# Multi Attribution analysis

## (Knowledge is power)

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## Abstract

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The ROZ/IPD Property index was established in 1994 to publicize an independent index on directly held real estate in the Netherlands. The real estate universe is split into the sectors: retail, offices, industrial, residential and mixed use/other. Based on the heterogeneous characteristics of properties for each sector attribution analyses are made. In the analyses the performance for the different characteristics of the sector could be compared. The office sector is segmented into centre location, office districts, residential districts, industrial park and other locations in common. Other analysis are also made for instance for geographic areas and the year of construction. Based on the segmentation for the office sector several analysis are already available with all different results for the benchmark's performance. The different kind of attribution analyses makes the used benchmark objective.
A working group of the ROZ/IPD Property index called "hedonic benchmarking" carried out a study on the possibility to produce one single and uniform benchmark tool, including miscellaneous individual property characteristics. The tool produces a benchmark for each individual property, based on the properties characteristics: *"how would this property have performed, if it were compared with its peers?"*. The study is based on the method of hedonic pricing, which is frequently used in the real estate sector (mostly residential) for analysis on rental levels and purchase prices. The analysis is made for individual years and time intervals and carried out for the total return, capital growth and the income return. The paper describes the results of the return's explicability, based on the individual property characteristics.

## 1. Introduction

Since 1995 the “ROZ/IPD Vastgoedindex” (the Dutch national real estate index) has provided its participants with a reliable analyses on the performance of Dutch real estate. Each participant is provided with information that allows it to measure the “rank” of its portfolio in relation to the benchmark. Since the beginning in 1995, the benchmark has distinguished between the performance of the sectors within the real estate- universe (residential, offices, retail and industrials)

Within these sectors, of course there also is a wide range of variety, when performance is being measured. The differences are caused by the heterogeneity of each individual asset. The attribution analyses that are being used, measure on the basis of certain defined sectorsegments. For example the office sector is split into city centre locations, office districts, residential areas and industrial business parks. Furthermore, the index allows attribution-analyses to be performed on the basis of the value of the projects, year of construction (renovation) and analyses can be made by cities and region.

To understand deviation from the benchmark, usually each fund (participant) refers to the specific composition of the portfolio. To support a better understanding of performance, the deviation of the composition of the portfolio is also measured. Within this context and with the necessary nuances, each fund is provided with its out- or underperformance.

The current attribution analysis measures how far one individual property-characteristic contributes to its sector-benchmark. This may eventually lead to misuse of the results: users of the reports may conclude wrongly when they do not understand the coherence of miscellaneous characteristics (and their effect on performance). For example a Fund manager with a residential portfolio which has delivered a better performance than the universal benchmark may conclude that he has out-performed. However, residential tends to deliver better return performance that other sectors during the history of the Dutch index. Thus comparing with the universal benchmark may not be appropriate. A more accurate comparison made by comparing performance with a sector specific benchmark, in this case residential only, may in fact show that his portfolio has under-performed.

Therefore, the Dutch ROZ panel has studied the possibilities to combine miscellaneous existing data (in the index) into a *“hedonic benchmark”.* As a result, each portfolio is not only being measured to the current benchmark, but also tested to a clone (simulation) of properties (portfolio) with similar characteristics. This process is a bottom-up process. To realize this analysis, and to eventually implemented for annual use, the following preconditions are essential:

1. We need explanatory power;
2. From year to year, there needs to be consistency at the level of explanatory characteristics;
3. The eventual (annual) hedonic benchmark must be simple and easy to understand;
4. The method needs to be simple, consistent in structure and comparable with analyses of former periods.

In order to evaluate the strengths and weaknesses of a “hedonic benchmark”, we have chosen to first of all study one sector, the office-universe in the index. The index consists out of 1000 office properties with a value of approximately € 10 billion. The majority (57 %) is located in the four main cities in the Netherlands; Amsterdam, The Hague, Rotterdam and Utrecht. Over 75 % of the offices are located in the Randstad, see figure 1. Compared with the data of the other sectors, office-data has sufficient records and data that is consistent enough “to stand the test”.

