# “The impact of capital flows on yields”

university of groningen


***Faculty of Spatial Sciences***
***Department of Economic Geography***


**Master Thesis**

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## Executive Summary

Demand for direct commercial real estate is rising as the interest of investors in the asset class is returning. Returning interest can be observed from the consistent growth in investment activity of the last years on the European real estate market (Financial Times, 2013a). Current levels exceed the record year 2007 in which European investment volumes reached 230 billion Euros (JLL, 2007). These capital flows impact asset values because they reflect investors' demand. When demand is high, asset values will rise (Kim & Yong Yang, 2009). Capital flows also affect asset values via the cost of capital as reflected in yields. The topic of this research is to consider the impact of capital flows on yields. The central research question is: *What is the impact of capital flows on yields?*

The widely held belief, which is described by Ling & Naranjo (2003, 2004), Fisher et al. (2006) and Clayton et al. (2009), is that yields go down when capital is poured into real estate. Other variables that affect yields can be divided in three main groups of determinants. These main items relate to: (a) the cost of capital, (b) the prospect for higher asset values, and (c) the risk of interruptions to the flow of income from the asset (Sivitanidou & Sivitanides, 1999; Sivitanides et al., 2001; Hendershott & MacGregor, 2005; Chichernea et al., 2008; D'argensio & Frédéric, 2009). Long-term bond rates and interest rates are examples of determinants that belong to group (a). GDP, inflation, rents and rental growth belong to group (b) and vacancy and liquidity to group (c).

The impact of capital flows on yields is tested using a LSDVC dynamic regression. This technique is developed by Bruno (2005) and focuses on small panel (longitudinal) data sets. With panel data from fifteen major European cities from the years 2008 through 2010 the analysis is performed. Real Capital Analytics provided the data on capital flows, i.e. reports on office properties and portfolios of €7.5 million or greater.

The main result implicates that capital flows do impact yields negatively. This result is in line with earlier findings of Ling & Naranjo (2003, 2004). The coefficient of -0.011 means that when capital flows increase with one percent, yields will decrease with 0.011 percent.

## Preface

With this master thesis I am finishing my master Real Estate Studies at the University of Groningen. It is the climax of my student time in Groningen, where I moved to in the summer of 2012. At that moment in time it was a completely new adventure. I remember being enthusiastic about the new people I was going to meet, the more profound lectures I was going to attempt, and the extracurricular activities I was going to participate in. All activities to make me ready for the next phase in my life. Now, as I'm writing this preface, I already started this new phase. Confident with the new gained academic knowledge and extracurricular experience I started my new job at Colliers International. Still thankful for the great time I had in Groningen with new friends, classmates and roommates.

For this I'd like to thank a few people who helped me reach this destination. First of all I want to thank my mother who always supported me in the choices I made and who worked hard to create the situation in which this was possible. Subsequently, I would like to thank both my supervisor Xiaolong Liu and my co-reader Arno van der Vlist for the time they took in helping me receiving my data, creating my own critical attitude and helping me to learn from the process of independently writing a master thesis. It was a very informative experience which will definitely help me in my future career.

Finally I hope this thesis can make its contribution to the academic world and help others to learn more about this interesting topic. Please enjoy reading.

Amsterdam, August 2015

Robert Aernout Hupkes

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# 1. Introduction

The European economy is recovering from the Great Financial Crisis and demand for direct commercial real estate is rising as the interest of investors is returning. Returning interest can be observed from the consistent growth in investment activity of the last years on the European real estate market (Financial Times, 2013a). Mainly the traditional European investment markets, like London or Paris, keep performing well and records are broken (Financial Times, 2013b). Current levels exceed the record year 2007 in which European investment volumes reached 230 billion Euros (JLL, 2007). These capital flows impact asset values because they reflect investors' demand. When demand is high, asset values will rise (Kim & Yong Yang, 2009). Capital flows also affect asset values via the cost of capital as reflected in yields. The topic of this research is to consider the impact of capital flows on yields.

The impact of capital flows on yields has been discussed earlier in the academic literature and mainly focuses on securitized real estate in the United States. Ling & Naranjo (2003, 2004) found a positive significant relation between one quarter lagged capital flows and yields. The effect turns significantly negative when two quarter lagged capital flows are used. Fisher et al. (2006) extend the work of Ling & Naranjo (2003, 2004) by investigating the long-run dynamics among institutional capital flows and property yields in the largest US metropolitan areas. The authors found some evidence that lagged institutional capital flows impact current yields at the aggregate level, but the evidence is less convincing at metropolitan level and by property type (Clayton et al, 2009). What is missing in the existing literature is research which addresses the impact of capital flows into direct commercial real estate on yields in European real estate markets. The previous research about capital flows into securitized real estate provides useful empirical characterizations of the dynamics of capital flows and yields on which additional research can be built.

Literature on capital flows suggests that in addition to capital flows other variables may affect yields. Thus, it is important to detect determinants that influence the variation in yields. Different studies about variation in yields have modelled yields as an adjustment around equilibrium. These are in turn determined by real estate fundamentals (Chervachidze & Wheaton, 2013). From the literature three main groups of determinants of yields come forward. These main items relate to: (a) the cost of capital, (b) the prospect for higher asset values, and (c) the risk of interruptions to the flow of income from the asset (Sivitanidou & Sivitanides, 1999; Sivitanides et al., 2001; Hendershott & MacGregor, 2005; Chichernea et al., 2008; D'argensio & Frédéric, 2009). Long-term bond rates and interest rates are examples of determinants that belong to group (a). GDP, inflation, rents and rental growth belong to group (b) and vacancy and liquidity to group (c).

## 1.1 Problem definition

Existing literature on the impact of capital flows on yields in direct commercial European real estate markets is missing. Although some research has been done on the topic by Ling & Naranjo (2003, 2004), Fisher et al. (2006) and Clayton et al. (2009) the topic seems to be rather neglected in the academic literature.

## 1.2 Research problem, -aim, -questions

### 1.2.1 Research problem

It is not clear to which extend capital flows impact yields.

### 1.2.2 Research aim

This research aims to provide clarification about the impact of capital flows on yields.

### 1.2.3 Research questions

Based on the preceding paragraphs the following research questions are formulated:

*Central research question:*
What is the impact of capital flows on yields?

