in single but large city regions with consistent market features and overall location features, while this study uses an office building data set scattered around different cities and regions. Above that it should be noticed that some literature data describe considerably homogenous sets according to the buildings’ physical characteristics. This however can be explained due to the research aim on location factors for most studies. In consequence relative less information is available on the physical aspects of office building in relation to its performance for an investor.

Despite the deviation in research focus, the results still provide a wide range of features that influence the financial performance of an office building. The information is useful at different levels in order to compose the set of variables that potentially influence this performance, as will be used to conduct a quantitative analysis.

2.6.1.6 Summary
Since many studies were conducted with varying perspectives the most important and interesting factors affecting office prices and performances are summarized in table 2.5.
The question still remains what criteria institutional real estate investors currently employ. Several interviews with experts in office portfolio management and acquisition & sales department of large Dutch institutional investors had to provide insight to this.

ING Real Estate for example uses a portfolio assessment model that basically comes down to the following criteria groups, each with its own value of importance. Location and location dependent factors such as the regional market form 70% of the assessment, while building related factors define 30%:

- Quality of the location 45%
- Regional market 25%
- Quality of the building 20%
- Age of the building 10%

This model provides criteria concerning factors that can be assessed in the long run and mention the quality of the buildings potentials and the physical and economic environment. Other criteria such as contract status or service costs are also part of the assessment of a property, yet will not directly be defined as performance indicators. Contract status (as mentioned earlier in paragraph 2.5) for example is more like a strategy criteria. Besides it is a temporary factor that can be changed by good management. Service costs in the other hand may influence a buildings performance, because relatively high service costs can put off possible tenants. Nevertheless it is not a direct performance indicator, since service costs are passed-on to tenants.

Another criterion that was mentioned by the professional investors was technical obsolescence of the building. This includes the status of the installations and the quality of the indoor climate. In fact these factors are incorporated in the group age in the above-mentioned model.

Eventually the decision-making criteria as used by institutional investors that are filtered from the interviews are listed in table 2.6.

| Table 2.6 Decision-making criteria as used by the interviewed Dutch institutional investors, grouped based on the ING RE model |
|-----------------|----------------|----------------|
| Regional market conditions | Location | Building qualities |
| Office employment | Parking | Age |
| Supply | Accessibility | Privacy |
| Take-up | Charisma of the surroundings | Lay-out |
| Vacancy rate | Local amenities | Lighting |
| Gross Domestic Product | | Flexibility |
| Office employment | | Entrance |
| Absorption rate | | Entrance |
| Office stock | | Entrance |
| Supply | | Entrance |
| Charisma of the surroundings | | Entrance |
| Regional market | | Entrance |
| Location features | | Entrance |
| Building features | | Entrance |

2.8 'CHANGEd OF PERSPECTIVE'  
In the ‘change of perspective’ boxes it will be tried to reflect on the investors’ considerations from a user perspective. These reflections will be short and are general of nature. The aim is to put the findings in another perspective.

The results for an investor whom is investing in offices are dependent on the willingness to pay of a user. It is discussed what demands come from the investors, but the question can be put forward what these users would like to obtain and for what they are willing to pay.

According to regional market circumstances users determine market changes. A decreasing workforce for example means fewer demands for office space. A decrease in demand can cause higher vacancy rates. More vacancy may indicate less populated areas, which can be a negative factor for a possible tenant.
In relation to location some demands that could be thought of are accessibility or visibility. Some companies want easy access by car since they provide for lease cars. Others like governmental organisations focus on public transportation as a mean for their employees. If exposure and as such visibility is a demand one can think of locations near highways or in the city centre.

Of course the building should fit to the organisations needs, directly but also on the long run. Besides it should be possible to change an office building in such way that all divisions of a company can be located at strategic places in the building. Cooperation is essential for an organisation and the building must facilitate that. These types of demands must provide for a pleasant atmosphere at work that thus must lead to optimal employee performances.

These are just examples of what users demand from an office building.
3. METHODOLOGY
3 METHODOLOGY

3.1 INTRODUCTION

This section of the report emphasizes the methods and materials used to conduct the statistical analysis of this research. Explanations and justifications are provided for the choices that had been made according to the methods and data that were used. Since this research uses regression analysis as methodology a short introduction is provided on regression techniques. This forms the basis for the selection and collection of the data needed for the dependent variable and the predictor variables as describes afterwards. Finally, an extended overview is provided of the analysis process and the decisions concerning the steps that were taken and the models that were used.

3.2 INTRODUCTION TO REGRESSION

As mentioned in the introduction, regression techniques are used to perform this research, for which dependent and independent variables had to be depicted. However before describing the selection of these variables in the next paragraphs, a short introduction into regression analysis is necessary to be able to understand the choices that were made.

The essence of regression analysis is a way of predicting some kind of outcome from one or more predictor variables (Field, 2005). When using one predictor variable it is named a simple regression, if more variables are used and the complexity is increased to predict an outcome it is named a multiple regression. In a regression model the outcome is indicated as the dependent variable because the outcome is depending on the predictor variables. Subsequently the predictor variables are assumed to predict the outcome independently of each other and as such are called independent variables.

For example it is expected that there is a relation between the price of an office building and the number of bidders, according to the common theory of demand and supply. In this case the price of an office building is the dependent variable and the number of bidders is the independent variable. The simple idea of predicting data can be describe by the following equation:

\[ \text{Outcome} = \text{Model} + \text{error}, \]  
(1)

This just means that a model plus some kind of error (a residual) can predict the outcome. In regression the model is a linear model and represents a straight line. The ‘straight line’ is the line that best describes the general trend of a dataset and since a straight line is described by its slope (\( \beta_1 \)) and intercept (\( \beta_0 \)), the model emerges into the following:

\[ Y_i = \beta_0 + \beta_1 X_i + \epsilon_i \]  
(2)

So, the model that fits best to the data in a linear regression can be conceptualized as a straight line that can be described mathematically by the above equation, in which \( \beta_0 \) and \( \beta_1 \) are the regression coefficients (Field, 2005). When adding more predictors, or performing a multiple regression, the number of coefficients will increase by the number of added predictors.

\[ Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n + \epsilon_i \]  
(3)

Using the example of the price of an office building as mentioned earlier and adding another predictor, for example the average market value of other office buildings in the close surroundings, assuming that the price of an office building will not diverge too much from the current market, the following equation can be derived at:

\[ \text{Office Building Price} = \beta_0 + \beta_1 \text{Number of bidders} + \beta_2 \text{Average market value} + \epsilon \]  
(4)

The number of predictors in a multiple regression analysis are theoretically indefinite, however the predicting power of such a model will significantly decrease, because it is likely that several independent variables are interrelated, causing unwanted noise.

Based on these basic principles of the regression model the next paragraphs will emphasize on the collection of the data and the selection of the outcome variable, or dependent variable, and the independent variables, the predictors.

3.3 DATA COLLECTION

3.3.1 Data source

Since this study focuses on investment choices concerning office real estate an extended database of office buildings was needed. To develop a statistical model and produce meaningful results the data set had to include 50 or more cases. With that, detailed information had to be collected for each case, as well as for the financial performance and building descriptions. The potential use of net rental cash flows of office buildings (see next paragraph) for this study required sensitive business information and can’t be acquired very easy. Nevertheless, with NSI a company was found that satisfied these demands.

NSI is a closed-end investment company with variable capital that invests in real estate. NSI was established at 1 March 1993 and since 3 April 1998 NSI is listed at the Amsterdam Stock Exchange. NSI invests in offices and retail. Besides maintaining its portfolio in the Netherlands, NSI is striving to build up an international portfolio in Switzerland and France. Currently 52% of the Dutch portfolio are offices, which amounts to 86 properties.

The timeframe as set for this study is 10 years, starting in 2000 (earlier information of the portfolio was not consistent enough to meet the demand level of data collection). All office properties that are included or have been included in the portfolio of NSI during this timeframe were target to enter the dataset. A constraint was that a minimum of 50% of the total asset had to be office function. For example an industrial building with a 4000 m² industrial hall added with a 100 m² office to it, did not qualify. Another constraint was the minimum time period of one year (4 quarters) the asset was in possession of NSI. Asset acquisitions as part of pack-out transactions that are instantly resold obviously did not qualify as well.

The filtered portfolio of NSI finally resulted in 119 useful office buildings that were part of the portfolio in the period 2000(Q1)-2009(Q3). The data set comprises buildings from 290 m² up to 25.000 m² with a book value varying from € 0.4 million to € 36 million. The assets are located...
at "A" and "B" locations1 in the large and medium sized cities throughout the Netherlands (figure 3.1).

As described above the descriptive information per office building in the dataset was compiled for 39 quarters in the period 2000(Q1) to 2009(Q3). Since a natural attrition in the portfolio can be recognized the density of the dataset did not match a complete 100%, which however was to be expected. A full 100% density demand for the time series in this case would diminish the number of cases to 28. Another option was to reduce the length of the time series, however both measures have a negative affection to the level of significance of the study when performing statistical research. In addition, adjustments as such are unnecessary as statistical solutions are available for missing data (The use of a linear mixed-effect model handles this problem as can be seen in paragraph 3.4), therefore the 39-quarter timeframe was maintained.

3.3.2 Dependent variable

The aim of the study was to find distinguishing office building features that improve the decision-making criteria for institutional real estate investors in the acquisition process. To improve such criteria a closer look had to be taken to common investment motives in the first place.

Having a surplus of means is a common incentive for investing capital. The aim of investing this surplus must obviously lead to a higher return compared to the interest rate of a savings account; otherwise doing nothing would be a better option. Today a variety of investment opportunities are available of which real estate is one. Along with the desire for a higher return the uncertainty of the expected return increases. This uncertainty is called risk. An investor has to make a comparative assessment between the required return and the acceptable risk (Brealey and Myers, 1981).

Focussing on this study it can be concluded that within this risk return spectrum the return on investment is the target variable, or the outcome to be predicted. The willingness to take risk for investors depends on the power of knowledge about the specifics of office buildings and its influence on return. From this perspective, the return on investment of office buildings would be the obvious dependent variable, however certain conditions discourage that, as will be cleared out below.

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1. Different rating methods are used to indicate different locations. In this case A+ are top locations such as The Zuidas in Amsterdam or the Willems in Rotterdam. Locations with less exposure are mentioned A- or B+ etc.
2. A schematic overview of the density and division of the dataset can be found in appendix C.1
The total return on investment is equal to the sum of the income return (direct return) and the capital growth (indirect return). The income return is calculated as net income expressed as a percentage of capital applied over a certain period, whereas the capital growth is calculated as the change in capital value, minus any capital expenditure incurred, expressed as a percentage of applied capital over a certain period. There were several reasons why indirect return series were not included as dependent variable in this research. Firstly the volatility of indirect return series is much stronger than that of direct return series (see figure 3.3), which means that it would highly influence the total return series. Secondly it should be noted that indirect return series are calculated using capital values that are based on appraisals. Using transaction prices would reproduce more fair indices concerning ‘smoothing’ and ‘lagging’ effects, but are practically impossible to collect due to fewer transactions in a dataset of 119 office buildings within a period of 10 years. Also for using appraisal values fewer measurements are available because in practice, office buildings are not appraised once a year. Considering the use of quarterly measurements for this research it would disproportionately influence the dataset with information not even based on limited facts. Finally the influence of economic circumstances on appraisal values is too strong and would introduce too much noise in the dataset.

Because of the aforementioned problems with indirect return, the net rental income was used as a dependent variable for this research. Basically the net rental income is equal to the direct return, yet direct return is indicated as percentage of capital value. It is this capital value that is disputable and as such the use of the net rental income was most satisfying.

The literature review of comparable studies showed the use of different dependent variables (table 2.3). Several studies used the asking rent of office units within an office building (Ozus, 2009, Glasscock et al., 1990, Dunse and Jones, 1998, Öven and Pekdemir, 2006), whereas others collected the average asking rent of an entire office building (Clapp, 1980, Hough and Kratz, 1983, Cannaday and Kang, 1984, Gat, 1998). However, asking rent might provide an indication of the performance of an office building, but it does not account for hidden factors like vacancy and rent-free periods. These hidden factors irrevocably influence a buildings financial performance. Asking rent can be artificially pushed towards prime level by providing longer rent-free periods as incentive. The use of actual transacted net rental income can overcome such irregularities. One study used the actual transacted rent (Brennan et al., 1984), but for single office units instead of the entire office building as targeted in this study. Another advantage of using net rental income is the inclusion of exploitation costs like maintenance, as well as periodically as large substantial maintenance. Due to the used timeframe of 10 years, the effect of interim investments for large substantial maintenance did provide information on long-term investment decisions.

Figure 3.3 Return series of the NSI office portfolio in the period 2000-2008 compared to the return series of the Dutch office market. (Source: R02/1PD)

Table 3.1 Calculation of Net Rental Income according to accounting department NSI

<table>
<thead>
<tr>
<th>Net Rental Income Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quarterly Actual Rental Income</strong></td>
</tr>
<tr>
<td>Management Costs (3%)</td>
</tr>
<tr>
<td>Exploitation Costs:</td>
</tr>
<tr>
<td>Fixed costs</td>
</tr>
<tr>
<td>Contribution Community of Property Owners</td>
</tr>
<tr>
<td>Periodical maintenance</td>
</tr>
<tr>
<td>Large maintenance</td>
</tr>
<tr>
<td>Preparation for lease</td>
</tr>
<tr>
<td>Service charges during vacancy</td>
</tr>
<tr>
<td>Insurance</td>
</tr>
<tr>
<td>Brokers fee</td>
</tr>
<tr>
<td>Questionable debtors</td>
</tr>
</tbody>
</table>

The net rental income figures per office building were used in proportion to the lettable floor area. This made the performance of the different cases comparable. Furthermore a correction for inflation was applied to the net rental income series to exclude overall economic factors over time. It provided fair comparison of measures at different moments in time.

4. The indirect return values are calculated using internal appraisal values in the period 2002-2004 and external appraisal values in the period 2005-2008
5. The used inflation rates where based on CBS publications and represents the Dutch market. The exact used figures can be found in appendix C.3
Below a short explanation is provided of the subset of used exploitation costs.

- **Fixed costs**: Quarterly returning costs.
- **Contribution Community of Property Owners**: If there is a Community of Property Owners for a larger complex of buildings with different owners a contribution has to be paid for that.
- **Periodical Maintenance**: Performing small maintenance is to repair little defects and to maintain the condition of the building. It is performed on an annual basis.
- **Large maintenance**: Once in 5 to 15 years large maintenance (i.e. painting, replacements or roof covering etc..) is performed to update the buildings condition substantially in order to decrease the effects of ageing.
- **Preparation for lease**: Costs for adjustments that have to be made for a new lease contract.
- **Service charges during vacancy**: Service costs are charged to tenants. In case of vacancy the owner is responsible for these expenses.
- **Insurance**: A premium has to be paid by the owner for the buildings insurance.
- **Brokers fee**: Brokers are used to search for new tenants. A broker’s fee pays them.
- **Questionable debtors**: Unpaid rents that are waiting for redemption are notified as questionable debtors.

Summarizing it can be stated that the quality of this dataset was of high value. Due to the used timeframe of 10 years, it was possible to recognize the influence of at least one economic market cycle. The ability to study long-term effects was valuable. In addition, collecting this information for 119 cases improved the significance of the results and created the opportunity to generalise possible outcomes (table 3.2 provides the technical description of the used variable).