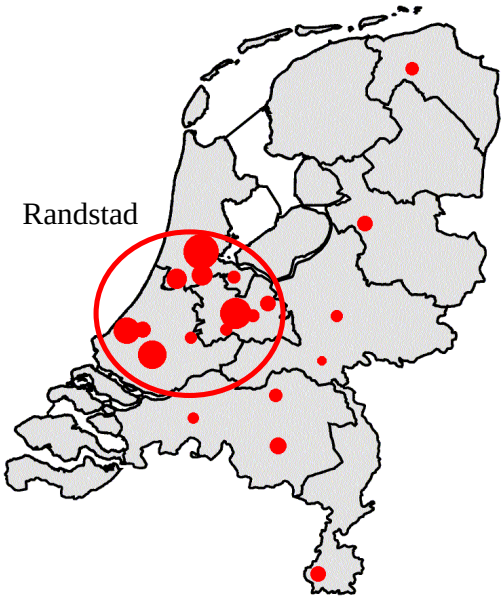


Figure 1. Map with the main office locations in the Netherlands.

## 2. General background

The hedonic theory is often used for the determination of prices for heterogeneous products. The hedonic theory assumes that the product's price could be determined by the characteristics of the product. The product's price could be calculated by the characteristics to give rise to utility. This doesn't mean one characteristic gives a rise on price but many characteristics will be shared in one product. Lancaster (1966) and Griliches (1967) introduced the hedonic theory in the sixties. The theory was first adopted for pricing automobiles. After the adoption in the automobile industry the theory is used for pricing for different heterogeneous products like computers and houses. Three criteria for the hedonic pricing are required, these are:

- The market isn't regulated by the government;
- Buyers have to know enough market knowledge;
- The buyer has to have the characteristics of the product and the utility of these characteristics.

Ball (1973) and Freeman (1979) were the first, who used the hedonic pricing theory in the real estate sector and in particular the residential sector. Some remarks are made on the research carried out: possible inconsistency and errors in the input data could influence the results of the analysis. Goodman (1989) determines the house price depends on three characteristics the location quality, the house quality and the neighbourhood quality. Nowadays many literature is available on hedonic pricing of houses. For instance in the USA over 125 papers are available on the impact of over 300 characteristics on the house price (MacPherson et al 2005). In the Netherlands also several surveys are carried out for instance on the regional housing market in Amsterdam by Francke et al (2000).

For commercial properties (retail and offices) the research carried out focuses on the rents. Some research is carried out on office rents particularly since 1990. Torto and Wheaton (1994) examined the rent development in 5 American cities and used the hedonic pricing model for the determination of a rent index. Webb and Fisscher (1996) examined the effective rent in Chicago and the effects of different kind of characteristics. Bolt (2002) examined shop rents in the Netherlands and analysed characteristics by the object characteristics and the number of passer-bys. Baum et al (1996) examined the causes and effects of depreciation in office buildings in the City of London. The characteristics floor space, location, year of construction and the year of the last renovation, influence the depreciation.

On explaining variables for returns by property characteristics no research is carried out. The sector performance (residential, offices and retail) is expected to be the first variable for explaining real estate returns. But no research is carried out on the explicability returns by the property characteristics. The hedonic theory could be useful due to the fact it meets all requirements:

- The office sector isn't regulated;
- Buyers and sellers act professional and have enough information on the building characteristics and their utility;
- The input data is consistent due to the uniform definitions established for the data collection of the ROZ/IPD index;
- The input is checked on errors by the ROZ/IPD index.

So the criteria for the hedonic theory could be adapted. The difference with previous research is that this will be one of the first research carried out on hedonic performing instead of hedonic pricing.

## 3. Building characteristics and property performance

The first item considered in this Section is the current method for performance-measurement within the ROZ/IPD real estate index and in particular for the office market. Next a methodical approach for the performance for heterogeneous products is considered.

### *3.1 Existing segmentation*

In general different market segmentations are distinguished by generally accepted characteristics like quality of location and age. Both these factors appear to influence performance. However, no research has yet been carried out to confirm whether this applies in the Dutch market .

The most elementary and often used office market classification is by location, i.e. city-centre location, office location, sub-divisions and business parks. However the explanatory-power of the different types of locations is low. The weak explanatory-power of the different segments is caused by a large spread of returns. Figure 1 shows the spread of the different segments based on a boxplot. Considering the fact that the average of the observations for the different types of locations differs around 2%, and where the return shows a spread of 5% (based on the boxplot) one may conclude that the explanatory-power is small.