*Sub research questions:*

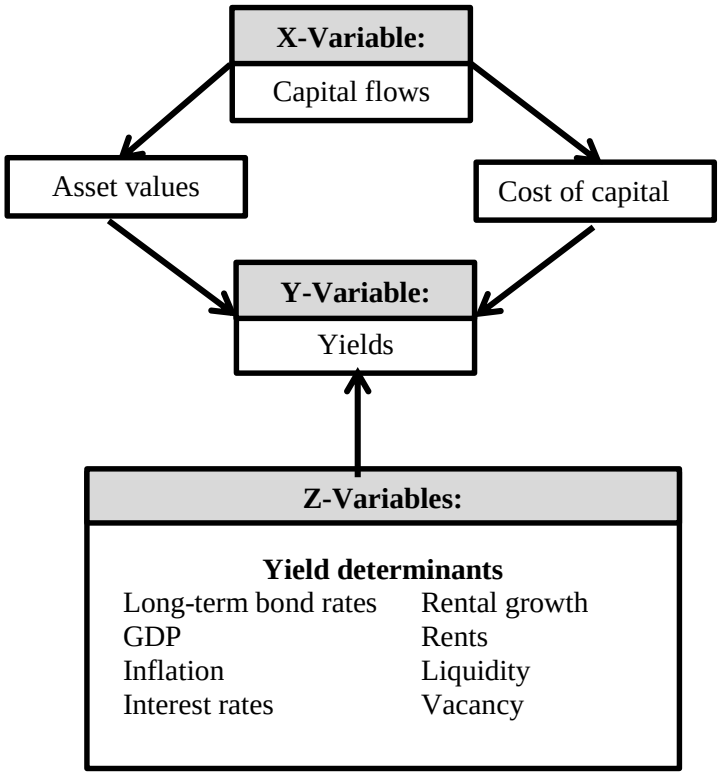
1) What are recent theories in the literature on the impact of capital flows on yields?
2) What are the trends in capital flows into real estate from a European perspective when analysing the panel data set?
3) To which extent do capital flows have an impact on yields according to empirical analysis?

## 1.3 Methodology and research design

### 1.3.1 Methodology

The methodology of this research is as follows. To answer question (1) a literature review is performed. By analysing journal articles from online academic libraries a theoretical framework is built on which the empirical analysis is based. From this review the variables that will be tested in the empirical analysis are found and the central hypothesis is formulated. Subsequently question (2) is answered by analysing de panel data set that is provided. A comprehensive description of the data is the basis to discover the trends in capital flows from a European perspective. With panel data from 19 European major cities a LSDVC dynamic regression model is built that answers sub research question (3). Finally the results are interpreted and validated to reach a conclusion.

**Figure 1. Conceptual model and mechanism.**



### 1.3.2 Research design

To create a clear research view one must consequently use terms, delineate the field of research and choose a moment in time to measure the effect of capital flows on yields. Therefore the definitions of the X- and Y-variable, the delineation and the time horizon of the research are:

- *Capital flows:*
  All the cross-border capital investments into direct commercial real estate.
- *Direct commercial real estate:*
  Offices.
- *Yield*
  The net operating income from an asset, as a percentage of the market price of that asset.
- *Time horizon*
  Panel data from 2007 to 2010 will be used.
- *Delineation of the field of research*
  This research is limited to the 19 European major cities listed below in table 1.

**Table 1. European major cities**

| | City | | |
|---|---|---|---|
| 1 | Amsterdam | 11 | Milan |
| 2 | Barcelona | 12 | Moscow |
| 3 | Berlin | 13 | Munich |
| 4 | Brussels | 14 | Paris |
| 5 | Budapest | 15 | Prague |
| 6 | Frankfurt | 16 | Rome |
| 7 | Hamburg | 17 | Stockholm |
| 8 | Istanbul | 18 | Vienna |
| 9 | London | 19 | Warsaw |
| 10 | Madrid | | |

## 1.4 Reading guide

The theoretical framework of this research is built in chapter 2, providing the answer to the first research question. At the end of this chapter the central hypothesis is formulated. Then the data, empirical model, operationalization and descriptive statistics are discussed in chapter 3. This chapter therefore provides an answer to the second research question. The results from the empirical part of the analysis are discussed in chapter 4 in order to answer research question 3. Finally chapter 5 discusses the conclusion, recommendations for further research and reflection.

# 2. Literature review

## 2.1 Capital flows and the variation in yields

Prior research on the effect of capital flows on yields show different findings. Ling & Naranjo (2003, 2004) provide studies that examine the effects of capital flows into the REIT sector on yields and, simultaneously, the effects of REIT yields on subsequent REIT capital flows with the use of a VAR model. Their work provides a positive significant relation between one quarter lagged capital flows and yields. The effect turns significantly negative when two quarter lagged capital flows are used. In addition they find evidence that yields do affect subsequent capital flows into securitized real estate markets. This shows that in some cases investors show return chasing behaviour or momentum strategies. Fisher et al. (2006) extend the work of Ling & Naranjo (2003, 2004) by investigating the long-run dynamics among capital flows and yields in the largest US metropolitan areas. Their work provides evidence that lagged capital flows positively impact current yields at the aggregate level. However, when these yields are divided by metropolitan area and property type the evidence is less convincing (Clayton et al., 2009).

Commonly, the presumed effect in the latter works is that yields follow a general downward trend when capital is poured into the asset class (D'argensio & Frédéric, 2009). The underlying mechanism of the effect has two channels. The first channel for reduced yields is via asset values. The explanation is that the bigger the amount of capital purchasing real estate, the higher the competition between investors, the higher asset values will be and thus the lower yields (Kim & Yong Yang, 2009). This may simple reflect price pressure in asset markets. The second channel can be found via the cost of capital. More capital in markets leads to lower cost of capital. This in turn leads to lower spreads (the gap between long-term bond rates and yields). In other words, increased capital flows are a proxy for lower cost of capital and investors' interest in the real estate asset class (Barkham, 2012).

## 2.2 Determinants of the variation in yields

Next to the expected impact of capital flows on yields there are also other factors that determine the variation in yields. The literature on the variation in yields, as mentioned earlier, can be divided in three main groups. These main items relate to: (a) the cost of capital, (b) the prospect for higher asset values, and (c) the risk of interruptions to the flow of income from the asset. Based on these main items the determinants of the variation in yields will be discussed.

*(a) The cost of capital and the variation in yields*

In this group long-term bond rates and interest rates are determinants. A country's sovereign risk, as measured by the 10-year government bond yield, is the most important determinant of the yield (D'argensio & Frédéric, 2009; Sivitanides et al., 2001). Their work provides significant evidence and show a positive relation between long-term bonds and yields. D'argensio & Frédéric (2009) estimate that a 1 percentage-point increase in the long-term bond rate will raise the yield by about 0.19 percentage-point. The secular decline in long-term bond rates since the mid-1980s, due to the fall in inflation, has pulled down real estate yields and boosted asset values (Sivitanides et al., 2003). The effect of this downward movement affects the real estate investment industry. This is because in equilibrium long-term bond rates should be about the same level as nominal GDP growth. Nominal GDP growth is approximately the rate of return investors can expect on real estate assets. The nominal bond yield is approximately the cost of capital. If the rate of return on assets is higher than the cost of capital, investment will surge and the price of real estate assets will rise (Barkham, 2012).