<table>
<thead>
<tr>
<th>Variable name</th>
<th>Label</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIM2[yr-q]</td>
<td>Quarterly net rent income per square meter LFA Scale</td>
<td></td>
</tr>
</tbody>
</table>

### Table 3.2  
Dependent variable set for Net Rental Income

**3.3.3 Independent variables**

This paragraph provides a description of the conducted independent variables, the realization of the different sets and criteria for the pre-selection phase. As mentioned in paragraph 3.2, the amount of variables that might predict the level of net rental income in a regression analysis is large if there are sufficient cases like in the present study. Therefore a pre-selection occurred, which was based on the hypothesis that the level of net rental income of an office building is dependent not only on economic and location characteristics, but also on specific characteristics of the building itself. The pre-selection norm was the hypothetically predictive power of each individual factor and the likelihood of the required information to be found. Knowledge from literature studies and interviews with professionals was used to add any previously neglected variables.

As mentioned before, the hypothesis stated that economic, location as well as building features influences the level of net rental income of an office building. Grouping the used variables into factor groups simplified the model and improved the ability to study the effects of specific building features. Since location is found to be the most important selection criteria in the real estate industry, all variables that involve location specific information were grouped into the factor group location. Market features such as regional vacancy rates or regional market supply are highly dependent on location and as such are expected to be placed in the location group. However due to the national spread of the NSI portfolio, regional market features became very important and as such were included in a separate factor group. The distinction between these groups can be characterized by the difference in physical location characteristics and economic conditions at regional level. The third factor group was the target factor group of the study and consisted of factors distributed over three groups plus a certain residual (figure 3.4). This residual represents the influence of factors other than the input predictors, which is also referred to as error (see equation 1, paragraph 3.2). Stemmed from the basic description of a regression model the following model can be formulated.

\[
\text{Net Rental Income} = \beta_0 + \beta_1 \text{Regional Market Features} + \beta_2 \text{Location Features} + \beta_3 \text{Building Features} + \epsilon_i
\]

The assumption was made that the level of net rental income of an office building could be predicted by all factors distributed over three groups plus a certain residual (figure 3.4). This residual represents the influence of factors other than the input predictors, which is also referred to as error (see equation 1, paragraph 3.2). Stemmed from the basic description of a regression model the following model can be formulated.

\[
\text{Net Rental Income} = \beta_0 + \beta_1 \text{Regional Market Features} + \beta_2 \text{Location Features} + \beta_3 \text{Building Features} + \epsilon_i
\]

The following subparagraphs will emphasize the results of the above-described process and provide a detailed description of the used independent variables according to factor group. Some adjustments to the use of variables were made in a later phase of the study (see paragraph 3.4) and were named recodes.

#### 3.3.3.1 Regional market features

The variables in the factor group regional market features (table 3.4) describe the historic trends and developments for the regional office market. Since market conditions are inconsistent over time, all regional market feature variables are treated as repeated measures. Information is collected from market reports of the Dutch broker DTZ Zadelhoff, which are published on a

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6. If not available in hard figures information was gathered by measuring up the graphs
yearly basis. Due to this frequency constraint in relation to the quarterly based income figures, annual measures have been interpolated to a quarterly scale. However, since actual changes in market conditions on quarterly basis in general are not considered significant, problematic distortion in the dataset did not occur.

The regional character of this factor group becomes apparent in the spread of the data. The location of each office in the NSI portfolio was linked to an agglomeration, based on a distinction made by DTZ (table 3.3). For all offices that were not located within these regions, market figures were mediated by characteristics of surrounding regions. For example the regional vacancy rate for a location in Delft was determined by the regional vacancy rate of the Rotterdam and The Hague area. Information on rent prices was available on the level of distinctive office locations within cities.

### Table 3.3 Division of important agglomerations in the Netherlands according to DTZ

<table>
<thead>
<tr>
<th>DTZ agglomerations</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Amsterdam and surroundings</td>
<td></td>
</tr>
<tr>
<td>Arnhem and Nijmegan</td>
<td></td>
</tr>
<tr>
<td>Breda and surroundings</td>
<td></td>
</tr>
<tr>
<td>The Hague and surroundings</td>
<td></td>
</tr>
<tr>
<td>Ede and Vegnendaal</td>
<td></td>
</tr>
<tr>
<td>Eindhoven and surroundings</td>
<td></td>
</tr>
<tr>
<td>Freeland</td>
<td></td>
</tr>
<tr>
<td>Gooi and Eemland</td>
<td></td>
</tr>
<tr>
<td>Groningen and Assen</td>
<td></td>
</tr>
<tr>
<td>Haarlemmermeer 's Hertogenbosch and Tilburg</td>
<td></td>
</tr>
<tr>
<td>Limburg</td>
<td></td>
</tr>
<tr>
<td>Rotterdam and surroundings</td>
<td></td>
</tr>
<tr>
<td>Twentse stedenband</td>
<td></td>
</tr>
<tr>
<td>Utrecht and omgeving</td>
<td></td>
</tr>
<tr>
<td>Zwolle, Apeldoorn and Deventer</td>
<td></td>
</tr>
</tbody>
</table>

### Table 3.4 Independent variables for factor group Regional Market Features

<table>
<thead>
<tr>
<th>Variable name</th>
<th>Label</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUPM2</td>
<td>Supply</td>
<td>Scale</td>
</tr>
<tr>
<td>ABSM2</td>
<td>Absorption</td>
<td>Scale</td>
</tr>
<tr>
<td>STOCKM2</td>
<td>Market stock</td>
<td>Scale</td>
</tr>
<tr>
<td>EMPLOY</td>
<td>Employment</td>
<td>Scale</td>
</tr>
<tr>
<td>GPP</td>
<td>GDP per capita</td>
<td>Scale</td>
</tr>
<tr>
<td>EMPLOYv</td>
<td>Employment volume in the region</td>
<td>Scale</td>
</tr>
</tbody>
</table>

SUPM2 and ABSM2 describe the supply and absorption of office space (m²) in the regional market (table 3.4). Absorption in this case is determined by the take up of office space, sold or leased at the ‘free market’, except for safe-and-leaseback transactions and developments on behalf of owner-users. Transactions below 750 m² are not registered. Market supply consists of buildings that have a minimum of 500 m² office space available for lease or for sale, and only relates to newly delivered buildings or buildings in construction. STOCKM2 represents the market stock of office space at a certain moment in time, consisting of existing offices and buildings in development with an area of at least 500 m². STOCKM2 is the stock that is in use and describes all office space that is not registered as supply at the moment of making the inventory. Average vacancy rates in the regions (VAC_RAT) are regarding office space supplied in delivered buildings that are not in use (any more). It is expressed by the proportion between the stock in use and the current office stock.

MRENT_LOW and MRENT_HIGH map the regional bandwidth of the asking rent per square meter lettable floor area office space (excluding tax and service costs) and are determined by the bottom of the market and the prime rents.

The volume of the employment in the region (EMPLOY) is estimated by the sum of desk jobs and is an indicator for the available workforce and need for office space.

Finally the growth of the national Gross Domestic Product (GDP) is absorbed as market indicator for the growth of the national economy and is recorded on a quarterly basis. It was expected that the effects of the economy on national level were of strong influence on the performance of office buildings. Therefore this factor was included in the factor group regional market features as well.

Obviously some of these variables appeared to be strongly interrelated. At this point it was however not clear which factor would be most important and as such all indicators were considered valuable. Further research had to clarify which factors represented the regional market factor best.

#### 3.3.3.2 Location features

The description of physical characteristics of an office location can be classified into four levels of scale and is based on the following considerations. Where is the office building located in the Netherlands? In what type of area is it situated compared to other Dutch areas? How and where is it located within the city of the location and what are the location features at building level? In this respect the factor location is very diverse, considering the theoretical inclusion of regional market features as well.

The set of variables composed to represent the factor location consisted of features that describe all four levels of scale (table 3.5). The location in relation to the Randstad area (RANDSTAD) turned out to describe the national location in the best way, better than using the division in economic regions (COROP) or agglomerations (DTZ regions). The latter two consisted of too many optional values that would decrease the predictability of the variables.

### Table 3.5 Independent variables for factor group Location Features

<table>
<thead>
<tr>
<th>Variable name</th>
<th>Label</th>
<th>Measure</th>
<th>Recode</th>
<th>Mutation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUPM2</td>
<td>Supply</td>
<td>Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABSM2</td>
<td>Absorption</td>
<td>Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STOCKM2</td>
<td>Market stock</td>
<td>Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMPLOY</td>
<td>Employment</td>
<td>Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GPP</td>
<td>GDP per capita</td>
<td>Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMPLOYv</td>
<td>Employment volume in the region</td>
<td>Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MRENT_LOW</td>
<td>Low rent</td>
<td>Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MRENT_HIGH</td>
<td>High rent</td>
<td>Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VAC_RAT</td>
<td>Vacancy rate</td>
<td>Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GPPv</td>
<td>GDP per capita</td>
<td>Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMPLOYv</td>
<td>Employment volume in the region</td>
<td>Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RANDSTAD</td>
<td>Location type (Randstad)</td>
<td>Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COROP</td>
<td>Location type (COROP)</td>
<td>Scale</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. A COROP-region is a regional area within the Netherlands. These regions are used for analytical purposes by, amongst others, Statistics Netherlands. The Dutch abbreviation stands for Coördinatie Commissie Regionaal Onderzoekprogramma
Another way of describing a location on national level is by using the density of population as proxy. Two types of measures were applied. The number of residents (NUMRES) indicates the size of a city, but does not describe density of population per se, but this was included in the variable urbanization grade (URB_CLASS).

The characteristics of locations surroundings was important according to investment experts. A location in the centre of a city might experience more quality exposure than an office building situated at an industrial area outside the city (LOC_SUR). Besides exposure, the accessibility of a location is considered an issue. Where accessibility by car (DIS_HW) used to be an important demand, currently accessibility by public transport (DIS_PT) becomes more important. Locations near NS stations (DIS_NS) are increasing in popularity.

Part of accessibility by car is the availability of parking places. Both the number of parking places (PP) and the parking norm (PN) was registered. The parking norm is expressed as the amount of lettable floor area per parking place.

The variable URB_CLASS was recoded (table 3.5) by merging cases located in less urbanized and not urbanized areas since fewer buildings were located in non-urbanized areas. Also the number of locations within the NSI portfolio situated in residential areas (LOC_SUR) were scarce and as such merged together with city centre locations into the group inner-city locations.

### 3.3.3 Building features

The selection of the set of variables describing building features has been constructed by matching findings from literature and interviews with educational expertise in real estate. The second, yet substantial criterion was the availability of information and the ability to register. This resulted in a variable set as described in table 3.6.

AGE describes the age of an office building according to its technical life. Substantial large maintenance and renovations that significantly extend the technical lifetime of the building are considered as points of measurement. Thus age is calculated as the period between construction or renovation and present day. Since age is variable over time and the NRI describes 10 years, this is interpreted as a repeated measure.

The number of floors (NR_FL), the average lettable floor area per floor (ALFA_FL) and the ratio between lettable floor area and gross floor area (LFGF_RAT) per office building were obtained from official measuring reports. These variables describe the spatial dimensions of the building.

Whether a building is generally used as single tenant or multi tenant office in the NSI portfolio during the last ten years is described by the using typology (USE). At first a distinction was made between multi tenant buildings with shared facilities, like a restaurant or a reception, and without shared facilities. The low number of effective cases caused these two to be merged together (USE__2). Whereas this variable describes the past, it is the flexibility of the layout

### Table 3.6 Independent variables for factor group Building Features

<table>
<thead>
<tr>
<th>Variable code</th>
<th>Label</th>
<th>Values</th>
<th>Measure</th>
<th>Recode</th>
<th>Mutation</th>
</tr>
</thead>
<tbody>
<tr>
<td>LFGF_RAT</td>
<td>LFA / GFA Ratio</td>
<td>Scale</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AGE</td>
<td>Year of construction or renovation to date quarterly</td>
<td>Scale</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USE</td>
<td>Using typology</td>
<td>Nominal</td>
<td></td>
<td>USE__2</td>
<td>1=multi tenant</td>
</tr>
<tr>
<td>FLEX</td>
<td>Flexibility in lay-out office building</td>
<td>Nominal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HYBRID</td>
<td>Mix of use in the building</td>
<td>Nominal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIS_HW</td>
<td>Flexing in lay-out office building</td>
<td>Nominal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIS_NS</td>
<td>Flexing in lay-out office building</td>
<td>Nominal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FAC_MAT</td>
<td>Facade materials used for overall part of the building</td>
<td>Nominal</td>
<td></td>
<td>FAC_MAT_CH</td>
<td>1=bricks</td>
</tr>
<tr>
<td>FAC_SHAPE</td>
<td>Shape of the buildings facade</td>
<td>Nominal</td>
<td></td>
<td>FAC_SHAPE_2</td>
<td>1=2+3+4+5+6</td>
</tr>
<tr>
<td>LOC_SUR</td>
<td>Shape of the footprint of the building</td>
<td>Nominal</td>
<td></td>
<td>LOC_SUR_2</td>
<td>1=rectangular</td>
</tr>
<tr>
<td>VOLUME</td>
<td>Shape of the footprint of the building</td>
<td>Nominal</td>
<td></td>
<td>VOLUME_2</td>
<td>1=box</td>
</tr>
<tr>
<td>SPAT_LAY</td>
<td>Spatial lay-out</td>
<td>Nominal</td>
<td></td>
<td>SPAT_LAY_2</td>
<td>1=domestic</td>
</tr>
<tr>
<td>URB_CLASS</td>
<td>Urbanization grade</td>
<td>Nominal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NUMRES</td>
<td>Number of residents</td>
<td>Scale</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENT_RURE</td>
<td>Entourage outside</td>
<td>Nominal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENT_RURE_IN</td>
<td>Entourage outside</td>
<td>Nominal</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(FLEX) that determines the possibility to how the building can be used. This flexibility is described by the following three options:

1. The layout of the office building/unit is barely adjustable to the demands of a future tenant.
2. The layout of the office unit can be divided by demand with some efforts. With the same efforts the building is adjustable for multi tenant use.
3. The layout of the office unit is very adjustable by demand. The building is also very adjustable for multi tenant use.

Buildings that contain multiple functions are designated as hybrid buildings. The variable HYBRID describes whether a building is just used for office activities or for other functions too. Buildings with shops in the plinth and offices on top or buildings that include apartments as well as offices are indicated as hybrid.

Some office buildings are part of larger complexes but are functioning solitaire. Others are build in an inner city environment such as canal side houses. These offices are indicated as not free standing (FREE).
Decision-making Criteria for the Acquisition of Office Buildings

Do building features decide?

3. METHODOLOGY

vertical core; the rooms are connected to the core and the external envelope and are skin oriented (figure 3.7). A spinal office has a linear floor plan with a central corridor access to cellular offices on the outside. The inner offices in a deep plan building are not related to the skin.

BUILD_TYP is a variable that describes the type of building (figure 3.8). This can be high-rise, if it contains more than 8 floors. Complex, which is a multi-block building. If it is a small maximum three-storey high freestanding single tenant office it is designated as pavilion. Urban offices are buildings that are situated in between street views. If an office does not match any of these descriptions it is ascribed to the value basic, which is mostly a standard 4 or 5 storeys high so called 'developers offices'.

BUILD_TYP is a variable that describes the type of building (figure 3.8).

The entrance of the building is assessed for the inside (ENTR_CHAR_IN) as well as for the outside (ENTR_CHAR_OUT). The criteria for the outside of the entrance to be attractive are obviousness and accessibility from the street or parking area and the degree of being inviting (figure 3.9). The inside criteria are offering a pleasant stay, providing for a favourable reception, enough incidence of natural light and being spacious.

The information according to the layout, flexibility and use of the building were determined by staff members of the property management department of NSI, who are responsible for the rental of the office properties. They also assessed the attractiveness of the entrance.