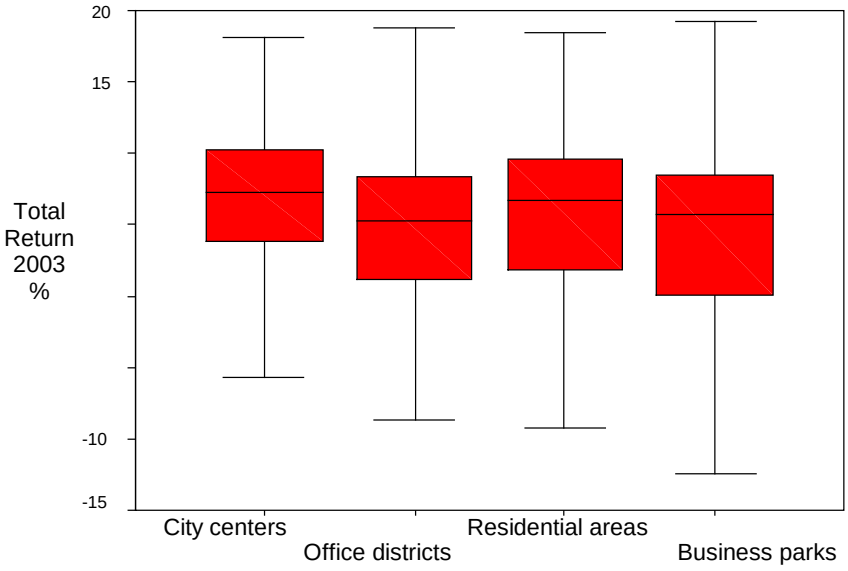


Figure 2 shows that for there are clear differences of approximately 2 % of the medians of the different categories. When, however, the spread of the number of observations is considered, it appears that a large number of observations likewise falls within 50% of the observation-spectrum of the other categories. This suggests that the segmentation has only weak explanatory power. Segments like city-centre locations include for example the cities of Amsterdam and Zwolle; which are very different in characteristics. In addition there are buildings in both locations which differ in age. This shows that even within existing segments the spread of returns is possibly affected by heterogeneousness.

*3.2 Hedonic Pricing*

A lot of research into hedonic pricing in real estate has, already been conducted. The influence of different factors on rents and initial yields has already in this regard been considered. Hedonic pricing is used in determining the price for heterogeneous products. Because real estate is a heterogeneous product this approach is applicable for the purposes of analysis An example of this is the relationship between the size of a building and its total purchase costs. : Larger buildings attract higher prices. A large number of explanatory factors for especially rental prices have been researched. However, research regarding the possibilities of explaining the variety of property-returns due to differences in building characteristics has not been much publicized especially because of a lack of available data.

## 4. Data

*4.1 Performance Data*

The Analysis was made on the office-data registered in the ROZ/IPD -index. This analysis is exclusively performed on objects that have been part of a portfolio for a complete year, the so called 'standing investments'. The Table below shows the number of objects and their representative values.

| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|
| Number of properties | 836 | 802 | 758 | 794 | 930 | 993 | 992 | 975 | 951 |
| Value milj. € (ultimo) | 5.268 | 5.462 | 5.625 | 6.303 | 7.595 | 8.373 | 9.197 | 9.587 | 9.697 |

For the explanation of the performance a classification is made concerning the different returns published in the ROZ/IPD index. The splicing is made for the total return, the capital value growth and the direct or income return. The effect of these three performance indicators has been researched in the workgroup. In addition attention was given to the classification of multi-year averages. For this the relationship between building-characteristics and 2-, 3-, 5- and 9-year averages of performance were considered.

*4.2 Building-characteristics*

An inventory was made based on external sources and the data within the ROZ/IPD -index. From this it may be shown that an extant part of the possible factors have already been included in the index, but that other factors are still missing. The latter are mostly factors that cannot be clearly deduced objectively and a few other factors that may yet develop over time. The different factors are listed in table 1.

Table 1. Overview of possible return influencing variables on the office returns.

| | Present in the index | Missing data: |
|---|---|---|
| Building characteristics | Gross floor area, Parking standard, Year of delivery, office segment, average unit size, no. Of tenants, Land quality, Value | Flexibility, No.of floors Airco Quality of building/ quality of building finish |
| Location | Type of location, name of city, market rent, reversionary yield, Relationship supply & demand | Accessibility , Type and presence of facilities Type of area within the city , Labour market characteristics |

The aim of the workgroup was to obtain an understanding of the relationship between the performance, building-characteristics and location-characteristics . Not all parameters concerning the explanatory-power of property-returns were available in the databanks. Therefore additional use has been made of the Real Estate Norm. (REN)[1]

*4.3 Management-of influential factors*

Alongside the building characteristics perhaps, the non-static building characteristics are of additional influence on the projected performance. These characteristics include, for instance, factors that were influenced by decisions taken in the past and the quality of the organisations responsible for managing the buildings. These factors have also been considered in this research. The application of these factors in asserting a new standard for comparison is doubtful. Especially so because the quality and added value of the decisions taken and the quality of management needs to be ascertained. Also, following this, the relationship between performance and management-costs may be analysed. Limited data on management-costs as such are present in the index but not all parties involved are listed in the ROZ/IPD -index.