The second determinant regarding the cost of capital and the variation in yields is the interest rate. Interest rates are mainly driven by investors' perceptions of risk across different real estate markets and used when discounting cash flows and hence in determining the value of the asset that creates the cash flow. The perceived volatility of an economy (with variables such as the historical or expected variability of growth rates as proxies) can be one potential driver of investors' risk perceptions. Theoretical models of the risk premium, such as the classic CAPM, suggest that higher risk levels result in a higher risk premium, which in turn reflect higher discount rates (Chichernea et al., 2008). From this can be concluded that interest rates have a positive relation with yields.

*(b) The prospect for higher asset values and the variation in yields*

This group brings GDP, inflation, rents and rental growth forward as determinants of yields. GDP is negatively related to yields (Fuerst & Matysiak, 2013). In general GDP growth expectations are an underlying driver of performance expectations for real estate. Higher expectations on cash flow growth should increase the price of property and, thus, decrease yields (D'argensio & Frédéric, 2009). Nominal GDP growth thereby can be seen as approximately the rate of return investors can expect on real assets. In addition GDP growth brings wealth, which in turn drives the development of the savings and investment industry. They in turn spur the development of a well-functioning real estate investment market. Moreover, GDP could also capture most of the legal, institutional and political factors that tend to improve when a country gets richer. Developed economies with stable GDP growth therefore can be seen as a proxy for real estate market maturity, which in turn reduces risk so that yields go down (Barkham, 2012).

Yields are also determined by inflation. Shaped in the capital market, expected inflation may also be relevant in predicting yields if it is not fully incorporated into past income growth (Sivitanidou & Sivitanides, 1999). Inflation should have a negative impact on yields, as expectations of higher inflation and, hence, higher nominal rent growth, would motivate investors to accept a lower income return when acquiring a property (Sivitanides et al., 2001). Thus when expected inflation is used by investors as a proxy for future capital appreciation, a negative influence on the yield should be expected, as investors would be willing to accept a lower return in exchange for a higher asset-appreciation potential (Sivitanidou & Sivitanides, 1999). Dokko et al. (1991) confirm the latter in their work and provide significant evidence that an increase in inflation of 1% annually lowers the yield by 46 basis points. However, if inflation is used by investors as a proxy for the potential erosion of purchasing power, a positive influence on the yield should be expected. Investors then would require a higher return to compensate for this inflation risk (Sivitanidou & Sivitanides, 1999).

Rents are another determinant of yields. Rents have a negative effect on yields (Sivitanides et al., 2001). The work of Sivitanides et al. (2001) provides evidence that a 10% increase in real rents generates a drop in yields of 56 basis points. It appears that during periods characterized by historically high rents yields are lower. This implies that investors have expectations of continued income growth in the future. The opposite holds as well: when a market is low, growth expectations are as well. What is of great importance for the influence of rents on yields is the investors' point of view. In case of forward-looking expectations, high rent levels compared to historical means, will inform investors that the market is at the peak of the cycle. Then a downward adjustment is in order, causing them to expect lower cash flows in the future. If investors possess this insight, high rent levels will have a positive effect on yields. Alternatively, if investors are backward-looking they will project current rent growth into the future and will bid up asset values accordingly (Chervachidze & Wheaton, 2013). This mind set implies a negative influence on yields.

The last determinant of yields in this group is rental growth which has a negative impact on yields. Sivitanides et al. (2001) show that a 1% increase in rental growth reduces the yield with 9 basis points. This relatively small impact is also discussed in the work of Hendershott & MacGregor (2005). Whereas the work of Chichernea et al. (2008) shows that all the variables considered as proxies for the expected growth of demand are generally not significant as explanatory variables of yields. The side note that has to be made is that most of previous empirical research about rental growth is focused on demand driver proxies. Supply constrains are thereby quite neglected. In trying to determine the expected rate of growth of real market rents, it is therefore important to develop some idea of how market rents move through time. There is literature which clearly suggests that real estate markets are not random walks, and that prices or rents are mean-reverting, stationary series. This generates considerably predictability over time (Wheaton, 1999).

*(c) The risk of interruptions to the flow of income from the asset and the variation in yields*

Vacancy and liquidity are determinants in this group. Vacancy plays an important role in the variation of yields. Sivitanidou & Sivitanides (1999) find a significant positive relation between vacancy and yields. Higher vacancy rates cause higher risk of future decrease in rents and asset values. In addition

lower vacancy rates may give rise to higher income-growth expectations (Sivitanidou & Sivitanides, 1999). Thus when vacancy rates increase, one should observe a lower or negative rental growth rate, and when the vacancy rate decreases, the adjustment between demand and supply is tighter, and one should observe an increase in the rental growth rate (D'argensio & Frédéric, 2009). This in turn will have a negative impact on the yield, so that lower vacancy rates cause lower yields and vice versa.

Finally liquidity is a determinant of yields. The liquidity of a market can be interpret as a measure of real estate specific risk. Numerous studies have explored and documented the effect of liquidity in the context of real estate (Sivitanidou & Sivitanides, 1999). The main argument within these studies is that investors consider investing in illiquid markets risky. Therefore, they may prefer to operate in a larger market to minimize transaction costs and hedge out the variability in price (Bernoth et al., 2012; Favero et al., 2005; D'argensio & Frédéric, 2009). Markets with a larger inventory and a more developed property market should guarantee investors less volatility in yields, because market inefficiencies are lower than in an emerging property market. For these reasons illiquid markets display higher yields to compensate for the larger transaction costs investors need to bear to invest in that market (D'argensio & Frédéric, 2009). Besides, illiquid markets show thin property demand (Sivitanides et al., 2001). The intuition therefore is that investments in less liquid markets are going to be deemed by investors as more risky. Therefore they will reflect higher yields. Consequently, investments in markets that are perceived as liquid may be associated with lower yields (Chichernea et al., 2008).

For an overview of all the determinants of the variation in yields and their expected effects see appendix 1.

## 2.3 Central hypothesis

From the previous theory a central hypothesis is formulated that examines the impact of capital flows on yields. The expected relation will be negative. The central hypothesis therefore is; c*apital flows have a negative impact on yields.*

# 3. Data and methodology

## 3.1 Data

For this research a panel (longitudinal) data set is used. The data about capital flows, the variable of interest, comes from Real Capital Analytics and includes data from 2007-2012. This data is based on independent reports of office properties and portfolios of €7.5million or greater. The data about office yields, the dependent variable, comes from JLL and includes the years 2000-2010. JLL also provided data about rent levels and vacancy levels for the same period. This data has been supplemented with macroeconomic data such as GDP, inflation, long-term bond rates and interest rates. This data comes from DataStream.