PROCEDURE

This paragraph will emphasize on the chronological sequence of steps that have been taken in the different phases of the statistical analysis of the research. The way to the final model that predicts and describes the effects of the earlier mentioned factors on the net rental income of an office building consists of three phases (table 3.7). In the exploration phase the usefulness of the data is examined and the first implications have been explored. Singular effects of all
For this the missing value analysis tool in SPSS is used with the NRI as quantitative and as categorical variable for all 39 quarters. Therefore these variables have been recoded as described in paragraph 3.3.3. Some variables were unequally divided which potentially undermines the prediction power of such variables. An exploration of the distribution of the variable values resulted in several adjustments. These estimated values are based on a matrix interpolation consistent pictures of average performances in relation to certain factor values, the missing NRI values were filled in by estimation. These estimated values are based on a matrix interpolation performed for the existing NRI values.

Variables that are measured irrespective of time, since the NRI is described for a time period of 39 quarters. According to this the NRI is interpreted as repeated measure. The analysis is performed for the original population and for a population that has been modified. A disadvantage of using the original population is that for only 28 out of 119 cases a value of the NRI is available for all 39 quarters. Therefore the effect of a factor is calculated based on just 28 cases, which is a quite a low number. To anticipate on this the same analysis is performed for a population of which the missing values are estimated as described earlier. Due to this modification, effects are calculated based on 119 cases.

In this procedure the null hypotheses is tested about the effects of the within-subject factors. The within-subject factor is indicated as time with 39 levels. Also the interaction between the within-subject factor and a variable is tested. The significance of the null hypotheses to be rejected was determining for the effect of a certain factor on the performance.

Some factors have more observations per subject. Age for example is dependent on time and is also different for each office building. The autocorrelation between the NRI observations is 0.83 (p<0.05) so that a mixed linear regression model is best to describe the relationship between age and performance. Although this is a different calculation method then used for the static variables the outcome of the different models is equal. The mixed linear models are conducted with a first-order autoregressive (AR1) covariance matrix. Since the residual errors within each office building are correlated, but independent across all office buildings, the independent variables are considered as fixed variables within this model.

The significances of the within-subject effects, for the GLM models, and the fixed effects, for the mixed models, of all individual factors were compared to make a selection of the most influencing ones. The selection criterion for entering the final model was a $p$-value of 0.250 or lower.

---

**Table 3.7** Description of the process steps undertaken in the three phases of the data analysis

<table>
<thead>
<tr>
<th>Phase</th>
<th>Description</th>
<th>Used regression model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exploration</td>
<td>Exploration of the dataset</td>
<td></td>
</tr>
<tr>
<td>Pre-selection</td>
<td>Singular variable analysis for static variables</td>
<td>General Linear Model</td>
</tr>
<tr>
<td></td>
<td>Singular variable analysis for repeated measure</td>
<td>Mixed Linear Model</td>
</tr>
<tr>
<td></td>
<td>variables for final model</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Forward and backward cluster analysis</td>
<td>Linear Model</td>
</tr>
<tr>
<td></td>
<td>Final selection of variables for final model</td>
<td></td>
</tr>
<tr>
<td>Final model</td>
<td>Developing Random Coefficient Model</td>
<td>Mixed Linear Model</td>
</tr>
<tr>
<td></td>
<td>Backward cluster model testing to find best fit</td>
<td>Mixed Linear Model</td>
</tr>
<tr>
<td></td>
<td>Define definitive &quot;Final Model&quot;</td>
<td>Mixed Linear Model</td>
</tr>
</tbody>
</table>

Variables were tested in the pre-selection phase, based on which an elective set of variables was assessed to be used for the final model. Finally, using several tests and try-out models, a final model was defined.

**Exploration phase**

In the first stage of the analysis a general survey is produced in which descriptive statistics describe means, standard deviations and confidence intervals for all variables. To provide more consistent pictures of average performances in relation to certain factor values, the missing NRI values were filled in by estimation. These estimated values are based on a matrix interpolation by performing a regression using the existing NRI values.

An exploration of the distribution of the variable values resulted in several adjustments. As described in paragraph 3.3.3.3 some variables were unequally divided which potentially undermines the prediction power of such variables. Therefore these variables have been recoded with the criterion of at least 10 cases that satisfy a variable value.

---

10. here the Greenhouse Geisser test is used
11. due to the different estimation methods that are used, General Linear Models and Mixed Models often do not produce the same results. This however is tested for this dataset and the equality seems to exist here. (based on “Linear Mixed-Effects Modeling in SPSS: An Introduction to the MIXED Procedure”)
To double-check the selection of factors a second type of analysis was applied. To this end, the dataset is restructured by creating a kind of ‘growth model’ (i.e. a model over time). This allows performing a multi level model. A simple linear regression is performed with NRI as dependent variable and a cluster of predictors. The cluster of predictors is equal to the previously distinguished factor groups. For each of the three factor groups, this model is executed twice, with a forward entry and backwards elimination methods, to take into account the possible correlations between explaining factors. Based on the resulting significant affecting factors, extra variables were added to the pre-selection for the final model, which led to a final selection.

**Final model phase**

Finally in the last phase where the input variables were determined it was essential to search for a model that best fits the data. The goal was to perform a regression model with NRI as dependent variable and all pre-selected factors as predictors. It was chosen to use a linear mixed-effects model (MIXED) procedure instead of a general linear model (GLM). MIXED can handle correlated data and unequal variances. The NRI is a repeated measure and correlates over time (autocorrelation). Furthermore MIXED can handle much more complex situations, as in this dataset in which observations of the NRI are not available for all office buildings for each quarter. MIXED can also process data obtained from samples of the dataset, such as a sample of offices selected from a sample of locations in the Randstad for example. According to fixed and random effects, adjustments were made to the interrelatedness (covariance structure) of the data to find the fixed effects, which are the ones of primary interest. Adjustments in GLM are often not appropriate as MIXED solves these problems by providing tools necessary to estimate fixed and random effects in one model.

It is impossible to use a single regression line to describe the behaviour of every individual office building. To account for possible variations between these individual office buildings it is possible to treat the regression coefficients of random variables. Such model is called a random coefficient model. It is assumed that the (random) regression coefficients have normal distributions. There are three types of random coefficient models, models with random intercepts, random slopes and random intercept and slopes.

Testing whether the intercept of the regression lines of all office buildings is random resulted in an estimated variance of the intercept of 83.65 (p<0.00). This means that it is best to use a random intercept, which means that NRI varies across locations. This seems reasonable in an estimated variance of the intercept of 83.65 (p<0.00). This means that it is best to use a random intercept, which means that NRI varies across locations. This seems reasonable to assume. The estimated variances of the slopes of the individual office buildings were also significant at 0.00 level, which indicated that the different cases have individual timelines i.e. the NRI changes over time and is different for all offices. The test for both effects with an unspecified covariance matrix showed random slopes and random intercepts. This means that the base level of performances for all buildings is different as well as the change of performance over time.

### Table 3.8 Akaike’s information criterion for different model types

<table>
<thead>
<tr>
<th>Model type</th>
<th>AIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Random intercept</td>
<td>21271</td>
</tr>
<tr>
<td>Random slope</td>
<td>21694</td>
</tr>
<tr>
<td>Random intercept and slope</td>
<td>20680</td>
</tr>
<tr>
<td>Random intercept and repeated time</td>
<td>18396</td>
</tr>
</tbody>
</table>

The advantage of using a MIXED model is that a hypothesis can be posed which states that results from the analysis may be generalized. According to this study this hypothesis is true, because time as fixed factor is significant at 0.00 level, so there is an overall effect across the population. The only constraint is that this does not count for office buildings at A+ locations, since such offices are not included in the dataset.

Again to search for the model that best fits the data fixed factors were added by factor group (table 3.9). The least significant affecting factors were eliminated stepwise, with p<0.05 as criterion (table 3.10). A new factor group was added to the model if all remaining factors remained significant. For each performed model the AIC was recorded to find the best fit. The first added factor group was regional market features; the second factor group was office building features. The goal is to discover the model that better fits the data, for which the Akaike’s Information Criterion is used. The test basically comes down to the idea of smaller-is-better. As shown in table 3.8 the random intercept and slope model best fits the data of the three tested ones with an AIC of 18396. To adjust for the correlation between the residual errors of the different office buildings time is added as repeated effect with the use of a first-order autoregressive (AR1) covariance matrix. It shows a better fit since the AIC has been dropped to 18396.

### Table 3.9 Factors per group that were added to the model

<table>
<thead>
<tr>
<th>Factor group</th>
<th>Regional market features</th>
<th>Location features</th>
<th>Building features</th>
</tr>
</thead>
<tbody>
<tr>
<td>STOCKIUm2</td>
<td>DISNS</td>
<td>DISNS</td>
<td>DISNS</td>
</tr>
<tr>
<td>PN</td>
<td>DISNS</td>
<td>DISNS</td>
<td>DISNS</td>
</tr>
<tr>
<td>SUPm2</td>
<td>DISNS</td>
<td>DISNS</td>
<td>DISNS</td>
</tr>
<tr>
<td>GDP</td>
<td>DISNS</td>
<td>DISNS</td>
<td>DISNS</td>
</tr>
<tr>
<td>MRENT_HIGH</td>
<td>DISNS</td>
<td>DISNS</td>
<td>DISNS</td>
</tr>
<tr>
<td>LFA_m2</td>
<td>DISNS</td>
<td>DISNS</td>
<td>DISNS</td>
</tr>
<tr>
<td>AGE</td>
<td>DISNS</td>
<td>DISNS</td>
<td>DISNS</td>
</tr>
<tr>
<td>HYBRID</td>
<td>DISNS</td>
<td>DISNS</td>
<td>DISNS</td>
</tr>
<tr>
<td>RANDSTAD</td>
<td>DISNS</td>
<td>DISNS</td>
<td>DISNS</td>
</tr>
<tr>
<td>ENTR_CHAR_IN</td>
<td>DISNS</td>
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### Table 3.10 Process of entering factor groups and eliminate least significant factors including the model dimensions according to AIC

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features. It turned out that model 21 fitted best since all including factors had a significant
effect on the performance and the model showed the lowest AIC (17881). Other models might
have lower or equal AIC, but included non-significant explaining factors.

Finally a fixed-effects model is fitted that predicts the NRI by using regional absorption rate
(ABSm2), distance to public transport (DISPT), number of residents in place of location
(NUMRES), inside charisma of the entrance (ENTR_CHAR_IN), building type (BUILD_TYP),
using typology (USE_2), flexibility in layout (FLEX), number of floors (NR_FL) and age (AGE)
as predictors. These predictors are considered as fixed-effects. This model describes a random
intercept and time is absorbed as repeated effect.

### 3.5 Conclusion

The data collection in this study, as described in this chapter, was based on theory that came
from personal experience and academic knowledge. This theory is matched with rational and
factual proceedings as found in literature and in interviews as described in the previous chapter.
As a result of this match, improvements could be made to the theoretical preparation that took
precedence of the eventual statistical analysis. As such it was possible to conduct targeted
research that not only aimed at finding a relationship between office building performance
and building features, but could also assign specific features based on sound analysis. This
application of theoretical preparation can also be seen in the statistical analysis process, where
extended pre-election procedures were applied. This was all to create a best fitting model that
described the effects on performance most fairly.

### 3.6 ‘Change of perspective’

The tenants of the office buildings in the NSI portfolio are mainly small and medium
enterprises (SME) or governmental organisations. The government as tenant generally
means reliability and steady long-term agreements since governmental organisations won’t
become bankrupt.

Companies in SME in the other hand are much less reliable. Bankruptcy regularly occurs,
which means instant loss if income for the owner of the building. Especially in times of
economic depression like today it is the SME that experiences difficult times. Reduction
in the financial burden might provide temporary options, but performances will drop for
sure.
4 RESULTS

4.1 INTRODUCTION
This chapter will elaborate on the results of the statistical analysis of the data set. Following the three major phases of the analysis, exploration phase, pre-selection phase and the final model, factual descriptions of the findings will be provided and attention will be paid to specific trends and striking results. Conclusions will be drawn on the statistical implications of the outcome of the analysis.

4.2 EXPLORATION
This paragraph will provide an explorative analysis of the data regarding possible irregularities, interesting trends and any conspicuous discoveries in the early phase of the study. Just remarkable observations will be discussed as more extensive descriptions of all variables and relations can be found in the appendix. The results will be discussed following the division in target variable and the factors groups.

Figure 4.1 shows the curve of the average NRI of the portfolio over the measuring 10 years. After showing an upward trend to the end of 2002, the curve starts a steady decline till now. The decline after 2002 is a reflection of the effects of the ICT bubble on the commercial real estate market. Direct return series of the Dutch office market reproduce the same trend (figure 3.3), which indicates a proper representativeness of the NSI portfolio according to national economic market.

All regional market indicators are describing the market circumstances per location. Theoretically, since the NSI portfolio is scattered around the Netherlands, the average of all regional market figures as analyzed will reflect the figures of the Dutch office market. This appears to be the case, as expected, and again it shows that the dataset is highly representative for the Dutch office market.

In accordance with the decline of the NRI in the period between 2002 and 2009 do the regional vacancy rates increase (figure 4.3). It is obvious that there is a relation between vacancy rate in the region and the performance of an office building. The question however is whether vacancy rate is a proxy for office building performance or that vacancy rate is a result of low performing office buildings. Because of this, a short comment should be made regarding the use of vacancy rate as an indicator for the NRI.

Figure 4.2 Number of cases included in the dataset

Figure 4.3 Quarterly means of regional vacancy rates in the office market (VAC_RAT)

1. If such large maintenance is indicated as added value and as such is recorded as investment it will become part of the indirect result

2. More detailed description of the results on regional market features can be found in appendix E.1.

Quarterly means of net rental income per square meter LFA (NIm2) corrected for inflation (source: CBS), price level of 2000Q1

VAC_RAT

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When considering the relation between location features and the NRI some unexpected but interesting results have been found. Depending on information of professional investors one might expect that offices located within the Randstad perform better than offices situated in backward areas. The opposite appears to be true for the NSI portfolio. Over a period of ten years offices located far outside the Randstad (mean 28.9, SD 9.36) have outperformed buildings in the periphery of the Randstad (mean 24.9, SD 9.56) or within the Randstad (mean 24.2, SD 10.96). Just locations in one of the four large cities have been able to meet up (mean=26.5, SD 10.82; figure 4.4). It must be noticed that the data does not contain A’ rated locations and it is probable that top locations can make a difference in NRI. However, it might indicate that location, if not A’ rated, according to position in relation with the Randstad is less important then commonly believed.

According to the urbanization grade of the city in which an office building is located no remarkable contrast can be noticed for the first 7 years, though from of 2007 buildings at locations in less urbanized areas seemed to perform better (figure 4.5). It is in this period that the first signs of the global financial crisis appeared. The statement that less urbanized areas suffer less from this crisis might be too suggestive, since one needs to acknowledge the existing lag of the real estate market, especially according to direct results. The real estate market generally follows the economy with a delay of about 2 years. Therefore it is more likely that other factors are involved here.

The large difference in performance of office buildings located at office parks (mean 27.9, SD 9.92) and industrial areas (mean 24.1, SD 10.48) was to be expected (figure 4.6). It is generally known that industrial areas lack in quality in comparison with inner-city locations (mean 25.3, SD 10.36) and specialized office parks.

The average distance to a NS station (2.5 km, SD 1.77) is equal to the distance to a highway (2.4 km, SD 2.02), which indicates a positive spread in the portfolio for the analysis of accessibility. The average number of parking places per office building is 74, but strongly differs between all cases (SD 67.2). Reversely, each office building has 62 m² of lettable floor area per parking place on average (SD 47.8).

At first sight there seems to be a small negative relation between the distance to public transport and the height of the NRI (R Sq linear 0.013; figure 4.7). In other words, if the distance between an office building and the nearest public transportation hub increases then the performance will drop, which is a plausible effect. Furthermore it looks like the performance of

---

3. A single global linear regression model is performed to calculate the estimated marginal means. Figures used for this regression have been adapted by using a missing value analysis for the missing NRI values.