Table 2. Possible management related factors influencing performance .

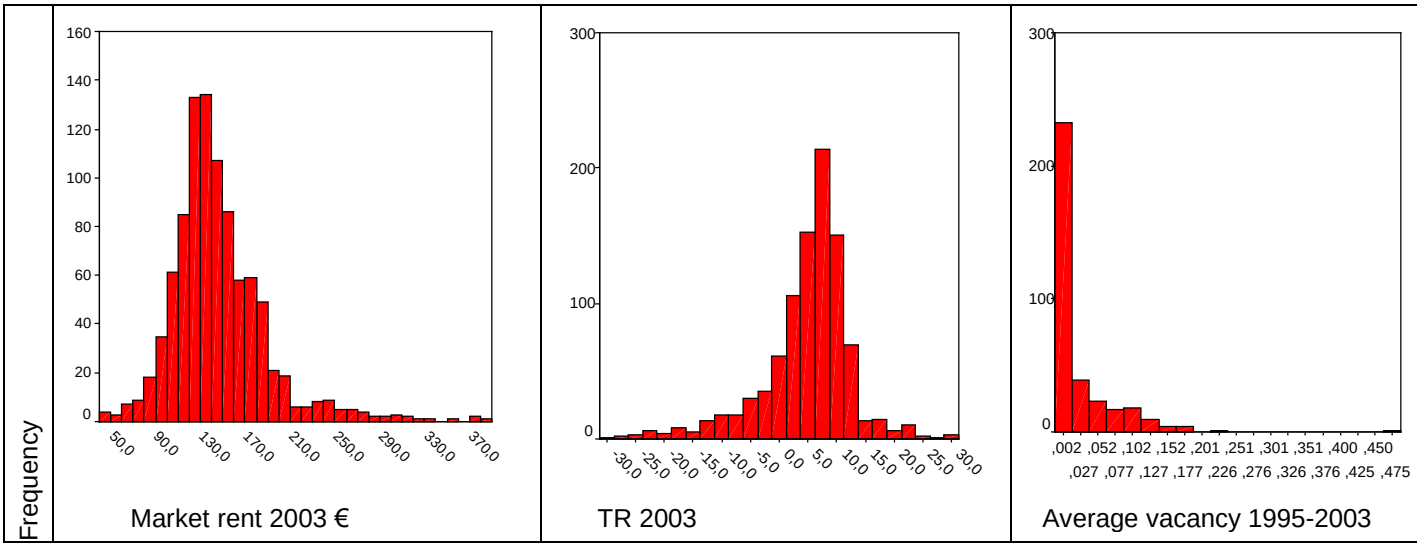
| | Data in the index | Non available data, f.e.: |
|---|---|---|
| Management | operating costs , potential rent, vacancy, length of remaining (2002 en 2003), contract rent, initial yield, | Tenant credit rating , type of management organization management costs |

*4.4 Composition of Data*

An inventory of the source-material was made in order to determine how the related data could be considered in the analysis. Based on the expected relationships and categories mentioned in the real-estate norm (REN) for office buildings it is determined that certain variables could have a different a non linear distribution. For those categories dummy variables are added.

In addition the division of the different variables has been tested. Results from this show the following: the operating costs considered as percentage of the value and vacancy were not distributed by a normal distribution evenly in each particular year. The research did not pursue this angle any further. Returns for these years are distributed normally as well as those for the initial yields and rental-levels. The operating costs are not divided normally, because they cannot be smaller than zero and because a large number of observations are close to zero and that is also true for the vacancy. The factors GLA, parkingnorm, number of tenants, unit-size are examples of categories made on the basis of the REN. Data concerning, for example, the city, office-location types and office-categories have been included per category. The different categories are included into the analysis as dummy-variables. Because there is no straight-line connection between variables like age of the building, and return the use of dummy-variables has been applied. In addition to this, factors like the city in which the property is located were added as variables because they are separate categories having no relation to other cities. In a follow-up it may be researched why a particular city has an influence on the returns, but first it needs to be researched if there is any influence at all concerning the fact in which city a particular object is located. In Figure 2 the distribution of the total return for 2003, the market-rent and the vacancy over 2003 have been given for illustration purposes.