## 3.2 Empirical model

The empirical model used is a LSDVC dynamic regression model. This model is developed by Bruno (2005) for dynamic (unbalanced) panel-data models with a small number of observations. It protects against bias and performs under the condition that all regressors must be exogenous. The model is conducted with the xtlsdvc command in Stata and will be as follows:

$$Y_{it} = \gamma_1 Y_{it-1} + \beta_1 * X_{1it-1} + \sum \beta_k * X_{kit} + \eta_i + \varepsilon_{it} \quad (1)$$

Whereby:

| | |
|---|---|
| $Y_{it}$: | yields in city *i* in year *t* |
| $\gamma_{1:}$ | parameter of dependent lag variable |
| $Y_{it-1}$: | yields in city *i* in year *t-1* |
| $\beta_1$: | parameter of independent variable |
| $X_{1it-1}$: | the independent variable (capital flows) in city *i* in year *t* |
| $\beta_k$: | the parameters of the control variables |
| $X_{kit}$: | the control variables in city *i* in year *t* |
| $\eta_{i:}$ | city *i* specific fixed effect |
| $\varepsilon_{it}$: | error term in city *i* in year *t* |

## 3.3 Null hypothesis

The null hypothesis (H0) will be tested with the results of the before mentioned empirical model. The null hypothesis will be: *capital flows don't have an impact on yields.* If the null hypothesis is rejected, one can assume that capital flows do have an impact on yields.

## 3.4 Operationalization

Due to data limitation the variable liquidity is omitted in this research. Next to the omitted variable a lot of observations of the provided data is excluded, because the years of the observations have to match. This means that only data of the years 2007 until 2010 is used. This leaves the total number of observations to 76 before preparing the data set. Preparing the data set includes deleting missing values, transforming data to comply with the underlying assumptions of the model and deleting outliers. The first step is detecting missing values, these are depicted in appendix 2.

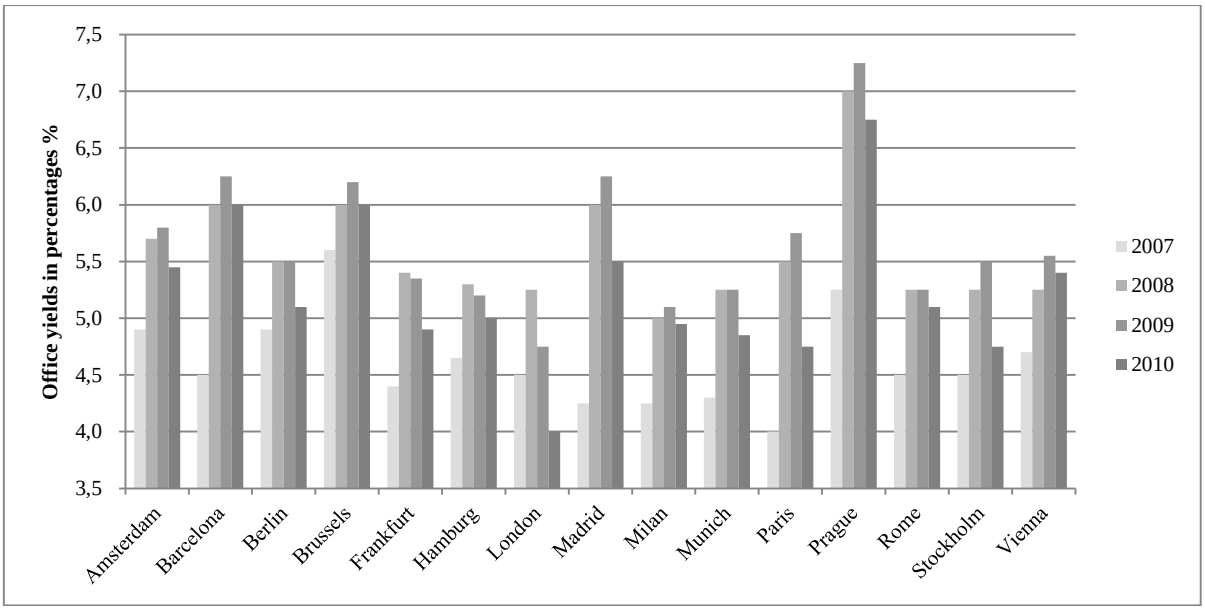
To create a balanced panel data set an equal number of observations per city must be pursued. This means four observations for each city. If this is not the case than all the observations of the city are deleted. This means that the observations of Budapest and Istanbul are subtracted from the data set. The next step in preparing the data set is transforming the data to comply with the assumptions of the model. The most frequently encountered assumption violation thereby is non-normality of the independent or dependent variables (Hair et al., 2010). A normality check therefore is made, so that where necessary a transformation is done. The resulting normal distributions can include extreme values which are appointed as outliers. These are deleted because they cause disturbance to the results, meaning that these outliers from the sample aren't representative for the total population. The cases which are deleted because of either being a missing value or an outlier are depicted in appendix 2. The balanced panel data set from this point on exists of 60 observations.

### 3.4.1 Dependent variable

The dependent variable is the office yield. To get a normal distribution, the natural logarithm is calculated. The final distribution is depicted in appendix 3.

In figure 2 the office yields of the fifteen remaining European major cities are depicted. The first thing that is remarkable is that yields follow a general upward trend between the years 2007 up until 2009. This is presumably the effect of the economic crisis that started in the autumn of 2008. After the year 2009 a clear recovery is visible noticeable in the downward turn of yield levels. Another remarkable observation is the strong recovery in cities like London or Paris. London for instance surpasses the yield level of 2007 in the year 2009. The highest yields can be found in Prague, Madrid, Barcelona and Brussels.

**Figure 2. Yields in 15 European major cities**




### 3.4.2 Independent variable

The independent variable is capital flow in millions of Euros. The data about capital flows helps answering the second research question. The first remarkable observation within the data is the amount of capital that is invested in the London office market. In 2007, London's performance was more or less one thousand times bigger than the amount being invested in the Roman office market. Not only Rome is left far behind, also the office market of Amsterdam got outperformed by London, which attracted more than twelve times the amount of capital compared to Amsterdam. The same applies to all the other cities from the sample, which is clearly visible in figure 3. The main explanation for London's attractiveness is that it is one of the most international cities in the world. This has led to a mature and liquid real estate market. From an investor's point of view this means that London accounts as a low risky market (Barkham, 2012). This attracts investors from around the world. Next to London the city of Paris is a popular city for investors. This is also noticeable in the top 10 biggest capital flows, depicted in table 2, where London and Paris fill seven out of ten ranks.