4. More detailed description of the results on location features can be found in appendix E.2.
As the current strategy of NSI is to disinvest in small single tenant office buildings for reasons of relatively high management costs and thus inefficiency, one would expect to find supportive evidence for this from the data. The opposite however seems to be true, as single tenant offices (mean 27.6, SD 10.61) consistently performed better over a period of ten years than multi tenant offices (mean 24.4, SD 10.14; figure 4.12). Possibly other factors than the management costs seem to be involved and might eliminate the importance and influence of management costs. One could think of causes like less vacancy due to higher loyalty of tenants in single tenant buildings.

The single tenant offices in the NSI portfolio are generally small offices and therefore possibly attract such typical users.

Ordered from high to low performance urban (mean 27.6, SD 10.34), basic (mean 26.8, SD 7.14) and pavilion type office buildings (mean 24.9, SD 10.24) perform rather continuous, whereas high-rise offices are more volatile (mean 27.9, SD 10.19). Complex type buildings (mean 22.4, SD 6.96) show a respectable underperformance from start 2004 onwards (figure 4.123). At first thoughts, it seems that high rise buildings respond more directly to the market as can be seen in the upturn in the period 2002-2005 and the slump after that. These types of buildings are often situated at the top of the market amongst others due to higher exposure. The late entrance of a significant amount of high-rise buildings in the NSI portfolio might cause a certain distortion, but this effect will be overcome in a later phase of the analysis.

As age is yet commonly recognized as a building feature that negatively influences performance, the development of the portfolio’s average in relation to the overall performance is interesting. In figure 4.10 the mean age is displayed for all 39 quarters and a consistent increase in age can be noticed from 2002. It is a trend that can be explained by the growing size of the portfolio and a lack of disposal of older buildings. The upward trend of the age is remarkably perfectly reversely proportional to the descending overall performance of the NRI, which is also starting after 2002 (as can be seen in figure 4.1). This observation seems to be justified by the findings of the negative relation between age and performance as showed in figure 4.9).

Another remarkable relation is that of the number of floors inside a building and its performance, a relation that is already noted by several authors in the literature. Office buildings with more floors tend to perform better (R sq linear 0.02; figure 4.11). This might be caused by factors like flexibility advantages or efficiency improvements.

As the current strategy of NSI is to disinvest in small single tenant office buildings for reasons of relatively high management costs and thus inefficiency, one would expect to find supportive evidence for this from the data. The opposite however seems to be true, as single tenant offices (mean 27.6, SD 10.61) consistently performed better over a period of ten years then multi tenant offices (mean 24.4, SD 10.14; figure 4.12). Possibly other factors than the management costs seem to be involved and might eliminate the importance and influence of management costs. One could think of causes like less vacancy due to higher loyalty of tenants in single tenant buildings. The single tenant offices in the NSI portfolio are generally small offices and therefore possibly attract such typical users.
Decision-making Criteria for the Acquisition of Office Buildings
Do building features decide?

4. RESULTS

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of
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Further
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SD
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than
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buildings
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SD
10.22).
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worst
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23.9,
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and
using
type
(.780,
p<0.01).

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that
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assessed
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show
better
NRI’s
(figure
4.15).

Figure 4.12 Estimated marginal means of Net Rental Income according to type of use described per value
(USE_2) corrected for inflation (source: CBS), price level of 2000Q1. The singular case dip is included in the single tenant line

Figure 4.13 Estimated marginal means of Net Rental Income according to building type described per value
(BUILD_TYP) corrected for inflation (source: CBS), price level of 2000Q1. The singular case dip is included in the urban office building line

Figure 4.14 Estimated marginal means of Net Rental Income according to flexibility of the layout
described per value (FLEX) corrected for inflation (source: CBS), price level of 2000Q1. The singular case dip is included in the not adjustable line

Figure 4.15 Estimated marginal means of Net Rental Income according to the inside charisma of the
entrance described per value (ENTR_CHAR_IN) corrected for inflation (source: CBS), price level of 2000Q1. The singular case dip is included in the unattractive line

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6. In appendix E.3 a complete table of all correlation coefficients between building features can be found
7. The graph with the performance of the outside charisma of an entrance can be found in appendix E.1
4.3 PRE-SELECTION

For all single variables a general linear regression model or a mixed linear regression model is performed with NRI as target variable as is described in paragraph 3.4. Based on the results of these models and using both the original database (ODB) and the database completed with missing values (MVDB), a selection is made of variables that were considered for inclusion in the final model. According to the degree of significance of the effect on the NRI, a distinction is made as can be seen in table 4.1.

<table>
<thead>
<tr>
<th>Regional Market</th>
<th>Factor Group</th>
<th>Variable</th>
<th>ODB</th>
<th>MVDB</th>
<th>Building Features</th>
<th>Variable</th>
<th>ODB</th>
<th>MVDB</th>
<th>Legend</th>
</tr>
</thead>
<tbody>
<tr>
<td>URB_CLASS_2</td>
<td>SUPf2</td>
<td>0.007</td>
<td>0.186</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NW_FL</td>
<td>0.023</td>
<td>0.016</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>LFA_f2</td>
<td>0.273</td>
<td>0.035</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GFA_f2</td>
<td>0.316</td>
<td>0.039</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of floors</td>
<td>0.035</td>
<td>0.016</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of residents</td>
<td>0.033</td>
<td>0.033</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.1 Pre-selection of variables to enter the final model according to significance of effect on NRI

Subsequently to these regressions analysis’s a cluster study (see paragraph 3.4) is conducted per factor group to double check the possible effect of every variable on the NRI. Resulting variables are added to the pre-selection group as well and are marked grey.

In this stage of the study it is very conspicuous that, despite the higher number of variables, more than regional market or location features, building features are leader in number of significantly influencing variables. Basically the opposite was to be expected. In fact only RANDSTAD and DISNS in the first resort were selected as location factors based on proportionally low levels of significant effect (resp. 0.273 and 0.316). DISPT is added as variable according to the results of the cluster study. Despite the resulting low significant effects of other location factors more variables have been accepted in the pre-selection (URB_CLASS_2, PN, LOC_SUR_2, NUMRES and DISHVY), based on theoretical considerations and according to the assumption that location is an influencing factor as commonly thought in the real estate business. However the findings of these weak predictors might indicate a less strong effect of location factors than generally assumed.

Significantly strong effects on the NRI are found for building features like charisma of the entrance (ENTR_CHAR_OUT, p=0.000; ENTR_CHAR_IN, p=0.001), number of floors (NW_FL, p=0.016) and age (AGE, p=0.033). But also factors like the type of use (USE_2, p=0.089), flexiblity (FLEX, p=0.095) and the ratio between LFA and GFA (LGF/ RAT, p=0.035) seem to have significant effects.

4.4 FINAL RESULTS

The final model is a model in which certain factors significantly explain part of the level of the net rental income. The differences in net rental income might be attributed to the factors described in table 4.2, in which factors from all three defined factor groups are attendant.

<table>
<thead>
<tr>
<th>Region</th>
<th>Factor Group</th>
<th>Source</th>
<th>Numerator df</th>
<th>Denominator df</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intercept</td>
<td></td>
<td>1</td>
<td>127.1</td>
<td>185.860</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>Time</td>
<td></td>
<td>1</td>
<td>240.3</td>
<td>49.463</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>Regional market absorption of office space</td>
<td>Regional absorption of office space</td>
<td>1</td>
<td>2096.9</td>
<td>5.333</td>
<td>.021</td>
</tr>
<tr>
<td></td>
<td>Location</td>
<td></td>
<td>1</td>
<td>104.7</td>
<td>5.784</td>
<td>.013</td>
</tr>
<tr>
<td></td>
<td>Building type</td>
<td></td>
<td>1</td>
<td>101.5</td>
<td>6.641</td>
<td>.013</td>
</tr>
<tr>
<td></td>
<td>Using typology</td>
<td></td>
<td>1</td>
<td>125.8</td>
<td>4.216</td>
<td>.042</td>
</tr>
<tr>
<td></td>
<td>Flexibility in lay-out</td>
<td></td>
<td>2</td>
<td>110.0</td>
<td>3.775</td>
<td>.026</td>
</tr>
<tr>
<td></td>
<td>Number of floors</td>
<td></td>
<td>1</td>
<td>108.9</td>
<td>3.915</td>
<td>.050</td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td></td>
<td>1</td>
<td>127.6</td>
<td>4.194</td>
<td>.000</td>
</tr>
</tbody>
</table>

Table 4.2 Model in which the following factors significantly explain part of the level of net rental income

Of the factor group regional market features, vacancy rate in the surrounding area (VAC_RAT, p=0.042), supply of office space in the region (SUPM2, p=0.146) and regional absorption of office space (ABSM2, p=0.138) tend to have the most strong effect on the performance of an office building and thus were selected for inclusion in the final model.

From the factor group regional market features only the amount of office space absorbed by the regional market significantly affects the NRI (F=5.3; df=1; 2996.9; p=0.02). Surprisingly, since the inclusion in the final model was based on theoretical grounds, the number of residents turns out to have a significant effect as well as one of two location factors (F=6.5; df=1; 104.7; p=0.01).

The significant effect of the number of floors (F=3.9; df=1; 106.9; p=0.05) and age (F=14.9; df=1; 127.6; p=0.00) confirm what is written in literature and support the reliability of the dataset and the outcome of the model. However the resulting effect of the charisma of the entrance (F=35.7; df=2; 102.6; p=0.00), the type of building (F=3.9; df=4; 100.2; p=0.01), the type of use (F=4.2; df=1; 125.8; p=0.04) and the flexibility (F=3.8; df=2; 110.0; p=0.03) clearly add to the existing knowledge of performance indicators for offices at building level.

Now it is clear which factors have an effect on the NRI, though the question is how and to what extent. If the absorption of office space in the region increases it will have a negative effect on the NRI, according to the model (table 4.3). Logically this would be in reverse, since an increase in absorption of office space theoretically indicates more demand and as such prices will increase as well.
Sensitivity analyses of the final model however shows that the regional market factor absorption of office space is very unstable and therefore no strong value will be attached to the first outcome. This is in line with the theoretical relation between absorption rate and the performance of an office building.

Since the distance to the closest public transport hub negatively affects the NRI it is prudent to reduce that. The number of residents in the city the building is located in works positively.

According to the building features the results of the final model show again the important role of the charisma of the entrance as was observed in the exploration phase, the better the charisma the higher the effect on the NRI. High rise buildings and complex buildings negatively affect the performance, whereas pavilions and urban offices are associated with increased performance. Single tenant offices have a positive effect on the NRI whereas the opposite is true for multi tenant offices. The more floors in the building, the better the performance, but obviously age negatively affects the NRI. The only remarkable result is the strong negative effect of highly adjustable buildings, whereas medium flexible offices work positively.

Following from equation 5 and based on the results as expressed in table 4.3 the equation below can be drawn up, which represents a regression model that best predicts the net rental income of an office building.

$$Net\ Rental\ Income = 24.97^{i} - 0.02^{i}\text{(Regional absorption of office space),} - 4.31^{i}\text{(Distance to public transport),} + 0.01^{i}\text{(Number of residents in place of location),} + 11.75^{i}\text{(Charisma entrance inside=attractive),} + 3.47^{i}\text{(Charisma entrance inside=medium attractive),} + 0^{i}\text{(Charisma entrance inside=unattractive),} - 5.83^{i}\text{(Building type=high rise),} - 3.66^{i}\text{(Building type=complex),} + 1.52^{i}\text{(Building type=pavilion),} + 4.43^{i}\text{(Building type=urban),} + 0^{i}\text{(Building type=basic),} + 4.22^{i}\text{(Using typology=single tenant),} + 0^{i}\text{(Using typology=multi tenant),} - 4.52^{i}\text{(Flexibility in layout=not adjustable),} + 0.83^{i}\text{(Flexibility in layout=medium adjustable),} + 0^{i}\text{(Flexibility in layout=very adjustable),} + 0.12^{i}\text{(Number of floors),} - 0.08^{i}\text{(Age),} + \epsilon$$

The right half of table 4.3 describes the impact of a certain factor on the prediction of the NRI in a regression. Previously the directions of the effects on the NRI are described, yet more interesting is the impact intensity of each variable. The average value that can be assumed by a variable in the regression equation above (5) describes the average degree of impact the variable can have on the prediction of the NRI, in other words, the amount of NRI that will be added or subtracted caused by the weight of that factor (see impact column in table 4.3).

Looking at the degrees of impact a distinct contrast is visible between regional market, location and building features. The impact of almost all types of building features is much larger then other factors (see % of grand mean column in table 4.3). Where DISTP and NUMRESX as location features can add or subtract values of round 6% to the constant, the regional market feature ABSM2X can only subtract 2%. That impact is very low compared to values of 71% if it is an urban office building or 29% negatively if it concerns a complex building for example. A building with an entrance that is valued the best for the inside can add round 47% to the value of the constant.

4.5 CONCLUSION

Some of the results stemming from the statistical analysis of the NSI portfolio were to be expected, whereas others are striking, but interesting. A first exploration of the data showed the representativeness of the real net rental income according to general economic forces. The resulting significant effects on the net rental income of the number of floors and the factor age as building features for example were to be expected according to the several studies in literature. Nevertheless, actually recording these effects as well works affirmatively and puts the study, including the results, in the right perspective. Furthermore, with the exception of offices at A locations, the findings of this study can be generalized for all office buildings in the Netherlands.

In general, it might be concluded that the direct performance of a Dutch office building that is not located at an A location, is strongly influenced by it’s building characteristics. Location factors such as the size of the city or public transport in the vicinity certainly affect the direct performance, as does the level of absorption of office space by the regional market, which is
a location related factor as well. However it appears that for office buildings at locations other
then A+ rated, the influence of the factor location is not as important as is currently presumed
in the real estate market. The qualities at building level seem to be more important as they play
a much more determining role in the office building’s performance. This study demonstrates
the generally known negative effect of ageing and the positive effect of the number of floors
an office building has as reported in earlier research. More interesting and innovative though
is the importance of the attractiveness of an entrance, the possibility to meet the demands of
new tenants according to layout or even the difference between a single or multi tenant office
building. Building type can make a difference too regarding the direct performance. Whereas
high-rise buildings or complexes have a negative influence, pavilions and urban offices positively
affect the net rental income.

It seems that building features at the detailed level of materials, shape or layout do not
significantly influence performance. Brick buildings do not significantly perform better than
buildings with a steel façade. Whereas buildings with round shapes do not significantly perform
differently in contrast with just rectangular office buildings. Also the shape of the footprint
seems not to be of particular influence.

4.6 'Change of Perspective'

Apparently tenants are not significantly willing to pay more for features like a special
façade or a different shape of the building. This may be because a different façade type
does not particularly improve the functioning of the building. Whether the building is build
with bricks or styled with a fancy glass façade, it does not influence the flexibility or the
user-friendliness for example. In terms of internal climate one can think of the use of a
brick façade above a glazing all around considering the heat level. Perhaps it is current
technology that is capable of preventing for such unpleasant factors.

According to the shape of the building one might think of shapes that cause loss of floor
area or provides for an inefficient layout. This however would only apply to few buildings,
since such issues are generally tackled in the design phase.
5. DISCUSSION
5

5.1 INTRODUCTION

In the introduction it was mentioned that the value or return of an asset for an investor depends on the users’ willingness to pay, which in case of office buildings is the tenant. It was stated that the physical features of an office building are of such importance to the fitness for use that they influence the willingness to pay and these features should be therefore included as investment criteria for institutional real estate investors, beside their idea of ‘location, location, location’.

This resulted in the following hypothesis:

"The 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 for the acquisition strategy of an institutional real estate investor."

In order to research the justification of this statement a number of questions had to be answered. What decision-making criteria do institutional real estate investors currently apply and what building features potentially influence an office building’s performance? To what extent do the qualified building features influence the net rental income of an office building? And finally, how should this knowledge be implemented as asset acquisition strategy?