[1] Information about REN can be obtained from ROZ/IPD




## 5. Analysis of Building Characteristics (Features)

In order to find a relation between the performance and building characteristics an appropriate analysis-technique should be adopted. Because the relation between dependent variables (the performance) and various independent variables (building characteristics)was being researched, a regression analysis was adopted. As a consequence whether or not the data is truly independent needs to be researched first before the analysis can be performed.

*5.1 Correlation*

In order to determine the independence of the variables the correlation between the different variables, as they have been described previously, has been considered. From the analysis it appears that the combination of a certain pair of factors results in a too high correlation creating their independence. These pairs of factors are f.e.:

- The value of the building and its gross surface-area;
- The contract-rent and market-rent per square meter. This factor could be included by taking into account the market rent and the difference between the contract rent and market rent.

This independence results in the prohibition of including both these factors in one regression-analysis. There has been a look at what the explanatory-power is for the performance of these factors. However for the correct explanation a combination of the above-mentioned factors should be avoided.

*5.2 Regression-analysis*

The analysis has been performed in three stages:

- singular regression
- multiple regression
- stepwise regression

The explanatory-power of an analysis is determined by the $R^2$. The $R^2$ is used in most cases when determining the explanatory-power. It should be noted that this number is not by any means a definitive answer but it can give a good indication of the existence of a relationship. The $R^2$ indicates which part of the variation in performance is the result of the building characteristics. A value of 1 indicates a strong relationship whereas a value of 0 indicates that no relationship exists. Because a regression of multiple variables mostly always results in a better explanatory-power the $R^2$ is automatically adapted in the SPSS analysis . A value of 0,3 to 1,0 is, in most cases, is regarded as acceptable. The discovered relations must have a clearly definable or expected

relation. Possible changes in the relationships, from positive in the first year to negative the next, must also be explained. Such a particular relationship could arise as a result of the cyclical nature of the office-market. Thus it may be predicted that, for example, the location in Amsterdam in 2000 has a positive effect on returns but a negative impact in 2003.

*5.3 Singular Regression*

The singular regression consists of one single independent variable of performance. The results of a singular regression of the performance reveal limited results as no single building characteristic delivers a $R^2$ of more than 0,100.

Table 3. Overview of factors which have most explanatory-power, on the basis of a singular regression, over the period 2001-2003 and measured over a 3years average.

| | Total return | $R^2$ | Capital growth | $R^2$ | Income return | $R^2$ |
|---|---|---|---|---|---|---|
| 1 | Vacancy | 0,088 | Length of lease | 0,050 | Gross initial yield | 0,250 |
| 2 | Length of lease | 0,031 | Vacancy | 0,043 | Vacancy | 0,208 |
| 3 | Unit greater than 10.000 m2 | 0,015 | Gross initial yield | 0,033 | Operating costs | 0,135 |
| 4 | | | Gross lettable area 500-1000m2 | 0,020 | | |
| 5 | | | Market rent | 0,020 | | |

As shown in the table above it appears that the explanatory-power of the performance of a singular regression is too low. In addition is appears that the static building characteristics have a very limited relation to the performance. The factors vacancy, lease terms, the gross initial yield on the basis of the contract rent and the exploitation costs appear to influence the performance. For the ROZ property index comparative reports are released on the basis of 1 factor. These singular regression analyses show differences in performance; however because of the large distribution of the performance. As has already been shown in Fig. 2, this does not result in a higher $R^2$. As a consequence, basing the explanatory-power on one factor alone is not enough.

*5.3 Multiple regression*

A multiple regression analysis entails an examination of the explanatory-power of the variables (the performance) on the basis of different independent variables. Important in this respect is the total explanatory-power of all available information. A consequence of this method is that as the amount of variables increase so does the explanatory power. In this case that means an analysis of 16 variables, effectively realizing a nearly instantaneous higher explanatory power. In order to include these in the outcome the adapted $R^2$ is shown in Table 4. The individual regression coefficients for the analysis of the total profit for the year 2003 have been included in the appendix.