The effects of the Great Financial Crisis are also visible in figure 3. If the year 2007 and 2008 are compared to one another only Rome and Madrid show an improvement in the total amount of capital flows. The other 13 cities all show a significant decrease in capital flow volumes. This fall in capital flows, expressed in relative numbers, is led by Munich and Frankfurt with respectively a decrease of roughly fifteen and fourteen times the amount of the previous year. When absolute numbers are taken into consideration once again London and Paris stand out. Investment volumes in these cities dropped €13,95 and €8,45 billion respectively. Compared to the loss in absolute numbers of Munich and Frankfurt, €2,30 and €4,68 billion respectively, this is much more. The least attractive cities can be

found in Italy and Spain, which take 6 out of 10 ranks in the top 10 of smallest capital flows depicted in table 2. From the year 2010 a clear visible recovery can be detected, mainly in the German cities, London and Paris.

**Figure 3. Capital flows in 15 European major cities**

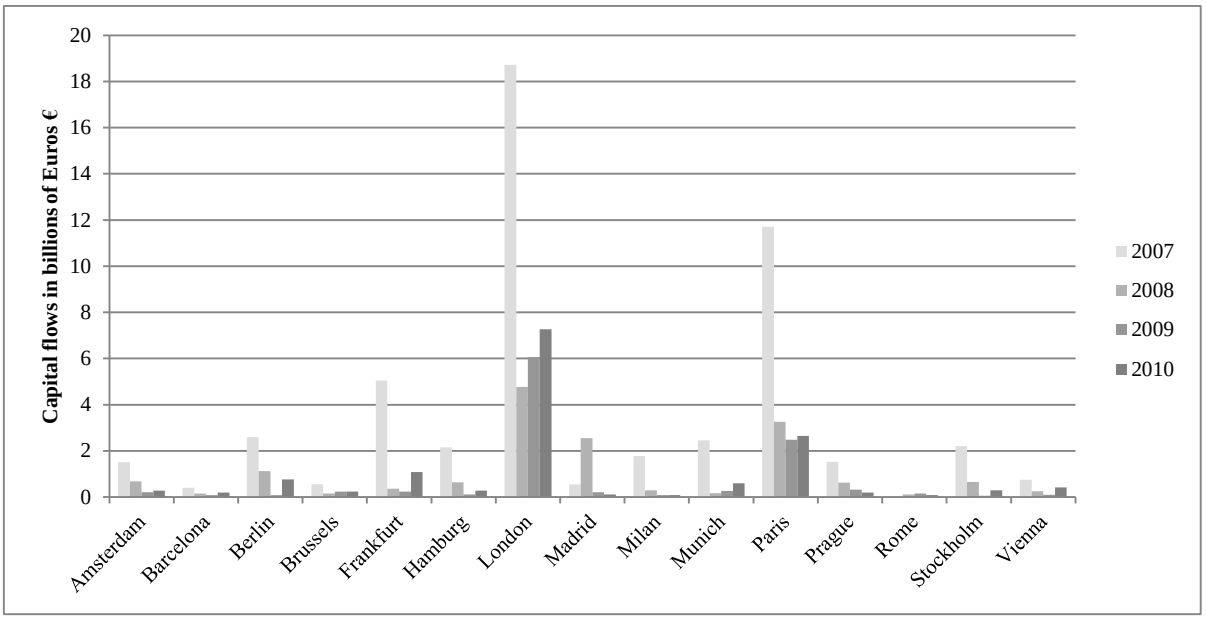



**Table 2. Top 10 biggest and smallest capital flows from sample**

| Rank | City | Year | Capital flow | Rank | City | Year | Capital flow |
|---|---|---|---|---|---|---|---|
| 1 | London | 2007 | € 18,718,212,062 | 1 | Rome | 2007 | € 18,728,750 |
| 2 | Paris | 2007 | € 11,706,795,518 | 2 | Stockholm | 2009 | € 52,316,701 |
| 3 | London | 2010 | € 7,263,183,708 | 3 | Milan | 2010 | € 76,480,133 |
| 4 | London | 2009 | € 6,064,929,689 | 4 | Rome | 2010 | € 80,763,261 |
| 5 | Frankfurt | 2007 | € 5,043,015,976 | 5 | Barcelona | 2009 | € 82,000,000 |
| 6 | London | 2008 | € 4,768,782,013 | 6 | Milan | 2009 | € 83,099,824 |
| 7 | Paris | 2008 | € 3,255,838,521 | 7 | Berlin | 2009 | € 84,542,224 |
| 8 | Paris | 2010 | € 2,652,310,944 | 8 | Vienna | 2009 | € 90,582,931 |
| 9 | Berlin | 2007 | € 2,595,125,645 | 9 | Hamburg | 2009 | € 105,421,927 |
| 10 | Madrid | 2008 | € 2,546,358,139 | 10 | Madrid | 2010 | € 108,000,142 |

From the independent variable the one year lag is used to comply with the exogenous requirement of LSDVC dynamic regression. Because the provided data about capital flows only includes the years 2007 until 2012 it is impossible to use the one year lag for the year 2007. This means that all observations from the year 2007 are omitted. From this point on the total number of observations exists of 45. The distribution of the independent variable is positively skewed. The remedy for such a positively skewed distribution is a transformation to a natural logarithm. The final distribution is depicted in appendix 3.

### 3.4.3 Control variables

The control variables, as mentioned before, can be divided in three main groups. These main items relate to: (a) the cost of capital, (b) the prospect for higher asset values, and (c) the risk of interruptions to the flow of income from the asset. This group classification is also based on importunateness in explaining the variation in yields. In other words: the variables mentioned first have been proved stronger determinants than variables that come last. Each group will be discussed next.

*(a) the cost of capital*

The group variables exist of long-term bond rates and interest rates. The first variable that will be discussed is the long-term bond rate. This is the rate of return, or yield, on a 10-year government bond of the country in which the city from the sample is located. This variable is transformed to a natural logarithm to get a better normal distribution.

The second variable in this group is the interest rate. The interest rate is used, within the context of this research, to discount the income from a real estate asset. The interest rate in the model is represented by the countries short-term interest rate, once again in which the city from the sample is located. Short-term can be defined as loans with a maturity date of less than a year.

*(b) the prospect for higher asset values*

The first variable in this group is GDP, which is expressed as the year on year percentage of growth in the country in which the city is located.

The variable inflation comes second. This is the actual year on year percentage increase in the general level of prices for goods and services. The variable inflation is also measured at national level.