In the following paragraphs the results will be discussed and answers will be provided to the sub research questions. Subsequently this will lead to a research outcome that answers the main research question, acknowledging any possible reservations and limitations. From this, recommendations to NSI, the industry and recommendations for further research will be provided.

5.2 DISCUSSION OF THE RESULTS

5.2.1 Decision-making criteria

The answer to the question what decision-making criteria are currently applied leaves some ambiguity. In literature is described what rational criteria should be theoretically used according to research, whereas practice shows the factual proceedings by the commercial real estate market. Mapping decision-making criteria for acquisition strategies is a complex problem, given the large differences in motives, strategies, circumstances and people involved (figure 5.1). Strategies might aim to add value to depreciated properties but might also focus on high quality real estate to gain stable income returns. Pension funds have liability issues, whereas private investors might act more speculative. Economical circumstances are influencing as well, since decisions made in a buyer’s market, where prices are low and options are abundant differ from those made in a seller’s market, where prices are high and options are scarce.

Decision-making also depends on the person who makes the decision, who may be rational and make decisions based on facts or who may be irrational and decide intuitively.

However, all strategies seem to come down to the same rules of play. These general rules determine the basic point of departure and could be applied by all people in every economic situation for each goal. It are these rules of play that form a simplification of the complex problem of mapping the decision-making criteria for office real estate acquisition strategies. It turns out from theory and practice that all different used criteria, rationally and intuitively, can be categorized into three factor groups. Assessments are being made for regional market features, physical location features and building features.

Decision-making criteria are based on knowledge of the effect of certain factors on the value or the performance of a property, including both long-term and short-term effects. The acquisition process is about measuring these affecting factors, assessing their quality to finally making a decision. Thus research into decision-making criteria is searching for performance affecting factors. Factors that can be placed in the earlier mentioned factor groups.

5.2.2 Net rental income

The performance in this study is represented by the net rental income of an office building, since direct income is a much better indicator for performance according to building factors than is indirect return. The NRI comprises the gross rental income minus exploitation costs and management costs. Due to the ability of using income series for a period of 10 years, the influence of economic cycles is included and analysis of the effects on performance is performed in times of prosperity and adversity. The growth of the gross domestic product is admitted as indicator to filter out general economic factors, to uncover effects of case specific factors. In addition the net rental income series are adjusted for inflation at year 2000 level. The use of real rental income values admits the possibility to make a fair comparison of performance related to time.

The use of actual transacted real NRI is quite comprehensive in several ways and as such provides the best representative definition of the performance of an office building compared to market rent or contract rent as performance indicators. The NRI describes both the actual transacted income as well as the actual transacted exploitation costs, so that the influence of important effects such as vacancy is accounted for. It is not just the loss of income that negatively affects the performance due to vacancy, also service costs are at the investors’ expense during vacancies. Large maintenance is causing an increase in exploitation costs as well as loss of income due to vacancy, including earlier mentioned collateral effects. Another advantage of using the NRI as performance indicator is the inclusion of information related to rent-free periods as incentive. Whereas market rents and contract rents as indicator can hide
the diminishing effect of rent-free periods and thus misrepresent the actual performance, the use of NRI is a more fair approach. It is still possible to mark down the loss of income over the contract duration, actually a popular method used by investors, but that is not used in this study. Therefore the performance gives a close view of reality.

The NRI line as showed in figure 4.1 in paragraph 4.2 is more smoothed than one would expect as it represents the average market rents of the portfolio. This is caused by the duration of the contracts that have a cushioning effect, since real contract rents only change at extension or renewing of a contract. Despite this cushioning effect, it shows the actual performance and as such is very valuable.

From a tenants’ point of view and according to the willingness to pay it should be remarked that service costs are not included in the NRI, although these are certainly part of the pack of demands and as such will influence its decision-making. A large part of the service costs include the use of energy, which is interrelated with the sustainability issue by means of the technical state of the building and sustainability measures. The discussion of energy labels is not incorporated in this study due to a lack of provable information, but it is most certainly interesting to investigate the effects on performance.

5.2.3 Affecting features

Regional market features, location features and features at building level appear to explain the most effects on the NRI of an office building according to theory, but the question is how and to what extent? Basically the level of the NRI is dependent on four handles. Firstly the height of the rent price determines the income. Secondly income is received only if a (part of the) building is rented out, which is also explained as occupancy rate or in reverse vacancy rate. When rented out, but agreed on a rental incentive, loss of income influences the NRI level. Finally the height of the exploitation costs negatively affects the NRI. The possible effects of the different features in the three categories should be related to a change in any of these four handles.

The answer to the question of which office building features to what extent determine the NRI is found by testing the hypothesis of a preselected set of features using a regression prediction model. The implications of the results according to this research will be discussed further on, and are limited to office buildings that are not located at A+ rated locations. This is because no A+ rated locations were available in the NSI portfolio. Examples of A+ locations are the Zuidas in Amsterdam or the Weena in Rotterdam.

However, despite this limitation, the implications of the results of this research can be generalized (see paragraph 3.4). This means that effects on the performance of office buildings as found in this study can be applied on all office buildings in the Netherlands, except for the A1 locations.

The results indicated a striking low share of location effects and regional market effects compared to the effects of a few building features. Even though every effort is made to support the importance of location factors as affecting features on the performance of an office building as is generally presumed, the opposite seems to be true. A fortiori are the influencing effects of features at building level, which strongly confirm the hypothesis that these features are important to the net rental income of an office building. It is likely that in fact factors related to location act as a proxy for building related features. Because information of building features is more detailed, this means that the essence of office performance criteria should be found in the level of knowledge about the building. It can be stated that decision-making criteria for the acquisition of office buildings that are not located at A+ locations should focus on building features. It is plausible to state that the exposure of A+ locations outshines the effects of the building features. This however is not the case for other less rated locations in the Netherlands, whether it is in Amsterdam or Rotterdam, or places like Groningen or even Deventer. The results show that a building is appreciated for what it is built for, to support the corporate process. As a matter of fact, it is for these office buildings that the fitness for use determines the willingness to pay and as such the performance of the building.

Although, according to the results, the age of the building, the number of floors, the charisma of the entrance, the type of building and use and the flexibility of the layout are all indicated as significant affecting factors for the performance of an office building, it is clear that there is a certain interrelationship.

The results are indicating that an increasing number of floors positively affect the performance, yet with a certain limitation. Buildings with more then 8 floors are qualified as high rise in this research and it turns out that in the long run these buildings do not perform well with respect to other more average types of offices, like pavilions, urban and basic offices. Average in this respect is medium sized with 3 to 6 floors and an average floor area of 1000 m2. Averaged sized offices do not include larger buildings with a complex set up, which show significant underperformance as well.

The relationship with the findings that single tenant buildings abundantly clearly outperform multi tenant buildings in the NSI portfolio and the conclusion that average sized buildings outperform oversized buildings is obvious. Evidently there is no support for large multi tenant office buildings at locations that are not A+ rated. This also explains why buildings that are medium flexible in the layout to meet the demands of multi tenant perform better than buildings that are very flexible in the layout. Flexibility for single tenant office buildings only concerns the layout of the suite and not the division into multi use.

An explanation for the finding that these single tenant offices appear to have better performances may be found in the duration of the measuring period of ten years. Tenants of single tenant offices in the region tend to attach value to top of the market properties and for this are willing to relocate from time to time. This means that these types of offices perform very well in the first years after construction whereupon vacancy will occur due to competition with newer buildings. This effect is probably present in the NSI portfolio as well, given that relocations theoretically still have to occur. A measuring period of five years longer would probably overcome this effect. Nonetheless the positive influence of single tenant offices still exists.

The attractiveness of the charisma of the entrance appears to be significant for the assessment of the quality of an office building. It should be tempting for a visitor/client to enter a building and feel comfortable and as such it is the front piece of a company. The attractiveness of the
inside seems more significant than the charisma of the outside of an entrance. Whereas the inside of the entrance is often used as waiting area for visitors, the outside is just a passage.

The age of a building is one of the expected building features that seems to have a significant effect on the performance. The obvious conclusion that can be drawn here about the negative relation between age and performance is a depreciation of the value due to deterioration of the building. The factor age however is more comprehensive since in addition to a deteriorating effect, which is a negative effect, age might also have a monumental value, which can have at times a positive effect. This factor is further complicated by the fact that the age of a building might also say something about the architectural style as a consequence of the era during which the building was constructed. In this study, the latter two age effects are thought to be excluded by defining age as the period since the year of construction or the year of renovation. This means that age is assessed as a factor of deterioration with the implication that investors will choose for newer office buildings. The assessment of the monumental value and the influence of the architectural type are quite complex and further research should be dedicated to investigate these relations. Yet, eventually it comes down to the fitness for use and in that sense an office building should be functional.

5.2.4 Implications

The final question is what do the results mean, how should they be interpreted and what are the implications? In other words how can the results be implemented into a practical advice regarding an acquisition strategy for institutional investors?

Based on the findings and the quality of the data it might be concluded that decision-making criteria for the acquisition of office real estate should focus more on building level. The level of detail however should be confined to proportions and building types and use. It turns out that location is an indicator for performance, but covers up the importance of certain building qualities. Based on the principle of fitness for use, in which the function of an office building is to support the corporate process, this is a sound conclusion. It should be noted that this only accounts for offices that are not located at A+ locations, since other location factors like exposure and status probably outshine the qualities at building level for these types of office locations. Another approach is needed due to interference of these complex mechanisms.

However, for all other office real estate in the Netherlands it is recommended to include knowledge of building features as a decision-making criterion. The practical implications of the findings in this study result in a description of the perfect office building with the following criteria. The building should be averaged sized with 3 to 6 floors and an average floor area of round 1000 m². The entrance should be very attractive, such that it is highly recognizable and invites to enter from the outside, but more importantly that it is functional and provides a pleasant stay for a visitor. It should be possible to adjust the layout of the building to meet the demands of a new tenant. The possibility to be used by more than one tenant is less important and as such a single tenant will probably use the building. The preferred location is in one of the large four cities (Amsterdam, Rotterdam, The Hague or Utrecht) or in a large city outside the Randstad. A public transportation hub should be located nearby.

To test the criteria as described above an office building is selected from the NSI portfolio that satisfies all these criteria. The result is a 6-storey high, averaged sized single tenant building in Zwolle, which indeed outperforms a building that is selected by using the opposite selection criteria (table 5.1). The latter is the "High Flex Center" in Maarsen, which is a 2-storey high, complex type multi-tenant building. The average quarterly NRI for "Le Versau" in Zwolle1 is 44.8 €/m² against 18.6 €/m² for the "High Flex Center" in Maarsen, which is quite a difference.

### Table 5.1 Selection of a good and bad performing office building in the NSI portfolio according to the resulting selection criteria

<table>
<thead>
<tr>
<th>Building Features</th>
<th>Le Versau, Zwolle</th>
<th>High Flex Center, Maarsen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Outside Randstad</td>
<td>Inner Randstad</td>
</tr>
<tr>
<td>Number of floors</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Average LFA per floor (m²)</td>
<td>1208</td>
<td>1654</td>
</tr>
<tr>
<td>Location in relation to Randstad</td>
<td>Outside Randstad</td>
<td>Inner Randstad</td>
</tr>
<tr>
<td>Building type</td>
<td>Basic</td>
<td>Complex</td>
</tr>
<tr>
<td>Using typology</td>
<td>Single tenant</td>
<td>Multi-tenant</td>
</tr>
<tr>
<td>Flexibility (bool)</td>
<td>Not adjustable</td>
<td>Very adjustable</td>
</tr>
<tr>
<td>Number of floors</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Average office area (m²)</td>
<td>1208</td>
<td>2000</td>
</tr>
<tr>
<td>Distance to public transport (m)</td>
<td>400</td>
<td>200</td>
</tr>
<tr>
<td>Number of residents in place of location</td>
<td>118,192</td>
<td>39,647</td>
</tr>
<tr>
<td>Performance</td>
<td>Good</td>
<td>Bad</td>
</tr>
</tbody>
</table>

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1. The divergence of the NSI (Le Versau, Zwolle) in 2005-Q4 and reversed in 2009-Q2 is probably caused by payback of rent arrears

---

Figure 5.2 Quarterly Net Rental Income of selected office buildings according to resulting decision-making criteria. Good example: Le Versau in Zwolle. Bad example: High Flex Center, Maarsen.

It is known that there is a gap between returns at primary and secondary locations in the Netherlands and according to Savills, an independent commercial property management company (PropertyNi, 2010), this gap is increasing due to current pressure on returns at...
secondary locations. This pressure is caused by the economic crisis and it is not surprising that locations other than the top ones seem to be hit. For too long and with too much importance location has been a driver for the acquisition of office real estate. Less attention was paid to qualities at building level while that might particularly count in unfavourable times. However, it shows the awareness of the market witnessing the following explanation, for example, of Jan Willem van Roggen, Managing Director of NIBC Real Estate:

‘Of course we have been more critical than during feast days and risk perception has been improved. In addition I stimulate my team to actually examine and understand the properties, something we have done insufficiently during feast days. We must be aware of the underlying value.’ (2010)

This research just supports the right direction of this consciousness and shows the most important building criteria. Decision-making criteria should aim more on building aspects and quality, both in good and in poor times. Perhaps the motto ‘location, location, location’ should be changed in ‘location, building, quality’.

5.2.5 Match with existing knowledge

As a result of the used type of dataset and due to the domestic spread of the office buildings, it is hard to match the results with any findings in the literature. All previous studies had a focus on locations in one city or in a Central Business District. The average building type in such areas can at best be described by genuine high-rise, which does not correspond to this dataset. Implications of this research in any kind are hard to verify with straight applicable existing scientific knowledge and as such seem explorative. However, indirectly the same conclusions are found regarding building features like age and number of floors. The basic principle of deterioration due to ageing is still the same. The general view in literature of the importance of location as decision-making criteria in relation with building features is differentiated in this study. This general view might match with possible findings if focussing on A+ rated locations, but differ compared to offices located at less rated locations, as found in this study.

The results of this study seem to partially rationalize gut feelings of market parties as found out during the interviews. There already is a certain awareness of the importance of building features as decision-making criteria, yet not so much in a rational way. In that sense the findings add to the existing knowledge. From the interviews it was clear that there was no understanding of the significant smaller importance of location for office buildings that are not at A+ rated locations. The conclusions therefore are striking and renewing.

5.2.6 Future prospects

In general, the impression of the Dutch market is one of being thin with lower transaction volumes and less players for a long period. There is a demand for first class real estate, yet the demand for secondary or tertiary properties is zero and will only increase with a prospect on economic recovery, internationally and in the Netherlands (Wessels, 2010a).

‘In 2009 we have entered a new phase of the market, a new equilibrium with a thin market, less players and lower transaction volumes. This will last for at least 5 years.

Tertiary real estate is unmarketable in 2010, for secondary real estate rental prices will drop and incentives will increase. Primary real estate shows stable rental prices’

Eric de Clercq Zubli, Jones Lang Lasalle (PropertyNL, 2010)

‘Demand will concentrate on properties with the following characteristics: inner city, accessibility to public transport and character of the property’s close surroundings. Decrease in prices and incentives will be applicable for properties that do not match these characteristics.’

Cuno van Steenhoven, DTZ Zadelhoff (PropertyNL, 2010)

‘An important phenomenon of the market is the recovery that concentrates on defensive investments: well rented, modern properties at top locations with long-term contract agreements. The recovery concentrates on quality and sustainability according to income. To a large extent the focus is to avoid or minimize the short-term exposure to the relatively weak tenant market. As it is we don’t see an increase in the demand for secondary real estate, which is more exposed to the user market as a consequence of vacancy, expiring contracts, or less solvable tenants.’