Table 4. Overview adjusted $R^2$ , on the basis of miscellaneous building characteristics

| Period | $R^2$ total return* | $R^2$ capital growth* | $R^2$ income return* |
|---|---|---|---|
| 2000 | 0,130 | 0,164 | 0,051 |
| 2001 | 0,065 | 0,092 | 0,039 |
| 2002 | 0,073 | 0,104 | 0,033 |
| 2003 | 0,173 | 0,156 | 0,066 |
| Multiple year averages | | | |
| 2002-2003 | 0,071 | 0,089 | 0,068 |
| 2001-2003 | 0,053 | 0,081 | 0,072 |
| 1999-2003 | 0,185 | 0,256 | 0,204 |
| 1995-2003 | 0,240 | 0,327 | 0,292 |

*Calculated on the basis of the following variables

Gross lettable Area, Parking norm, Year of delivery, Office segment, Average unit size, number of tenants, type of office location, city, market rent, reversionary yield, supply versus take-up, relationship gross to net floor space

*5.4 Geographical limitation*

Table 5. Overview of adjusted $R^2$ on the basis of building characteristics, and differences in geographical location for total return, capital growth and income return in 2003.

| Geographic area | $R^2$ total return * | $R^2$ capital growth * | $R^2$ income return * | Number of observations |
|---|---|---|---|---|
| Netherlands | 0,173 | 0,156 | 0,066 | 716 |
| 4 Biggest Cities | 0,111 | 0,131 | 0,036 | 279 |
| Other Cities ex 4 largest | 0,267 | 0,232 | 0,122 | 425 |
| Satelliet cities | 0,288 | 0,355 | 0,032 | 35 |
| Rotterdam | 0,141 | 0,058 | -0,039 | 41 |
| Utrecht | 0,361 | 0,444 | 0,102 | 53 |
| Amsterdam | 0,319 | 0,362 | -0,058 | 69 |

* Calculated on the basis of of the following variables:
Gross lettable Area, Parking norm, Year of delivery, Office segment, Average unit size, number of tenants, type of office location, city, market rent, reversionary yield, supply versus take-up, relationship gross to net floor space

The problem of this particular level of analysis (geographical limitation) is the small sample size which is too small for reliable analyses. The number of variables is too great for the number of objects being examined, especially when dummy variables are used, whereby a further division of the total database is required, and the number of objects to be explained is further limited. Ultimately only two objects per dummy fall into this category resulting in incorrect conclusions.

*5.4 Stepwise regression analysis*

In a multiple regression analysis it appears that a limited number of factors have explanatory power. In most cases only 5 of the most influential factors account for 80% of the total explanatory power. Therefore it is useful to determine what these most influential factors are.

Table 6. Overview of the factors with the most explanatory-power on the basis of a stepwise regression for performance over the period 1999-2003. The $R^2$ is reproduced on the basis of cumulative explicability of the analysed factors.

| | Total return | $R^2$ | Value growth | $R^2$ | Income return | $R^2$ |
|---|---|---|---|---|---|---|
| 1 | Market rent 1999-2003 | 0,088 | Market rent 1999-2003 | 0,144 | Gross reversionary yield | 0,044 |
| 2 | Amsterdam | 0,119 | Year < 1950 | 0,193 | Year < 1950 | 0,060 |
| 3 | Year < 1950 | 0,139 | Amsterdam | 0,220 | City of Amersfoort | 0,077 |
| 4 | Year 1995-2003 | 0,155 | Year 1995-2003 | 0,235 | | |
| 5 | Year 1950-1960 | 0,169 | Year 1950-1960 | 0,246 | | |

Based on the outcome of the Table above it appears that market rent, the fact whether or not an object is located in Amsterdam and the date that the building was first in, are of influence on the total return and the capital growth. In Table 7 a further analysis has been made of the explanatory-power based on the market rent in relation to the capital growth. As is shown in this figure it can be concluded that the explanatory-power is applicable for a relatively small part and with regards to the annual data only of influence in 2000. However, over the long term this yields better results.

Table 7. Explanation-power on the basis of the market rent.

| Period | $R^2$ |
|---|---|
| 1995 | -0,001 |
| 1996 | 0,003 |
| 1997 | -0,001 |
| 1998 | 0,000 |
| 1999 | 0,038 |
| 2000 | 0,087 |
| 2001 | 0,028 |
| 2002 | 0,017 |
| 2003 | 0,005 |
| 2000-2001 | 0,083 |
| 2002-2003 | 0,014 |
| 1998-2000 | 0,050 |
| 2001-2003 | 0,025 |
| 1995-1999 | -0,001 |
| 1999-2003 | 0,144 |
| 1995-2003 | 0,087 |

Based on the outcome of the results in Table 6 an examination was made to see if there was a possible relation between the year that the building was first in use and the capital value growth. In addition whether the relationships have a similar direction was examined. In Table 8 the results of these are shown. A limited number of conclusions may be drawn based on this analysis. The age gives a great explanatory-power for buildings of before 1950, whereby it should be noted that it concerns a limited number of observations. In addition it is notable that buildings from after 1995 show a lower annual value growth. However no clear relationship can be established in the other periods- resulting in a lower total annual explanatory power.