Rents are the third variable in this group. Similar to the independent variable capital flow, rents have a positively skewed distribution. A natural logarithm transformation is performed to correct for this.

Rental growth is the last variable in this group. This variable is computed by calculating the year on year percentage of change in rents.

*(c) the risk of interruptions to the flow of income from the asset*

The only variable in this group is vacancy and is expressed as the year on year percentage of change. This was positively skewed, so the data is transformed to a natural logarithm.

### 3.4.4 Multicollinearity

To check for multicollinearity in the model a correlation matrix is added to the analysis. High correlating variables have to be merged or one of the variables has to be excluded from the analysis. The threshold correlation value is *0,9*. No values surpass this threshold value which means no variables are excluded. The correlation matrix is added to appendix 4.

## 3.5 Descriptive statistics

Table 3 gives an overview with the descriptive statics of the variables. This overview includes the minimum and maximum score, mean and standard deviation.

**Table 3. Descriptive statistics**

| Variable | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|
| Yield % | 4.00 | 7.20 | 5.49 | .61 |
| Log_Yield % | 1.39 | 1.97 | 1.70 | .19 |
| Log_Yield %_t-1 | 1.39 | 1.98 | 1.66 | 0.13 |
| Capital flow € X 1,000,000._t-1 | 18.73 | 18,718.21 | 1,740.00 | 3,350.00 |
| Log_Capital flow € X 1,000,000._t-1 | 16.75 | 23.65 | 20.13 | 1.55 |
| Long-term bond rate % | 2.70 | 4.80 | 3.78 | .60 |
| Log_Long-termbondrate % | .99 | 1.57 | 1.32 | .17 |
| Interest rates % | .40 | 5.50 | 2.20 | 1.73 |
| Nominal GDP % | -4.00 | 7.30 | .84 | 3.27 |
| Inflation % | -.50 | 6.30 | 1.85 | 1.49 |
| RentM2/year € | 231 | 1111 | 413.96 | 213.89 |
| Log_RentM2/year € | 5.44 | 7.01 | 5.93 | .41 |
| Rental growth % | -37.20 | 22.80 | -2.29 | 10.87 |
| VacancyM2 X1000 | 225 | 3,626 | 1,251.47 | 724.54 |
| Log_VacancyM2 X1000 | -.32 | .60 | .14 | .20 |
| N = 45 | | | | |

# 4. Results

## 4.1 Results from the LSDVC dynamic regression

The results of the regression model are depicted in table 4. Because the dependent variable is transformed to a natural logarithm, the interpretation of ratio and interval variables will be as follows. An increase of one unit will lead to a percentage change of $(e^{\beta k} - 1)*100$ of yields[1]. For the natural logarithm transformed independent variable, and other similar transformed variables, applies that the elasticity can be calculated. This means that one percentage increase would lead to a $[(1.01)^{\beta 1} - 1]*100$ percentage change in yields. To assess the overall model fit it is important to underline that the xtlsdvc command does not produce a R-squared or figures to calculate it. Therefore no discussion about the overall fit of the model is added.

However, the coefficients produced by the model depict some interesting results. The most important result is the almost significant negative outcome of the one year lag variable of capital flows. Given the high standard errors and the low number of observations one could expect a significant outcome when the data is extended with a few more observations. Therefore, one could conclude that capital flows do impact yields. The negative beta is consistent with the prior expectation that capital flows will negatively affect yields. This coefficient of -0.011 implies that when capital flows increase with one percent, yields would decrease with 0.011 percent. This effect is in line with the results of Ling & Naranjo (2003, 2004).

**Table 4. Results LSDVC dynamic regression**

| Variable | Coefficient | P-value |
|---|---|---|
| Log_Yield%_t-1 | 1.043 | .000 |
| | (.296) | |
| Log_Capitalflow € X1,000,000._t-1 | -.011 | .107 |
| | (.007) | |
| Log_Long-termbondrate | 1.186 | .000 |
| | (.199) | |
| Interest rates % | -.334 | .000 |
| | (.059) | |
| Nominal GDP % | -.009 | .016 |
| | (.004) | |
| Inflation % | -.026 | .132 |
| | (.017) | |
| Log_RentM2 € | 1.170 | .000 |
| | (.179) | |
| Rental growth % | -.011 | .000 |
| | (.002) | |
| Log_VacanyM2 X1000 | .147 | .029 |
| | (.067) | |
| N = 45 | | |
| a. dependent variable: Log_Yield | | |
| b. standard error between parentheses | | |

Seven out of nine regressors have a significant relation with yields. As expected, the long term bond rate proofed to be the most important determinant of yields. It shows a strong significant positive relation. This strokes with the work of D'argensio & Frédéric (2009) and Sivitanides et al. (2001). From its beta can be concluded that a one percent increase in long-term bond rates increases the yield with 1.187 percent. Interest rates show a strong significant negative relation with yields. This is contradictory to the effect that Chichernea et al. (2008) mention. An explanation for this might be found in the fact that the interest rates used in the analysis were, for twelve out of fifteen cities, all the same. This is because they all belong to the same monetary policy of the Eurozone. GDP also turns out to have a

[1] e= 2,71828183

significant relation with yields. The negative beta of 0.009 means that when GDP levels increase, yields will decrease with 0.896 percent. This corresponds with the work of Fuerst & Matysiak (2013) and D'argensio & Frédéric (2009). The variable inflation was found to be insignificant. The work of Sivitanidou & Sivitanides (1999) might explain this. They state that the effect of inflation might be captured by past income growth. The variable rental growth turned out to be significant and shows a negative relation with yields. This is in line with earlier findings of Sivitanides et al.(2001) and Hendershott & MacGregor (2005). Rents have a significant positive relation with yields. This is not consistent with earlier expectations. Perhaps, the forward-looking investors as suggested by Sivitanides et al. (2001) dominated the sample, causing them to expect lower cash flows in the future and thus higher yields. Vacancy has a significant positive relation with yields. This result is in line with the work of Sivitanidou & Sivitanides (1999). It underlines that higher vacancy rates result in higher risk of future decrease in rents and asset values and thus higher yields. Finally from the significant one year lag variable of yields comes forward that past yields do seem to impact current yields.

## 4.2 Testing the null hypothesis

The results of the LSDVC dynamic regression help to reach a conclusion on the null hypothesis. The null hypothesis is that capital flows do not impact yields. With a p-value of 0.107 the null hypothesis can get rejected. This means that capital flows do impact yields.