Marco Hekman, CB Richard Ellis (PropertyNL, 2010)

According to the above quoted senior executives of the three large brokers offices in the Netherlands, the real estate market prospects for the coming years clearly show a decreasing market for secondary and tertiary real estate. It are the qualities and characteristics at building level that will make a difference between letting and vacancy among these properties for at least the coming 5 years. It is striking though that van Steenhoven did not mention the importance of characteristics at building level. Marco Hekman mentions that recovery concentrates on quality and sustainability according to income. The results of this study showed the criteria for location and building features to obtain that stable income.

5.3 Restriction and limitations

This section discusses the reservations and limitations regarding the results of this study.

As discussed before the portfolio of NSI does not accommodate office buildings at A+ locations. Pronouncements concerning this type of real estate are speculative and based on assumptions. The results of this study therefore can be applied only for office buildings in the Netherlands that are not located at A+ locations.

There are a few peculiarities in the NSI portfolio that may influence the results from the analysis. For example a substantial number of office buildings were acquired from one single market party within a short period of time. These objects were all fully leased offices at the moment of transaction and matched the criteria of average sized buildings. In addition, incentives issues from the original owners were eliminated due to a special construction, which caused some bias in the data. This may have exaggerated the average level of performance for this category.

Footnote:
2. The quotations are translated from Dutch
The uniqueness of a dataset containing office buildings that are spread over many places in the country has the consequence that not so much literature can be found to verify the results. Although the quantity and thus the quality of the dataset can provide firmly based statements as a result of the data analysis, results cannot be verified with direct comparable scientific research. The conclusions in that sense are explorative.

Due to time restrictions and limitations of resources the assessment of certain variables are based on opinions of only two people, not further involved in data collection and analysis. This might reduce the quality of the data, despite the fact that these persons are experts in the field of property management.

Sustainability as decision-making criteria is not included in this research. Information on energy labels or other sustainability measures were not available and as such could not be incorporated in the dataset.

### 5.4 Recommendations

#### 5.4.1 Recommendations for the industry

Investors in office real estate are recommended to leave the idea of 'location, location, location' and embrace the idea of 'location, building, quality'. The quality and characteristics of the property are just as important as location and market situation. It is the willingness to pay of tenants for a well functioning office building that determines the stability of the performance for an investor in the long run.

A clear distinction in decision-making criteria should be made between investments at A+ locations and investments at other locations in the Netherlands. The findings of this study and as a result the recommendations for the industry primarily concern investors with a focus on non-A+ office real estate.

For that group of investors, based on the findings of the analysis, it is recommended to focus on locations in the large four cities or locations in large places outside the Randstad, such as Groningen. For these locations investors are dissuaded from investments in large multi-tenant high-rise buildings or complexes. Instead, medium sized 3 to 6 storey office buildings, flexible for multi-tenant use, but focussing on single-tenant use, are advisable selection criteria, not to mention the importance of a visible, tempting and attractive entrance.

The decision-making criteria for the acquisition of office buildings as currently employed by NSI focus on location, market position and technical quality of the building. The intension to emphasize more on peculiar building features might be encouraged and might be definitely added to the current set of decision-making criteria. The earlier mentioned description of the theoretically best performing office building could be served as guideline.

The company’s current acquisition strategy is to focus on central locations in larger places (more then 60,000 residents) and at peripheral locations in the large cities. In addition the goal is to dispose small offices with a book value of EU 5 million or less and focus on much larger multi tenant buildings.

In accordance with the location strategy NSI is recommended to limit the selection of peripheral locations in the large cities in the Randstad to Amsterdam, Rotterdam, The Hague and Utrecht. Other interesting locations are in places outside the periphery of the Randstad using the current criterion of 60,000 residents as an absolute minimum. Office parks are preferred to inner city locations.

Disposition of the small office buildings in the portfolio is a trend that is to be encouraged. The switch to the acquisition of larger multi-tenant buildings probably comes along with more risk. According to the analysis of the portfolio it are particularly the multi-tenant offices that underperform compared to single tenant offices. Large high-rise buildings such as “La Tour” in Apeldoorn are a model for underperformance. Unless aiming for A+ locations this strategy might need reconsideration.

#### 5.4.3 Recommendations for further research

Due to the lack of direct comparable studies regarding this type of dataset it is recommended to repeat this research. Therefore the current dataset might be extended with buildings that are also spread over the Netherlands. In addition it would be interesting to extend the dataset with buildings that are located at A+ locations to investigate the importance of the effect of building features for these types of offices as well.

Finally NSI is recommended to repeat this same research in about 5 years. As can be seen in figure 5.3 within the coming 3 years a substantial amount of rent contracts will be expiring, with a top in 2012. For many buildings in the NSI portfolio contract expirations did not occur in the study period of 10 years. Therefore it is interesting to investigate the consequences of this future scenario according to the performance of the portfolio.

**Figure 5.3** Maturity and expiration dates of lease agreements offices (Source: NSI Annual report 2009)

Since the past does not predict future results, ex ante research is needed to provide for future implications of buildings features as decision-making criteria. Although a prediction model is used for this study no considerations are made for future scenarios. Further research into this topic would be interesting.

Preambulatory to this research subject, it was assumed that diversification for office type classes might lead to a more accurate optimised composition of a real estate investors’ office portfolio and for that reason, this study was considered important to the portfolio strategy. The objective was to create several office type classes distinguished by typical office building features, for
which finally the diversification potential would be measured. It turned out that in order to find distinguishing building features separate research had to be conducted to the influence of these features. This study shows the effect of assignable building features and with this knowledge the diversification effect might be further investigated.

Therefore this study can be appointed as stage one and the results can provide input for stage two, which is the research into diversification effects.
CONCLUSION
6. CONCLUSION

6.1 General Conclusions
It was the objective of this study to rationalize the role of features at office building level in order to provide the real estate industry for an advice in decision-making criteria for the acquisition of office buildings. The hypothesis stated that these building features are of such importance to the performance of an office building that investors should consider them as part of their strategy.

It can be concluded that building features indeed are that important that they cannot be disregarded as concrete decision-making criteria. The fact that many professionals already mention the urgency of such an approach and that decisions based on gut feeling already took place, is positive. Basically this study has accumulated all these ideas and translated them into factual performance indicators that can be used for strategy formation.

Adjusting the view on the significance of location as a performance indicator for non-A-rated locations was not a primary goal. The finding however is interesting and makes sense with respect to the concept of the willingness to pay of users/tenants. Primary concern for a company is to employ their corporate process in the best way. The office building is used as a mean and as such should fit for the use of a tenant. Accessibility is of course also very important, but may be seen as a secondary demand.

The building features that turned out to be significant performance indicators in this study largely focus on function. Size, layout and flexibility are important factors and positive values can add to the well functioning of an organisation.

Since less practically comparable knowledge about this subject for the Dutch office market is available it is absolutely necessary to conduct further research. The findings of this study should be tested with new comparable research so that conclusions might be improved and implications might be addressed.

6.2 Professional Feedback
A summary of the research results has been send to the professionals that have been interviewed. Ascertain to four questions they have provided for feedback. The content of this feedback is described below. The goal was to find out what intentions the market has towards building features as decision-making criteria for the acquisition of office buildings. Besides the question was to what extent investors are willing to hold on to the principle of the dogma "location, location, location".

1. Is the outcome of the research something that you had expected? If not, why?
The results from the research where definitely expected by the market. Particularly the division in A-rated properties and secondary properties are substantial in the decision-making criteria. This division can clearly be identified in the real estate investment market. Market parties however think that the importance of location for secondary properties may not be underestimated at the cost of building features. An argument for this is the decreasing lifespan of these types of offices as a result of which the location still remains essential for the assessment.

2. Do you recognize the influence of building features on the performance of an office building, as is described, within the portfolio of your company?
Reactions are divided on this subject. Where one can agree on this influence, another states that the return of the existing objects is (still) not substantially stipulated by their external consultants by means of building features. Capital expenditures, maintenance costs and rent incentives, however, are taken into account. Location, tenant and contract duration are still important for the assessment at this time. Nonetheless there is the expectation that building features will influence the definition of return for secondary properties in the near future.

3. Did the results of this research give you food for thought regarding the use of decision-making criteria?
Again it is emphasised on the importance of location, also for secondary real estate. One states that a poor building at an excellent location provides for more future value then an excellent building at a poor location. The opinion however is that these results are a foundation for the already taken path.

4. What is your opinion on the recommendation to think about "location, building, quality", instead of "location, location, location"?
The professionals can agree with this recommendation, but again mention not to underestimate the importance of location. Furthermore sustainability is indicated as an important decision-making factor as well besides location, building and quality.

6.3 Personal Reflection
The reason for choosing this subject stemmed from the participation in the course Real Estate Finance for Investments in which I was confronted with the investors perspective on real estate.

One of my objectives was to bridge the gap between study and future profession. Since I have an interest in financials and in real estate, this seemed like a subject I could work on for a year.

It must be said however that the first intention for this research was to investigate portfolio diversification at the level of office building features. Much time is devoted to a pre-study for this subject, but eventually I came to the conclusion that there was one important step that should be researched ahead of the diversification study. This step is the subject of this graduation report. Despite the fact that not so much from the pre-study could be used for the eventual study, I can add lots of knowledge into my backpack.

I have made things hard myself by being persistent on performing a quantitative study that forced me to find a suitable dataset. Despite the warnings and objections from my mentors concerning the feasibility of my plan I kept positive, and maybe tenacious, and managed to
find my dataset at NSI. However from of that moment on, the real job just had to start by collecting all the information as necessary for the statistical model. I have spend many ours in searching and restructuring excel sheets but I have been paid back by the striking results as a consequence of this extensive hunt for information.

Due to this graduation project I was able to learn many things in different domains. I have amassed knowledge in real estate investments and the office market amongst others due to interesting conversations with Johan Buiks, my mentor on the job. I have learned about the advantages of statistical modelling for which Clarine van Oel, my second mentor, was of great help. Due to this graduation project I was also introduced into the real estate investment industry. The interviews with different professionals enabled me to take a look behind the scenes, very helpful for an orientation to the labour market.

An important personal goal for this graduation project was to prove myself with my capabilities. I have tried to use this last project at the university to individually employ and manage a long-term project to a quality end product. My personal conclusion is that I am satisfied with the process and the end result.
In the summer of 2009 an e-mail arrived in my inbox at NSI with a rather short request from a student at the Delft Technical University: could he do his ‘master thesis’ for his master of science degree of the master Real Estate & Housing.

In itself such a short request is nowadays not really surprising. E-mail has changed the way - especially young - people correspond drastically and not always to the better. This one however triggered me, first of all because in only a couple of lines it expressed perfectly its goal and intentions, indicating a bright and well-organized mind. I wasn’t disappointed during the next half year in which Rodiaan Gijselaar concluded his Delft study at our office.

Besides Rodiaan’s personality the topic of his master thesis was the second reason to accept his request. “Decision-making criteria for the acquisition of office buildings; Do building features decide?” is of course a question any real estate investment company should be interested in.

And did it get our attention! Most likely I will never forget an evening meeting I had with Rodiaan. After several months of preparing and data mining for his research Rodiaan called for an appointment to discuss his preliminary findings. In a restaurant in Rotterdam called “Het Zalmhuis” we met at around 17:00 hrs. and in the next couple of hours Rodiaan slice by slice cut away my company's rationale behind its investment strategy. Not even the most sacred dogma in the land of real estate “Location Location Location” was left unchallenged. Rodiaan, thank you for that meeting, it was most enlightening.

The end result of all Rodiaan’s work - and you must have read it all or you wouldn't have reached these final words - is a solid and good piece of work with a lot of ‘food for thought’ for our company.

Rodiaan I trust you will do well in the years to come.

Hoorn, March 31st, 2010

Johan Buijs
CEO
NSI – Nieuwe Steen Investments NV
BIBLIOGRAPHY


FGH Bank N.V., 2009. Met het oog op de stenen; Focussing on bricks and mortar. FGH Bank Valuation and Research Department.


Keeris, W., 2009, personal communication


Decision-making Criteria for the Acquisition of Office Buildings
Do building features decide?


Ree van der, D., 2009, Interview at NIBC, (3 November)


SPSS Inc., Linear Mixed-Effects Modeling in SPSS: An Introduction to the MIXED Procedure. SPSS Inc.


Zande van der, P., 2009, Interview at Vastned O/I, (19 November)

Websites visited
www.lasalle.com
www.vastned.nl
www.ingrealestate.com
www.cbreinvestors.com
www.IPD.com
www.roz.nl
www.ncref.com
www.arternavastgoed.nl
www.cbre.nl
www.bouwfonds.nl
www.min-services.nl
www.nbc.com
www.pgpm.nl
www.corio-eu.com
www.unibail-rodamco.nl
www.unibail-rodamco.nl
www.uni-invest.nl
www.landsecurities.com
www.mnl.nl
www.dealtaaloyd.com
www.unilearning.uow.edu.au

Zande van der, P., 2009, Interview at Vastned O/I, (19 November)
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TABLE 5.1

Resulting selection criteria indicates a negative relationship

Table 4.3

Table 3.9

Table 3.8

Table 3.6

Table 3.5

Table 3.3

Table 3.4

Table 3.2

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DEFINITIONS LIST

Asset-Liability Management
A risk management technique designed to earn an adequate return while maintaining a comfortable surplus of assets beyond liabilities. Takes into consideration interest rates, earning power, and degree of willingness to take on debt, also called surplus management.

Buyer’s market
A market that has more sellers than buyers and where low prices result from this excess of supply over demand. It is also called soft market and is the opposite of a seller’s market.

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

Core fund
A substantial long-term holding in a portfolio. A core holding is bought with the express purpose of being held for a very long time, and is often of high quality with a history of fairly steady performance.

Correlation coefficient
Statistical measure of the linear relationship (correlation) between a dependent variable and an independent variable. Represented by the lowercase letter ‘r’, its value varies between -1 and 1: 1 means perfect correlation, 0 means no correlation, positive values means the relationship is positive (when one goes up so does the other), negative values mean the relationship is negative (when one goes up the other goes down).

Dependent 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 Real Estate
In case you own over 50% of the investment in a property, you invest direct.

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 this is rent.

Diversification
Dividing investment funds among a variety of securities with different risk, reward, and correlation statistics so as to minimize unsystematic risk.
**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.

**Income 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 this is rent.

**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.

**Indirect Real Estate**
A way of investing in real estate without actually investing in the property. Indirect investment can be done in many ways, 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.

**Indirect return**
The increase in an asset’s market price, also called capital appreciation.

**Lagging**
An appraisal error caused by appraisers using ‘old’ comparables that fail to mirror market conditions current at the time of the appraisal.

**Listed-fund**
Listed managed funds hold and manage a portfolio of assets on behalf of their investors and can include a variety of assets. Buy and sell decisions are made by an investment professional on behalf of an investor.

**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 tradeable between investors thereafter.

**Real Estate Investment Trust**
A company that purchases and manages real estate and/or real estate loans. Some REIT’s specialize in purchasing long-term mortgages while others actually buy real estate. Income earned by a trust is generally passed through and taxed to the stockholders rather than to the REIT.

**Seller’s market**
A market that has more buyers than sellers and where high prices result from this excess of demand over supply. It is the opposite of a buyer’s market.

**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.
Decision-making Criteria for the Acquisition of Office Buildings
Do building features decide?

APPENDIX

A. INTERVIEWS

A.1 INTERVIEW SCRIPT

Datum: [ ] Naam informant: [ ]
Tijd: [ ] Functie: [ ]
Plaats: [ ] Bedrijf: [ ]

1. Introductie interview (10 min.)
   - Toestemming voor opname
   - Iets over mijzelf
   - Doel en aard interview
   - Selectie informanten
   - Anonimiteit en vertrouwelijkheid informatie
   - "Homogeniteit" interviews
   - Tijdsduur ± 1 uur

2. Introductie informant (5 min.)
   - Achtergrondinformatie informant (functieomschrijving, loopbaan, werkenaamheden)

A. Aankooptraject (10 min.)
   - Kun je een beschrijving geven van het aankoopproces van een kantoorpand?
   - Wat zijn motieven voor een nieuwe aankoop?
   - Hoe wordt er geselecteerd?
   - Welke rol spelen de huidige economische omstandigheden hierbij?
   - Welke informatie is er beschikbaar bij het selecteren van panden?
   - Hoe kieskruik kun je zijn bij het selecteren van potentieel panden?