Table 8. Correlation analysis between capital value growth and year of the building's first use.

| Period | capital value growth and year of the building's first use | | | | | | |
|---|---|---|---|---|---|---|---|
| | <1950 | 1950-1960 | 1960-1970 | 1970-1980 | 1980-1990 | 1990-1995 | 1995-2003 |
| | correlation coefficients | | | | | | |
| 1995 | 0,001 | 0,046 | 0,058 | -0,033 | -0,075 | 0,099 | |
| 1996 | 0,017 | -0,044 | -0,047 | 0,006 | 0,009 | -0,043 | 0,012 |
| 1997 | -0,010 | -0,059 | 0,017 | 0,121 | 0,078 | -0,061 | -0,049 |
| 1998 | 0,063 | -0,073 | -0,001 | -0,063 | 0,107 | -0,034 | -0,081 |
| 1999 | 0,192 | 0,036 | -0,024 | -0,002 | 0,049 | -0,043 | -0,066 |
| 2000 | 0,158 | 0,063 | 0,003 | 0,010 | 0,033 | -0,012 | -0,055 |
| 2001 | 0,140 | 0,106 | -0,003 | 0,008 | 0,037 | 0,006 | -0,137 |
| 2002 | 0,188 | 0,023 | -0,131 | -0,007 | 0,042 | 0,024 | -0,076 |
| 2003 | 0,037 | -0,005 | 0,058 | 0,039 | 0,042 | -0,068 | -0,029 |
| 2000-2001 | 0,189 | 0,129 | -0,015 | 0,008 | 0,047 | -0,030 | -0,095 |
| 2002-2003 | 0,114 | 0,055 | -0,109 | 0,043 | 0,029 | -0,081 | -0,023 |
| 1998-2000 | 0,266 | -0,053 | -0,054 | -0,077 | 0,058 | -0,064 | -0,004 |
| 2001-2003 | 0,084 | 0,042 | 0,010 | -0,088 | 0,099 | -0,003 | -0,114 |
| 1995-1999 | 0,155 | -0,020 | -0,088 | 0,033 | 0,064 | -0,075 | |
| 1999-2003 | 0,300 | 0,044 | -0,020 | -0,072 | 0,092 | -0,047 | -0,106 |
| 1995-2003 | 0,474 | 0,024 | 0,028 | -0,059 | 0,102 | -0,220 | |
| Average | 0,148 | 0,020 | -0,020 | -0,008 | 0,051 | -0,041 | -0,063 |

5.5 *Conclusion*

Based on the results in this paper there were no building characteristics identified which significantly affected performance at the object-level. The market rent does appear to be sensitive for only a limited period as does capital value growth. Both these facors were especially influential for several categories between the years 1999-2000; however outside of this period the explanation is minimal. In addition it appears that a buildings year of first use seems to be of great influence, but when the direction of the different years is considered it appears that it only has any influence for the period before 1950 and after 1995. However, drawing conclusive statements from this would be a step too far, especially considering the fact that the number of buildings in the period before 1970 is quite small. Contact with IPD has been made in order to determine whether the results for the total analysis based on building characteristics are moderate only as far as the Dutch market is concerned. The explanatory-power for the English market also appears to be slight.

## 6. Analysis of all factors.

In the previous Section relations between performance and building characteristics were examined. In addition to building characteristics management-affected factors are present in relation to the performance. These are duration of lease terms, the level of contract rent, the difference between market rent and contract rent, vacancy and initial yield. The results are for illustration purposes only and will never be part of a benchmark. This because the quality of management is of influence on these factors and should therefore not be disregarded. The results are shown in order to present a complete picture of the explanatory power.

*Table 9. Results "Total Return", incl. Management influential factors*

| | 2003 | 2000 | 1995-2003 |
|---|---|---|---|
| 1 | Vacancy | Amsterdam | Amsterdam |
| 2 | Gross reversionary yield (market) | Gross initial yield (contract) | Gross reversionary yield (market) |
| 3 | City of Haarlemmermeer | Year of first use 1995-2003 | Vacancy |
| 4 | 2 tenants | Parkingplaces 50-100 | GLA 500-1000m2 |
| 5 | Office location | Running costs | Business Park |
| $R^2$(adjusted) | 0,323 | 0,157 | 0,313 |