# 5. Conclusion

## 5.1 Conclusion

The importance of capital flows and yield dynamics in public securitized markets has received significant attention in the academic literature. However, a rigorous analysis on the impact of capital flows into direct commercial real estate in Europe on yields is missing. This is a serious void in the literature given the sizes of the direct commercial real estate investment markets. This research therefore examines the relation between capital flows and yields. The main research question thereby is: *What is the impact of capital flows on yields?* To answer the main research question three sub research questions are formulated: (1) What are recent theories in the literature on the impact of capital flows on yields? (2) What are the latest trends in capital flows into real estate from a European perspective when analysing the panel data set? (3)To which extent do capital flows have an impact on yields according to empirical analysis?

For the empirical part of this research a panel data set is used with 15 European major cities in the years 2008 up until 2010. The main tool of analysis is a LSDVC dynamic regression, which is develop by Bruno (2005) for small panels. This technique brings estimates forward that are protected against bias.

The main result is that that capital flows do impact yields. When capital flows increase with one percent, yields will decrease with 0.011 percent. This result is consistent to prior expectations that capital flows will negatively impact yields. Other results show that most regressors have a significant relation with yields, with an effect that is in line with earlier findings. Trends in capital flows show that offices in London are most popular under investors. Paris comes in second place and together with London they fill seven out of ten ranks in the top ten of biggest capital flows. The least attractive cities for investors can be found in Italy and Spain.

To conduct the analysis in the most robust manner data is cleaned, transformed and tested for multicollinearity.

## 5.2 Further research

The results clearly indicate that more in-depth research is needed. A recommendation for further research therefore, is to use a more comprehensive panel data set to increase the statistical power of the results. In addition it would make the model less vulnerable for disturbance and therefore it would increase the validity of the results. Now the total number of observations used for the analysis reaches only 45. This is mainly due to the effects of data limitation because of the sensitive nature of the data. The biggest challenge thereby is to get institutions willing to cooperate and share their data. An expansion of the data can be reached in two ways. One is to collect data from more years so that the time horizon of the research gets bigger. The other way is to include data about capital flows from other major cities in the world, for example cities in Asia and South-America. However, real estate data in developing countries often is scarce. Finally scaling up the frequency of data on capital flows, for instance quarterly, monthly or even weakly observations would be a great contribution to increase the understanding about this topic. When the number of observations is bigger a vector autoregression (VAR) would be more appropriate. With this technique it would be interesting to discover the dynamic relation between capital flows and yields and simultaneously the relation between yields and capital flows. The latter would reveal more about return chasing behaviour of investors. In addition to this it would be interesting to see whether there are cross-sectional differences between mature and developing real estate markets. This so investors can determine more profound investment strategies.

## 5.3 Reflection

When a reflection on this research is made a few things are remarkable. These things relate to the length of the time series, the number of panels and the process of writing a thesis. The time series in this research was very short. This was mainly due to the effects of data limitation. The initial idea of the thesis was to include much more global capital cities. However, this turned out to be too ambitious and the company who was willing to provide the data withdrew. Related to the process of writing a thesis the following can be stated: to produce non-biased estimates costs several attempts. Different techniques

like OLS, fixed effects regression and between regression were conducted but never led to satisfying results. However, LSDVC dynamic regression did succeed. This resulted in a revision of several parts of the thesis. Looking back on this path led to the conclusion that the process was not quite time efficient. However, it was a very informative and therefore an enriching process. In the end this research still managed to get an answer on the main research question.

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## Appendix 1. The determinants of the variation in yields: expected effects.

| Variable | Expected effect | Sources |
|---|---|---|
| Capital flows | - | D'argensio & Frédéric, 2009 |
| Long-term bond rates | + | D'argensio & Frédéric, 2009; Sivitanides et al., 2001 |
| Interest rates | + | Chichernea et al., 2008 |
| GDP | - | Fuerst & Matysiak, 2013; D'argensio & Frédéric, 2009 |
| Inflation | - | Sivitanidou & Sivitanides, 1999; Sivitanides et al., 2001; Dokko et al., 1991 |
| Rental growth | - | Sivitanides et al., 2001; Hendershott & MacGregor, 2005 |
| Rents | - | Sivitanides et al., 2001; Chervachidze & Wheaton, 2013 |
| Vacancy | + | Sivitanidou & Sivitanides, 1999; D'argensio & Frédéric, 2009 |
| Liquidity | - | Bernoth et al., 2012; Favero et al., 2005; D'argensio & Frédéric, 2009 |

## Appendix 2. Missing values and deleted cases

Missing values:

| Variable: | Case number: | City: |
|---|---|---|
| Capital flow | 19 | Budapest |
| Capital flow | 30 | Istanbul |
| Capital flow | 31 | Istanbul |
| Capital flow | 32 | Istanbul |
| Long-term bond rate | 29 | Istanbul |
| Long-term bond rate | 30 | Istanbul |
| Long-term bond rate | 31 | Istanbul |
| Interest rates | 29 | Istanbul |
| Interest rates | 30 | Istanbul |
| Interest rates | 31 | Istanbul |
| Interest rates | 32 | Istanbul |

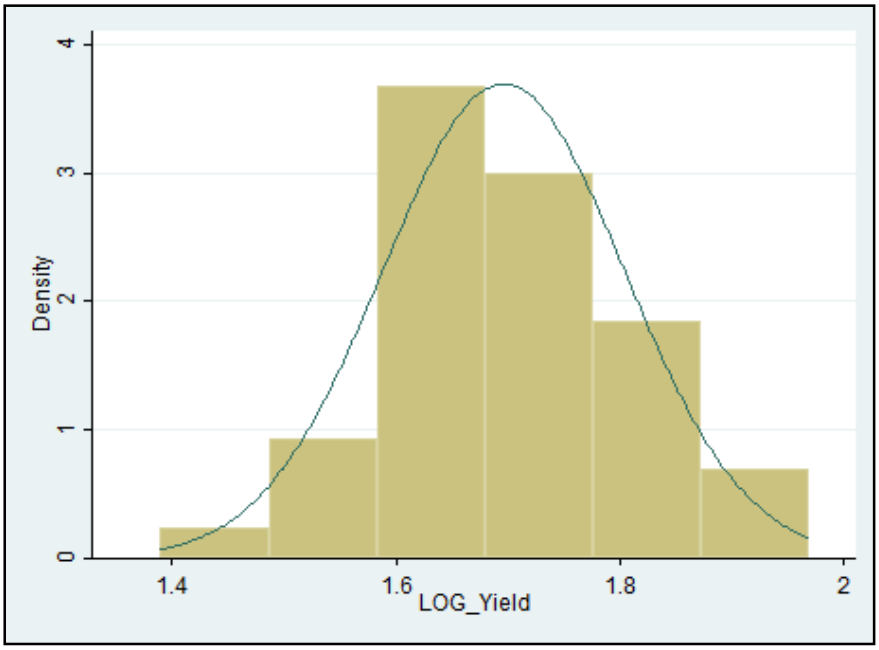
Deleted cases:

| Case number: | City: | Reason deleted | Value in box plot[2] | Variables |
|---|---|---|---|---|
| 17 | Budapest | Missing value | - | |
| 18 | Budapest | Missing value | - | |
| 19 | Budapest | Missing value | - | |
| 20 | Budapest | Missing value | - | |
| 29 | Istanbul | Missing value | - | |
| 30 | Istanbul | Missing value | - | |
| 31 | Istanbul | Missing value | - | |
| 32 | Istanbul | Missing value | - | |
| 45 | Moscow | Outlier | 0 | Yield, long-term bond rate, interest rate, inflation, rents, rental growth |
| 46 | Moscow | Outlier | * | ,, |
| 47 | Moscow | Outlier | * | ,, |
| 48 | Moscow | Outlier | * | ,, |
| 73 | Warsaw | Outlier | * | Long-term bond rate, vacancy |
| 74 | Warsaw | Outlier | * | ,, |
| 75 | Warsaw | Outlier | * | ,, |
| 76 | Warsaw | Outlier | * | ,, |

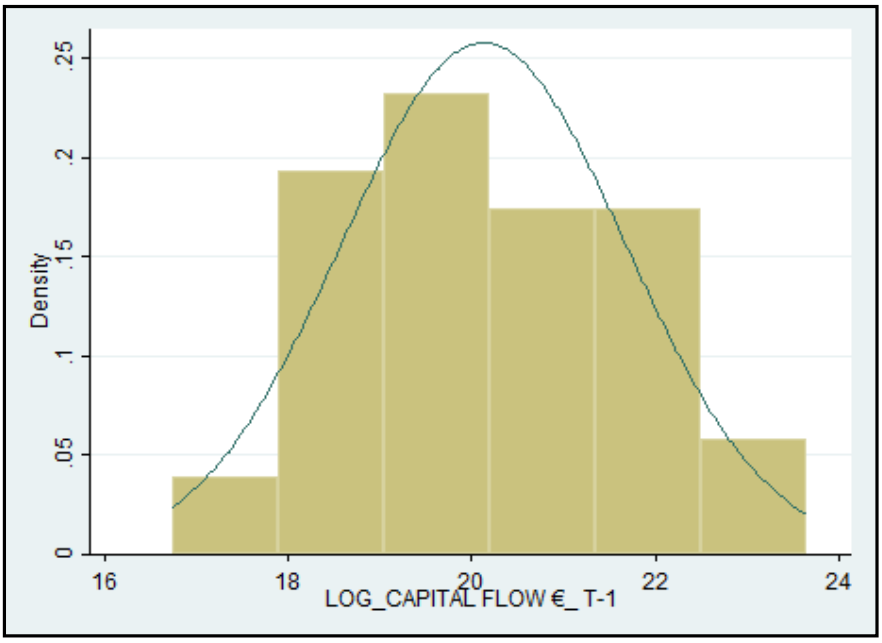
[2] 0= an outlier that is farther than 1,5 interquartile ranges, yet closer than 3 interquartile ranges, from the nearer edge of the box in a box plot. *= more than 3 interquartile ranges away from the nearer edge of the box.

## Appendix 3. Data and methodology figures: distribution of variables

Distribution of dependent variable after transformation to natural logarithm:




Distribution of independent variable after transformation to natural logarithm:



## Appendix 4. Pearson correlation matrix

| Correlations | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Log_Yield % | Log_Yield %_t-1 | Log_Capital flow € X 1,000,000._t-1 | Log_Long-termbondrate | Interest rates % | Nominal GDP % | Inflation % | Log_RentM2 /year € | Rental growth % | Log_Vacancy M2 |
| Log_Yield % | Pearson Correlation | 1 | | | | | | | | | |
| | Sig. (2-tailed) | | | | | | | | | | |
| Log_Yield %_t-1 | Pearson Correlation | 0.4525* | 1 | | | | | | | | |
| | Sig. (2-tailed) | 0.0018 | | | | | | | | | |
| Log_Capital flow € X 1,000,000._t-1 | Pearson Correlation | -0.0553 | -0.4003* | 1 | | | | | | | |
| | Sig. (2-tailed) | 0.7180 | 0.0064 | | | | | | | | |
| Log_Long-termbondrate | Pearson Correlation | 0.4232* | -0.2262 | 0.2311 | 1 | | | | | | |
| | Sig. (2-tailed) | 0.0038 | 0.1352 | 0.1266 | | | | | | | |
| Interest rates % | Pearson Correlation | 0.1657 | -0.6739* | 0.4759* | 0.6337* | 1 | | | | | |
| | Sig. (2-tailed) | 0.2767 | 0.0000 | 0.0010 | 0.0000 | | | | | | |
| Nominal GDP % | Pearson Correlation | -0.2400 | -0.2671 | -0.0423 | -0.1602 | 0.2604 | 1 | | | | |
| | Sig. (2-tailed) | 0.1123 | 0.0761 | 0.7826 | 0.2932 | 0.0841 | | | | | |
| Inflation % | Pearson Correlation | 0.0433 | -0.5114* | 0.3179* | 0.5108* | 0.7401* | 0.5999 | 1 | | | |
| | Sig. (2-tailed) | 0.7776 | 0.0003 | 0.0334 | 0.0003 | 0.0000 | 0.0000 | | | | |
| Log_RentM2/year € | Pearson Correlation | -0.5342* | -0.4390* | 0.5128* | 0.0542 | 0.0975 | 0.0850 | 0.1975 | 1 | | |
| | Sig. (2-tailed) | 0.0002 | 0.0026 | 0.0003 | 0.7236 | 0.5242 | 0.5786 | 0.1933 | | | |
| Rental growth % | Pearson Correlation | -0.2648 | -0.0899 | -0.2413 | -0.2214 | -0.0862 | 0.5330* | 0.2308 | -0.0446 | 1 | |
| | Sig. (2-tailed) | 0.0788 | 0.5570 | 0.1103 | 0.1439 | 0.5733 | 0.0002 | 0.1272 | 0.7711 | | |
| Log_VacancyM2 | Pearson Correlation | 0.5122* | 0.2052 | -0.0478 | 0.2370 | -0.0755 | -0.4038* | -0.0763 | -0.0321 | -0.4712* | 1 |
| | Sig. (2-tailed) | 0.0003 | 0.1762 | 0.7552 | 0.1170 | 0.6220 | 0.0059 | 0.6182 | 0.8342 | 0.0011 | |
| | * Correlation is significant at the 0.05 level | | | | | | | | | | |