B. Beslissingscriteria (20 min.)
   - Welke beslissingscriteria worden er momenteel door u gehanteerd bij de selectie van aan te kopen panden?
   - In hoeverre speelt bedrijfsstrategie hierbij een rol? Kun je hier voorbeelden van geven?
   - Naar welke fysieke kenmerken van een pand wordt gekeken?
   - Hoe grote rol speelt gevoel bij een beslissing? En waar is dat gevoel op gebaseerd?
   - Zou je een indeling kunnen maken van rationele en irrationele beslissingscriteria?
   - Als eerste indruk een criterium is, welke aspecten zijn hiervoor dan bepalend denkt u?

C. Behoefte aan informatievoorziening omtrent beslissingscriteria (10 min.)
   - Ik doe onderzoek naar de rationalisatie van fysieke gebouw eigenschappen als beslissingscriteria voor de aankoop van kantoorpanden voor een belegger; welke fysieke eigenschappen hebben een positieve/negatieve invloed op de prestatie van een pand volgens uw ervaring?
   - Welke fysieke eigenschappen zouden nog meer een onderscheidend vermogen kunnen hebben gezien de prestatie van een pand?
   - Is er behoefte om meer over het onderscheidend vermogen van de fysieke eigenschappen van een pand te weten?

3. Afsluiting (5 min.)
   - Afsluiten dat alles gevraagd is
   - Eventuele vragen vanuit de informant
   - Uitleg wat er met de informatie gebeurd
   - Informeer over de questionaire achteraf
   - Controleer contactgegevens
   - Danken voor de tijd en de moeite

---

A.2 INTERVIEWEES

<table>
<thead>
<tr>
<th>Company</th>
<th>Interviewee</th>
<th>Function</th>
<th>Date of interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPF Bouwinvest</td>
<td>Bas Jochims MSc.</td>
<td>Manager Office Portfolio</td>
<td>11/30/09</td>
</tr>
<tr>
<td>ING Real Estate</td>
<td>Ir. Jo Veezen</td>
<td>Senior Asset Manager</td>
<td>12/8/09</td>
</tr>
<tr>
<td>NIBC</td>
<td>Daan van der Ree</td>
<td>Investment Director</td>
<td>11/3/09</td>
</tr>
<tr>
<td>NSI</td>
<td>Anneke van der Ende</td>
<td>Asset Manager</td>
<td>12/7/09</td>
</tr>
<tr>
<td>VastNed O/I</td>
<td>Peter van der Zande</td>
<td>Head of Purchase and Sales Department</td>
<td>11/19/09</td>
</tr>
</tbody>
</table>
B

LITERATURE REVIEW

B.1 TABLE OF USED VARIABLES BY ÖVEN AND PEKDEMİR (2006)

<table>
<thead>
<tr>
<th>Code</th>
<th>Variable references</th>
<th>Source</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>BANK</td>
<td>The building consists of a bank (1-0) (Bollinger et al., 1998; Mils, 1992)</td>
<td>Brokerage firms</td>
<td>Dummy</td>
</tr>
<tr>
<td>COMPLEX</td>
<td>The building is a part of a complex (1-0) (Bollinger et al., 1998; Sladojevic, 1995, 1996; Wheaton, 1994)</td>
<td>Brokerage firms</td>
<td>Dummy</td>
</tr>
<tr>
<td>CONFERENCE</td>
<td>The building has a conference room (1-0) (Bollinger et al., 1998)</td>
<td>Brokerage firms</td>
<td>Dummy</td>
</tr>
<tr>
<td>ELEVATOR</td>
<td>Number of elevators in the building (Sivitanidou, 1996)</td>
<td>Brokerage firms</td>
<td>Dummy</td>
</tr>
<tr>
<td>ID</td>
<td>Percentage of common space in the building (Frew and Jud, 1988)</td>
<td>Brokerage firms</td>
<td>Numeric (%)</td>
</tr>
<tr>
<td>LOSS</td>
<td>Percentage of unused space in the office (Brennan et al., 1995)</td>
<td>Brokerage firms</td>
<td>Dummy</td>
</tr>
<tr>
<td>MLT</td>
<td>The building has multiple tenancies (1-0) (Bollinger et al., 1998)</td>
<td>Brokerage firms</td>
<td>Dummy</td>
</tr>
<tr>
<td>PARK DECK</td>
<td>The building contains a garage (1-0) (Bollinger et al., 1998; Sladojevic, 1995)</td>
<td>Brokerage firms</td>
<td>Dummy</td>
</tr>
<tr>
<td>PARKING</td>
<td>Parking space per person in the building (Frew and Jud, 1988)</td>
<td>Brokerage firms</td>
<td>Dummy</td>
</tr>
<tr>
<td>PRESLOC</td>
<td>The office is situated in a prestigious location in the building (1-0) (Brennan et al., 1994)</td>
<td>Brokerage firms</td>
<td>Dummy</td>
</tr>
<tr>
<td>REST</td>
<td>The building consists of a restaurant (1-0) (Bollinger et al., 1998; Mils, 1992)</td>
<td>Brokerage firms</td>
<td>Dummy</td>
</tr>
<tr>
<td>SF</td>
<td>Office floor area (Bollinger et al., 1998; Brennan et al., 1994; Clapp, 1980; Mils, 1992; Sivitanidou, 1995; Sladojevic, 1995; Sladojevic, 1996; Wheaton, 1994; Wheaton and Jud, 1994)</td>
<td>Brokerage firms</td>
<td>Numeric (m²)</td>
</tr>
<tr>
<td>SHOP</td>
<td>The building contains a shop (1-0) (Mils, 1992)</td>
<td>Brokerage firms</td>
<td>Dummy</td>
</tr>
<tr>
<td>TFLRS</td>
<td>Number of floors (Bollinger et al., 1998; Clapp, 1980; Frew and Jud, 1989; Gutiérrez, 1995; Sladojevic, 1995, 1996; Wheaton, 1994)</td>
<td>Brokerage firms</td>
<td>Dummy</td>
</tr>
<tr>
<td>TSQFT</td>
<td>Total area of the building (Bollinger et al., 1998; Brennan et al., 1994; Glasscock et al., 1996)</td>
<td>Brokerage firms</td>
<td>Numeric (m²)</td>
</tr>
<tr>
<td>VERT</td>
<td>The storey level the office is situated in the building (Brennan et al., 1994)</td>
<td>Brokerage firms</td>
<td>Dummy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Variable references</th>
<th>Source</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>WGLASS</td>
<td>The building has a cladding (1-0) (Sivitanidou, 1996)</td>
<td>Brokerage firms</td>
<td>Dummy</td>
</tr>
<tr>
<td>CPI</td>
<td>CPI adjustment in the lease (1-0) (Brennan et al., 1998; Frew and Jud, 1998)</td>
<td>Brokerage firms</td>
<td>Dummy</td>
</tr>
<tr>
<td>E</td>
<td>Operational expenses (electricity, water, gas, security etc.) (Stilling et al., 1987)</td>
<td>Brokerage firms</td>
<td>Dummy</td>
</tr>
<tr>
<td>ESCAL</td>
<td>Contract contains a rent escalation clause (1-0) (Bollinger et al., 1998; Brennan et al., 1994)</td>
<td>Brokerage firms</td>
<td>Dummy</td>
</tr>
<tr>
<td>FREE</td>
<td>Duration of free rent (Brennan et al., 1998; Wheaton, 1994)</td>
<td>Brokerage firms</td>
<td>Dummy</td>
</tr>
<tr>
<td>NET</td>
<td>Offered rent is not (1-0) (Bollinger et al., 1998; Sivitanidou, 1995; Wheaton, 1994)</td>
<td>Brokerage firms</td>
<td>Dummy</td>
</tr>
<tr>
<td>TAX</td>
<td>Annual tax rate of the office (Bollinger et al., 1998; Clapp, 1980; Sivitanidou, 1995; Wheaton, 1994)</td>
<td>Brokerage firms</td>
<td>Dummy</td>
</tr>
<tr>
<td>TERM</td>
<td>Duration of contract (Brennan et al., 1994; Wheaton and Jud, 1994)</td>
<td>Brokerage firms</td>
<td>Dummy</td>
</tr>
</tbody>
</table>

Location variables

<table>
<thead>
<tr>
<th>Code</th>
<th>Variable references</th>
<th>Source</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUT</td>
<td>Number of firms on the road leading to the building (proxy for easy access by car) (Clapp, 1980)</td>
<td>Site observation</td>
<td>Numeric</td>
</tr>
<tr>
<td>BFI</td>
<td>Number of employees in banking, finance, insurance sector in the district (Tsoukas, 1993)</td>
<td>SIS</td>
<td>Numeric</td>
</tr>
<tr>
<td>BLUE</td>
<td>Number of blue-collar workers in the district (Bollinger et al., 1998; Sivitanidou, 1995)</td>
<td>SIS</td>
<td>Numeric</td>
</tr>
<tr>
<td>COLLED</td>
<td>Percentage of college-educated households in the district (Bollinger et al., 1998; Wheaton, 1994)</td>
<td>SIS</td>
<td>Numeric</td>
</tr>
<tr>
<td>CRIME</td>
<td>Reported annual crime incidents in the district (Sivitanidou, 1995, 1996)</td>
<td>SIS</td>
<td>Numeric</td>
</tr>
<tr>
<td>DPORT</td>
<td>Distance from major airports (Sivitanidou, 1995, 1996)</td>
<td>Aerial maps</td>
<td>Numeric (km)</td>
</tr>
<tr>
<td>DBRIDGE</td>
<td>Distance from bus stops (Sivitanidou, 1995, 1996)</td>
<td>Aerial maps</td>
<td>Numeric (km)</td>
</tr>
<tr>
<td>DCR</td>
<td>Distance from CBD (Sivitanidou, 1995, 1996)</td>
<td>Aerial maps</td>
<td>Numeric (km)</td>
</tr>
<tr>
<td>DCENTER</td>
<td>Distance from the nearest secondary centre (Bollinger et al., 1998; Wheaton, 1994)</td>
<td>Aerial maps</td>
<td>Numeric (km)</td>
</tr>
<tr>
<td>DFREEWAY</td>
<td>Distance from the nearest highway (Brennan et al., 1996; Clapp, 1980; Frew and Jud, 1998; Sivitanidou, 1995, 1996)</td>
<td>Aerial maps</td>
<td>Numeric (km)</td>
</tr>
<tr>
<td>Code</td>
<td>Variable references</td>
<td>Source</td>
<td>Type</td>
</tr>
<tr>
<td>------</td>
<td>--------------------</td>
<td>--------</td>
<td>------</td>
</tr>
<tr>
<td>DMALL</td>
<td>Distance from the nearest shopping centres (Bollinger et al., 1998)</td>
<td>Arcview maps</td>
<td>Numeric (km)</td>
</tr>
<tr>
<td>DMETRO</td>
<td>Distance from the nearest metro station (Bollinger et al., 1998)</td>
<td>Arcview maps</td>
<td>Numeric (km)</td>
</tr>
<tr>
<td>DPRESTIGE</td>
<td>Proximity to prestigious districts namely Eliter, Bagdat St., or Bozburen (Clapp, 1980; Sivitanidou, 1996)</td>
<td>Arcview maps</td>
<td>Numeric (km)</td>
</tr>
<tr>
<td>DSEA</td>
<td>Distance from the sea (Sivitanidou, 1995, 1998)</td>
<td>Arcview maps</td>
<td>Numeric (km)</td>
</tr>
<tr>
<td>DSQUT</td>
<td>Proximity to the squatter settlements (Bollinger et al., 1998; Gai, 1990)</td>
<td>Arcview maps</td>
<td>Numeric (km)</td>
</tr>
<tr>
<td>EDUC</td>
<td>Expenditure for primary education in the district (Sivitanidou, 1995)</td>
<td>Computed based on SIS²</td>
<td>Numeric (US$/²)</td>
</tr>
<tr>
<td>EMPRTL</td>
<td>Number of retail sector employees in the district (Sivitanidou, 1995, 1998)</td>
<td>SIS²</td>
<td>Numeric</td>
</tr>
<tr>
<td>FAR</td>
<td>The floor area ratio restriction on office commercial development (Sivitanidou, 1995)</td>
<td>Planning dept., IMM²</td>
<td>Numeric</td>
</tr>
<tr>
<td>HEIGHT</td>
<td>The height restrictions on office commercial development (Sivitanidou, 1995)</td>
<td>Planning dept., IMM²</td>
<td>Numeric (m²)</td>
</tr>
<tr>
<td>HY</td>
<td>Number of streets within 1 km square area (Bollinger et al., 1998; Wheaton, 1984)</td>
<td>Site observation</td>
<td>Numeric</td>
</tr>
<tr>
<td>INCOME</td>
<td>Annual average household income in the district (Bollinger et al., 1998; Sivitanidou, 1996)</td>
<td>SIS²</td>
<td>Numeric (US$)</td>
</tr>
<tr>
<td>OFI</td>
<td>Total office space within 1 km square area (Clapp, 1980)</td>
<td>Arcview maps</td>
<td>Numeric (m²)</td>
</tr>
<tr>
<td>PRO</td>
<td>Number of professional employees in the district (Bollinger et al., 1998; Sivitanidou, 1995, 1996)</td>
<td>IMM</td>
<td>Numeric</td>
</tr>
<tr>
<td>SERVICE</td>
<td>Number of service sector employees in the district (Bollinger et al., 1998; Sivitanidou, 1996)</td>
<td>SIS²</td>
<td>Numeric</td>
</tr>
<tr>
<td>SMGC</td>
<td>The air pollution rate in the district (SO²) (Clapp, 1980)</td>
<td>SIS²</td>
<td>Numeric (µg/m³)</td>
</tr>
<tr>
<td>Ecometric variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABS</td>
<td>Average inlet duration of the office in the region (absorption) (Sivitanidou, 1997; Wheaton and Torto, 1984)</td>
<td>Collier-Resco</td>
<td>Numeric (months)</td>
</tr>
<tr>
<td>CONSM</td>
<td>Annual consumer expenditure per person in the district (Henderson, 2002)</td>
<td>Computed based on SIS²</td>
<td>Numeric (US$/²)</td>
</tr>
</tbody>
</table>

APPENDIX

<table>
<thead>
<tr>
<th>Code</th>
<th>Variable references</th>
<th>Source</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>DR</td>
<td>Annual depreciation rate of the building (Henderson, 1996)</td>
<td>Computed⁴</td>
<td>Numeric</td>
</tr>
<tr>
<td>EMP</td>
<td>Growth in employment rate in the district (Glascock et al., 1990; Heukam, 1985; Henderson, 2002; Torto, 1988; Wheaton and Torto, 1988)</td>
<td>SIS²</td>
<td>Numeric (%)</td>
</tr>
<tr>
<td>GDP</td>
<td>[GDP]annual/GDP³</td>
<td>SIS²</td>
<td>Numeric (%)</td>
</tr>
<tr>
<td>IR</td>
<td>Annual interest rate (D’Arcy et al., 1996, 1997; Garin and Henneberry, 1988, 1991; Henderson, 1985; Torto, 1988)</td>
<td>CBRT⁴</td>
<td>Numeric (%)</td>
</tr>
<tr>
<td>MSFT</td>
<td>Annual manufacturing output in the district (Henderson et al., 2002)</td>
<td>SIS²</td>
<td>Numeric (%)</td>
</tr>
<tr>
<td>OFBO</td>
<td>Annual office construction investment in the region; proxied by new office area underconstruction (Sivitanidou, 1997; Torto, 1988)</td>
<td>Collier-Resco</td>
<td>Numeric (m²)</td>
</tr>
<tr>
<td>RC</td>
<td>Replacement cost of building (Henderson, 1996)</td>
<td>Computed based on SIS²</td>
<td>Numeric (US$)</td>
</tr>
<tr>
<td>RETAIL</td>
<td>Annual retail sales per person in the district (Henderson et al., 2002)</td>
<td>Computed based on SIS²</td>
<td>Numeric (US$)</td>
</tr>
<tr>
<td>UNEMP</td>
<td>Number of annual unemployment in the district (D’Arcy et al., 1996; Heukam, 1985)</td>
<td>SIS²</td>
<td>Numeric (US$)</td>
</tr>
<tr>
<td>V</td>
<td>Vacancy rate (Frei and Jud, 1988; Glascock et al., 1990; Heukam, 1985; Henderson, 1996; Henderson et al., 2002; Polidakis et al., 1992; Rosen, 1984; Shilling et al., 1987; Sivitanidou, 1997; Wheaton and Torto, 1988, 1994)</td>
<td>Collier-Resco</td>
<td>Numeric (%)</td>
</tr>
</tbody>
</table>

(*) Source brokerage firms are indicated in Appendix B.  
(1) SIS² Republic of Turkey, Prime Ministry State Institute Statistics  
(2) IMM Istanbul Metropolitan Municipality  
(3) CBRT Central Bank of the Republic of Turkey  
(4) * Education Expenditure = Consumer Price Index × Education Expenditure  
(5) * Number of Students  
(6) * Consumer Expenditure Ratio = Consumer Price Index × Population  
(7) * Depreciation Rate = 1 / (1 + 0.05) × 100  
(8) * Replacement Cost of Building = Total Construction Area × Construction Cost Index  
(9) * Retail Expenditure Ratio = Consumer Price Index × Population  

Decision-making Criteria for the Acquisition of Office Buildings

Do building features decide?