*Table 10. Results "Direct Return", incl. Management influential factors.*

| | 2003 | 2000 | 1995-2003 |
|---|---|---|---|
| 1 | Operating costs | Operating costs | Gross reversionary yield (market) |
| 2 | Vacancy | Gross reversionary yield (market) | Operating costs |
| 3 | Gross reversionary yield (market) | Rent potential | Rent potential |
| 4 | Office location | GLA 250-500m2 | Vacancy |
| 5 | Rent Potential | Amsterdam | City of Eindhoven |
| $R^2$(adjusted) | 0,620 | 0,447 | 0,821 |

*Table 11. Results "Growth Capital Value", incl. Management influential factors.*

| | 2003 | 2000 | 1995-2003 |
|---|---|---|---|
| 1 | Gross initial yield (contract) | Gross initial yield (contract) | Gross reversionary yield (market) |
| 2 | Vacancy | Operating costs | Residential area |
| 3 | Operating costs | Amsterdam | Value 1-2 mio EURO |
| 4 | City of Haarlemmermeer | Market rent | Vacancy |
| 5 | Length of leases | Year of first use 1995-2003 | Value >20 mio EURO |
| $R^2$(adjusted) | 0,235 | 0,226 | 0,116 |

## 7. Conclusions and Recommendations

*7.1 Conclusions*

In this paragraph the conditions, as mentioned in Section 1, are tested.

**1. The explanatory-power for the return from the object's characteristics should be large enough.**

The explanatory-power for the different returns on the basis of the existing building characteristics in the datafile is small. It is important for all concerned that the existing data developed since 1995 be allowed to continually grow making further analysis possible. One of the factors recently added is that of the average duration of lease terms. Concerning the analysis the following conclusions may be drawn:
- There is a market in which future value-developments are anticipated
- The totality of factors is irrelevant, and data of other influential factors is not available.
This dealt with further in the following paragraph.

*Future value-development considered in the price*

The efficient market hypothesis (EMH) assumes that all available data has already been considered in the pricing. This means that the existing data concerning possible value-decline of objects has already been considered in the price. Analogous to this a lower property return will deem satisfactory when a higher value-development is expected. When the conducted analyses are considered it becomes apparent that explanatory-power of both the capital value growth over the whole of the period and property return based on multi-annual averages is higher which could indicate a limited measure of an anticipated market.

*Inefficient Market*

The second option is the assumption that the whole of factors is irrelevant and this would mean that there are no relations between the performance of buildings and their individual characteristics. This means that an investor undergoes no negative or positive influence from their portfolio but only the quality of the executable management will affect under or out-performance. This is unlikely especially considering the fact that different performance is being realised in the current attribution-analysis for the different segments.

**2. Large shifts in the explaining factors should not annually appear**

From the analysis it can be deduced that during different years different factors are of influence regarding the profit and in some cases even generate a negative influence on the profit while in other years exercising a positive influence. An object located in Amsterdam, for example, generated a positive influence over the year 2000 but a negative one in the year 2003. Over the long term this results in the effect being a neutralized. When, however, on the basis of cyclical factors a clear relation can be established this shift will not create any problems; this applies for example to Amsterdam. For the relations in year of construction such a relation cannot be established.

**3. The calculation of the new comparison standard per object needs to be communicable.**

The practical background of the composition of an alternative test, by means of the building characteristics is quite communicable. A theoretical support and a calculation of the test will, however, create for many parties a black box. This needs to be developed further after the results are accessible to all participants. In one look it should be clear to the participant what the performance is with regards to the benchmark.

**4. The method needs to be consistent and comparable with regards to the previous period.**

The calculation of an alternative test results in a large amount of work. This means that every year a very thorough calculation needs to be carried out. With regards to this it is important that the manner of calculation is properly documented. The comparison is possible, however, because new and relevant data is being added to the database it is possible to enlarge the analysis and results increased and optimalized. Another problem regarding the comparability of the results is created by the ability of certain factors to neutralize themselves and that as a result of this no connection between the year to year calculations and the long-term average exists for testing.

**Conclusion**

Based on the answers to the stated - conditions for the alternative test, it must be concluded that it is (momentarily) impossible to create an alternative test for the performance-measurement for the available office market-data.

*7.2 Recommendations*

It is recommended to see if the expected value-development of a particular object is already being considered. This can, for example, be drawn from the initial yields. In a follow-up an inquiry may be made into the individual factors determining the return. Through means of hedonic pricing it is possible to examine which factors are of influence on, for example, the initial yields, market rent and operating costs.

It is the aim of the ROZ index to conduct and publicize research concerning this. Research and results will be presented in articles and professional publications. In addition to office buildings other sectors within the index will also be considered. In future research, the current Panel may serve as sounding board. The Panel will continue in a more permanent form and undertake research in a broader sense and in other areas.

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