APPENDIX

C.3 QUESTIONNAIRE BUILDING FEATURES

Gebouwindicaties

Complex nr.: 34
Naam: Agri-gebouw
Adres: Graanmarkt 3
Plaats: Zwaagdijk-Oost
Aangekocht: 6/24/93
Verkocht: na

A. Gevelmateriaal
   (Alleen kantoorgedeelte)
   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 (meerere bouwdelen in laagbouw)
   3. Paviljoen (kentkantoor met max. 3 verdiepingen)
   4. Stedelijk (ingeschreven in straatbeeld)
   5. Standaard (niet gelijkend 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

F. Uitstraling entree
   (Binnenkant)
   1. Aantrekkelijk
   2. ...
   3. Onaantrekkelijk

G. Uitstraling entree
   (Buitenkant)
   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

C.1 Density and Division Data Set

Density and Division Data Set

C.2 Inflation Figures

<table>
<thead>
<tr>
<th>Year</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
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<tbody>
<tr>
<td>Value</td>
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<td>3.4</td>
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<td>1.2</td>
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<td>1.1</td>
<td>1.6</td>
<td>2.5</td>
</tr>
</tbody>
</table>
**D. Methodology**

Script of the final model:

```plaintext
MIXED NIm2 BY ENTR_CHAR_IN BUILD_TYP USE_2 FLEX WITH Time ABSm2X DISPT NUMRESX NR_FL AGE
/FIXED=INTERCEPT Time ABSm2X DISPT NUMRESX ENTR_CHAR_IN BUILD_TYP USE_2 FLEX NR_FL AGE | SSTYPE(3)
/METHOD=ML
/PRINT=SOLUTION TESTCOV LMATRIX
/RANDOM=INTERCEPT | SUBJECT(ID) COVTYPE(ID)
/REPEATED =Time | SUBJECT(ID) COVTYPE(AR1)
/EMMEANS=TABLES(ENTR_CHAR_IN) COMPARE ADJ(LSD).
```

**E. Results**

**E.1 Descriptive statistics of Regional Market Features**

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<tr>
<th>Period</th>
<th>Office Supply (m²)</th>
<th>Office Absorption (m²)</th>
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<td></td>
<td>Mean, Standard Deviation, 95% CI Upper Bound, 95% CI Lower Bound</td>
<td>Mean, Standard Deviation, 95% CI Upper Bound, 95% CI Lower Bound</td>
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</table>

Quarterly means of regional office supply (SUPm²) and office absorption (ABSm²).
### E.2 Descriptive Statistics of Location Features

#### Frequency tables of location variables

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
<th>Frequency</th>
<th>%</th>
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<tbody>
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<td>RANDSTAD</td>
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<td></td>
<td>Inner Randstad</td>
<td>35</td>
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<td></td>
<td>Peripheral Randstad</td>
<td>32</td>
<td>26.9</td>
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<tr>
<td></td>
<td>Backward area</td>
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<tr>
<td></td>
<td>Total</td>
<td>119</td>
<td>100.0</td>
</tr>
<tr>
<td>URB_CLASS_2</td>
<td>Very strong urbanized</td>
<td>36</td>
<td>30.3</td>
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<tr>
<td></td>
<td>Strong urbanized</td>
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<td>41.2</td>
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<td></td>
<td>Medium urbanized</td>
<td>24</td>
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#### Descriptive Statistics

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<th>Maximum</th>
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<th>Std. Deviation</th>
<th>Std. Error of Mean</th>
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<tbody>
<tr>
<td>Parking (PN)</td>
<td>0</td>
<td>32.0</td>
<td>277.9</td>
<td>67.40</td>
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<td>0.223</td>
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<td>6957</td>
<td>2188.65</td>
<td>2.30</td>
<td>0.222</td>
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<tr>
<td>Distance to Public Transport (PP)</td>
<td>0.1</td>
<td>9.6</td>
<td>280.6</td>
<td>2.36</td>
<td>0.16</td>
<td>0.223</td>
</tr>
<tr>
<td>Distance to HS Station (DS)</td>
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<td>1.7</td>
<td>10.0</td>
<td>0.30</td>
<td>0.03</td>
<td>0.223</td>
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</table>

#### 95% Confidence Interval for Mean

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<th>Upper Bound</th>
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<td>Distance to HS Station (DS)</td>
<td>150540.26</td>
<td>232096.37</td>
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</tbody>
</table>

---

![Distance to Public Transport](image1.png)

![Distance to HS Station](image2.png)
E.3 DESCRIPTIVE STATISTICS OF BUILDING FEATURES

Frequency table of building feature variables

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
<th>Frequency</th>
<th>%</th>
<th>Feature</th>
<th>Value</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE_2</td>
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<td>44.5</td>
<td>VOLUME_2</td>
<td>box</td>
<td>55</td>
<td>46.2</td>
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<tr>
<td></td>
<td>Multi</td>
<td>64</td>
<td>53.8</td>
<td>LTX-shape</td>
<td>30</td>
<td>25.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Missing</td>
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<td>1.7</td>
<td>multiple rectangles</td>
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<td>18.5</td>
<td></td>
</tr>
<tr>
<td>HYBRID</td>
<td>Yes</td>
<td>23</td>
<td>19.3</td>
<td>FREE</td>
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<td>No</td>
<td>96</td>
<td>80.7</td>
<td>No</td>
<td>No</td>
<td>22</td>
<td>18.5</td>
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<tr>
<td>FAC_MAT_CH</td>
<td>bricks</td>
<td>63</td>
<td>52.9</td>
<td>SPAT_LAY_2</td>
<td>Domestic</td>
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<tr>
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<td>17.6</td>
<td>spinal</td>
<td>57</td>
<td>47.5</td>
<td></td>
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<tr>
<td></td>
<td>classic</td>
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<td>16.8</td>
<td>deep plan</td>
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<td>mixed use</td>
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<td></td>
<td>119</td>
<td>100.0</td>
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<td>FLEX</td>
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<td>15.1</td>
</tr>
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<td>12.6</td>
<td>Medium Adjustable</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>other</td>
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<td>31.9</td>
<td>Very Adjustable</td>
<td>62</td>
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<td></td>
<td>119</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
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<td>High Rise</td>
<td>10</td>
<td>8.4</td>
<td>ENTR_CHAR_IN</td>
<td>1</td>
<td>37</td>
<td>31.1</td>
</tr>
<tr>
<td></td>
<td>Complex</td>
<td>18</td>
<td>15.1</td>
<td>Pavillion</td>
<td>37</td>
<td>31.1</td>
<td></td>
</tr>
<tr>
<td></td>
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<td>20.2</td>
<td>237</td>
<td>37</td>
<td>31.1</td>
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<td>Basis</td>
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<td>Missing</td>
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<td>31.1</td>
<td></td>
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<tr>
<td></td>
<td>Total</td>
<td>119</td>
<td>100.0</td>
<td></td>
<td>119</td>
<td>100.0</td>
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<tr>
<td>FAC_SHAPE_2</td>
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<td>103</td>
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<td>ENTR_CHAR_OUT</td>
<td>1</td>
<td>43</td>
<td>36.1</td>
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<tr>
<td></td>
<td>round shapes</td>
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<td>13.4</td>
<td>237</td>
<td>35</td>
<td>29.4</td>
<td></td>
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<tr>
<td></td>
<td>Total</td>
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<td>100.0</td>
<td></td>
<td>119</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Average age of the office buildings in the portfolio (including two outliers of 250 years old)

Estimated marginal means of Net Rental Income according to façade materials with respect to maintenance described per value (FAC_MAT_MAIN) corrected for inflation (source: CBS), price level of 2000Q1.

Estimated marginal means of Net Rental Income according to spatial layout described per value (SPAT_LAY_2) corrected for inflation (source: CBS), price level of 2000Q1.

Estimated marginal means of Net Rental Income according to the charisma of the outside of the entrance described per value (ENTR_CHAR_OUT) corrected for inflation (source: CBS), price level of 2000Q1.
Decision-making Criteria for the Acquisition of Office Buildings
Do building features decide?

APPENDIX

Estimated marginal means of Net Rental Income according to type of described per value (FREE) corrected for inflation (source: CBS), price level of 2000Q1.

Estimated marginal means of Net Rental Income according to shape of the footprint of the building described per value (VOLUME) corrected for inflation (source: CBS), price level of 2000Q1.

Estimated marginal means of Net Rental Income according to façade materials with respect to charisma described per value (FAC_MAT_CH) corrected for inflation (source: CBS), price level of 2000Q1.

Estimated marginal means of Net Rental Income according to shape of the facade described per value (FAC_SHAPE) corrected for inflation (source: CBS), price level of 2000Q1.

Table: Descriptive Statistics

<table>
<thead>
<tr>
<th>Description</th>
<th>Mean</th>
<th>Standard Error</th>
<th>Lower Bound</th>
<th>Upper Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of floors</td>
<td>119</td>
<td>1.00</td>
<td>21.00</td>
<td>514.00</td>
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<tr>
<td>Average LFA per Floor</td>
<td>119</td>
<td>113.33</td>
<td>3876.00</td>
<td>102629.48</td>
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<tr>
<td>LFA / GFA Ratio</td>
<td>88</td>
<td>0.45</td>
<td>11.10</td>
<td>76.87</td>
</tr>
</tbody>
</table>

Descriptive Statistics

| Number of Rooms | 110 | 11.00 | 547.00 | 12699.00 | -482.00 | 482.00 | .48 | .257 | 6.09 | 748.73 | 976.15 |
| UFA / GFA Ratio | 80 | -0.45 | 1.10 | 17.87 | 0.05 | 0.98 | 0.01 | -1.98 | 207.81 | -89.16 | 58.67 |
| Valid N (listwise) | 80 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |

Graphs showing trends and distributions of various features and their impact on Net Rental Income.
## Correlation coefficients between building feature variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Correlation Coefficient</th>
<th>N</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facade materials</td>
<td>-0.084</td>
<td>117</td>
<td>0.477</td>
</tr>
<tr>
<td>Building facade</td>
<td>-0.178</td>
<td>117</td>
<td>0.394</td>
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<tr>
<td>Free standing</td>
<td>-0.051</td>
<td>117</td>
<td>0.190</td>
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<tr>
<td>Shape outside</td>
<td>-0.370</td>
<td>117</td>
<td>0.000</td>
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<tr>
<td>Spatial layout</td>
<td>1.000</td>
<td>117</td>
<td>0.000</td>
</tr>
<tr>
<td>Flexibility inside</td>
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<td>0.000</td>
</tr>
<tr>
<td>Flexibility outside</td>
<td>-0.149</td>
<td>117</td>
<td>0.000</td>
</tr>
</tbody>
</table>

**Notes:**
* Significant at the 0.05 level
** Significant at the 0.01 level
* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

## Results of pre-selection phase

### Decision-making Criteria for the Acquisition of Office Buildings

Do building features decide?

### Mixed Use of Functions

- **Charisma entrance:**
  - Internal entrance:
    - Correlation coefficient: -0.088
    - N: 117
    - Sig. (2-tailed): 0.898
  - Outside entrance:
    - Correlation coefficient: -0.112
    - N: 117
    - Sig. (2-tailed): 0.642

- **Entrance inside:**
  - Correlation coefficient: -0.029
  - N: 117
  - Sig. (2-tailed): 0.954

### Do buildings features decide?

- **Building footprint:**
  - Correlation coefficient: 0.106
  - N: 117
  - Sig. (2-tailed): 0.017

### Flexibility in Office Layout

- **Entrance:**
  - Correlation coefficient: 0.043
  - N: 117
  - Sig. (2-tailed): 0.368

### Facade Materials

- **Building facade:**
  - Correlation coefficient: 0.121
  - N: 117
  - Sig. (2-tailed): 0.152

### Results of pre-selection phase

#### Appendix

- **Results of selection phase**
  - Correlation coefficient: 0.055
  - N: 117
  - Sig. (2-tailed): 0.559
### APPENDIX

#### E.5 RESULTS FINAL MODEL

<table>
<thead>
<tr>
<th>Model Dimension</th>
<th>Number of Levels</th>
<th>Covariance Structure</th>
<th>Number of Parameters</th>
<th>Subject Variables</th>
<th>Number of Subjects</th>
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<tr>
<td>Fixed Effects</td>
<td>Intercept</td>
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<td></td>
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<tr>
<td></td>
<td>Time</td>
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<td>First-Order Autoregressive</td>
<td>2 ID</td>
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#### E.6 SENSITIVITY ANALYSIS

### FINAL MODEL (WITHOUT OUTLIER "DE LERAISSESTRAAT")

#### Type III Tests of Fixed Effects

<table>
<thead>
<tr>
<th>Factor group</th>
<th>Source</th>
<th>Numerator df</th>
<th>Denominator df</th>
<th>F</th>
<th>Sig.</th>
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</thead>
<tbody>
<tr>
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<tr>
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</tr>
<tr>
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</tr>
<tr>
<td>Number of residents in place of location</td>
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<td>3.616</td>
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</tr>
<tr>
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<tr>
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<tr>
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<td>.023</td>
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<tr>
<td>Age</td>
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#### Building features

| Type III Tests of Fixed Effects
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<th>Source</th>
<th>Numerator df</th>
<th>Denominator df</th>
<th>F</th>
<th>Sig.</th>
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<tr>
<td>Number of residents in place of location</td>
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### FINAL MODEL (WITHOUT OUTLIERS "DE LERAISSESTRAAT" AND AGE >250 yrs)

#### Type III Tests of Fixed Effects

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<th>Denominator df</th>
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### FINAL MODEL (WITHOUT OUTLIERS AGE >250 yrs)

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#### Covariates appearing in the model are evaluated at the following values:

- Quarter = 21.29
- ABSm2 (x1000) = 30.6911
- Distance to Public Transport = .350
- NUMRES (x1000) = 193.7231
- Number of floors = 4.19
- AGE = 15.97