Performance and oerformance drivers in global property markets

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PERFORMANCE AND PERFORMANCE DRIVERS IN GLOBAL PROPERTY MARKETS

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Ivo de Wit

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Promotor:

Prof. dr. P.M.A. Eichholtz

Beoordelingscommissie:

Prof. dr. C.C.P. Wolff	(voorzitter)
Prof. dr. W. McIntosh	(University of Cincinnati)
Prof. dr. P.C. Schotman	

"It would be very interesting to preserve photographically not the stages, but the metamorphoses of a picture. Possibly one might then discover the path followed by the brain in materializing a dream."

Pablo Picasso

PREFACE

Since 2000, I have worked on the dissertation that now lies before you. I have worked on it with a lot of enthusiasm and I am proud of what I have achieved. The whole path leading to this dissertation has been an adventure, because it is not only about writing the dissertation but also a journey that has given me a lot of new knowledge and insights into real estate, finance and quantitative methods. The journey has also shaped me and especially tested my perseverance to always keep progressing with the dissertation, despite a sometimes busy schedule at work. It has demonstrated that the journey is about creating a balance between the three areas of my life: dissertation, work, and private life.

First of all, I would like to thank Piet Eichholtz for the confidence he had in me to start this journey and to keep on working with me, even when I moved to New York. You have helped me to maintain a critical view of my work and challenged me to focus on improving this dissertation. Piet, I have learned a lot from you, your knowledge and vision have shaped this dissertation from the literature review to formulating the conclusions.

I would very much like to thank Robert Lie and Will McIntosh: as I worked with them over the past years, they have motivated me to work on this dissertation, each in his own way. Robert, I much appreciate the guidance that you gave me with the first steps of my professional career and in starting this dissertation, especially in creating an initial setup. Will, you motivated me to make big strides forward and to achieve results during my time in New York. I would also like to thank my colleagues at ING Real Estate who have supported me in this effort.

I would like to thank the members of the committee for their comments and feedback. In particular, Peter Schotman for his input on the use of panel data model while I was writing Chapter 4.

Maastricht University has played a big role in my life. Both during my study and in my work at the university, I have made a lot of friends who have motivated me in writing this dissertation. I would especially like to thank my former colleagues at the UM for interesting discussions and feedback during the time that I returned to the university to work on my dissertation. Other universities that allowed me to present parts of my work are the Massachusetts Institute of Technology (MIT) and the University of Connecticut (UConn), for which I would like to thank Lynn Fisher, David Geltner, and C.F. Sirmans.

Both paranimfen Bas van Alphen and Ronald van Dijk have played a very important role in writing this dissertation: Bas, I would like to thank you for your insights into organizational and strategic planning of a dissertation path. We had many interesting discussions over the last years and hopefully we will have many more. Ronald, I would especially like to thank you for the quantitative insights that

you shared with me. I enjoyed very much working with you as co-author of Chapters 2 and 3 of this dissertation.

My parents, Vanda and Charles, you have been supportive and motivated me from the start. Always interested and willing to listen to my stories about the development of the dissertation. You have encouraged me to set my own goals and pursue them until they have been achieved. My sisters, Mira and Olga have been a source of motivation. Both have a similar kind of perseverance in order to achieve their goals, with which I hope that I offer you support from my side.

Simone, my wife, over the last years we have each in our own way worked on education. You have supported me from the start in this adventure and we have created an environment in which we could both realize our ambitions. I am very proud of your achievements and I hope that we are going to undertake many more new and interesting adventures together in the years to come.

These new adventures will probably happen as this message from a fortune cookie is already indicating:

☺ Now is the time to try something new. ☺

Ivo de Wit
April, 2007

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Chapter 1

INTRODUCTION

1.1 Background

International real estate ownership has been of interest to the business environment for a long time. In the sixteenth century, Dutch merchants saw the importance of strategically located trade ports around the world to create a logistics network for trading goods with Asia and the Americas. The Dutch trade organization that focused on the Americas was the Dutch West India Company (WIC). It established settlements in North America, amongst which New Amsterdam (or later New York) was one of the most important. This is also the city where I wrote the major part of this dissertation.

As mentioned in Ball, Lizieri, and MacGregor (1998) colonial expansion in the sixteenth and seventeenth centuries set in place a pattern of international real estate ownership. The earliest data about international capital flows are from the nineteenth century. Lapier (1998) shows that the largest capital exporters at that time were the U.K., France and Germany. The U.S., Canada, Australia, Sweden, Italy, South Africa, Argentina, and India were the largest capital importers. Bloomfield (1968) estimated that the total amount of foreign investment in 1914 was \$ 14 billion: the majority was from the U.K. (\$ 6.5 billion), the U.S. (\$ 2.4 billion), France (\$ 1.7 billion) and Germany (\$1.5 billion). Most of this investment was in railroads, utilities, land, public works and manufacturing facilities. Cross-border direct investment increased rapidly after World War Two. Most of the investments were in manufacturing facilities and the service industry. However, governments placed restrictions on capital outflows (except in the U.S.) to promote faster recovery from the disruptions of the war in their home country. At the end of the 1950s manufacturing companies started to invest abroad on a larger scale as they expanded into new markets and new products, thereby increasing the demand for international real estate as part of their business operations. Even though demand for international real estate was high, actual investment was limited by several factors. First, there were still government restrictions on cross-border direct investment in services, including real estate, especially in Europe and Japan. Secondly, the economic costs of information about international investments exceeded those for domestic investments. Thirdly, financial institutions focused on domestic needs and support of the export of goods, not on financing foreign direct investment. Fourthly, there were, and still are cultural and regulatory differences, making international investment more complicated. These factors kept the amount of cross-border direct real estate investments relatively small at that time. In 1966, cross-border direct real estate investment from Germany, Japan, and the U.S. totaled $575 million, or only 0.5 percent of world outward direct investment.[1] Compared with total outward direct investment from these three countries, 54 percent of world outward investment at that time, this is very low.

As of the early 1970s cross-border direct real estate investment started to increase. At that time many countries eased their restrictions on foreign direct investment, the Bretton Woods standard ended and a floating exchange rate system began, and dollar surpluses were created by OPEC oil price increases. In the 1980s the volume of direct real estate investment increased tremendously. Direct investment capital to the U.S. was promoted by means of divergent monetary and fiscal policies among the major industrial countries. Other macro-economic factors, including divergent economic growth rates, savings-investment imbalances, and substantial dollar depreciation, also fueled the rapid growth of cross-border investment. Large multinationals in Germany, the U.K. and especially Japan increased their foreign direct investments in the U.S. up to the late 1980s. Japanese ownership of real estate in the U.S. rose from $57 million in 1979 to $15.4 billion in 1990,[2] a compound growth rate of 66 percent per annum in nominal terms. The U.S. attracted the largest amount of foreign real estate investment during the 1980s, primarily due to a strong increase in commercial real estate prices and expectations of future price increases, and to the country's open investment policy. In the 1980s, foreign direct investment in U.S. real estate totaled $6.1 billion, and direct foreign investment in real estate peaked in 1990 at $34.9 billion. From 1990 to 1994 the total invested amount decreased to $28.5 billion.[3]

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[1] US Department of Commerce, International Trade Administration, International Direct Investment: Global Trends and the U.S. Role (Washington, DC:1988).

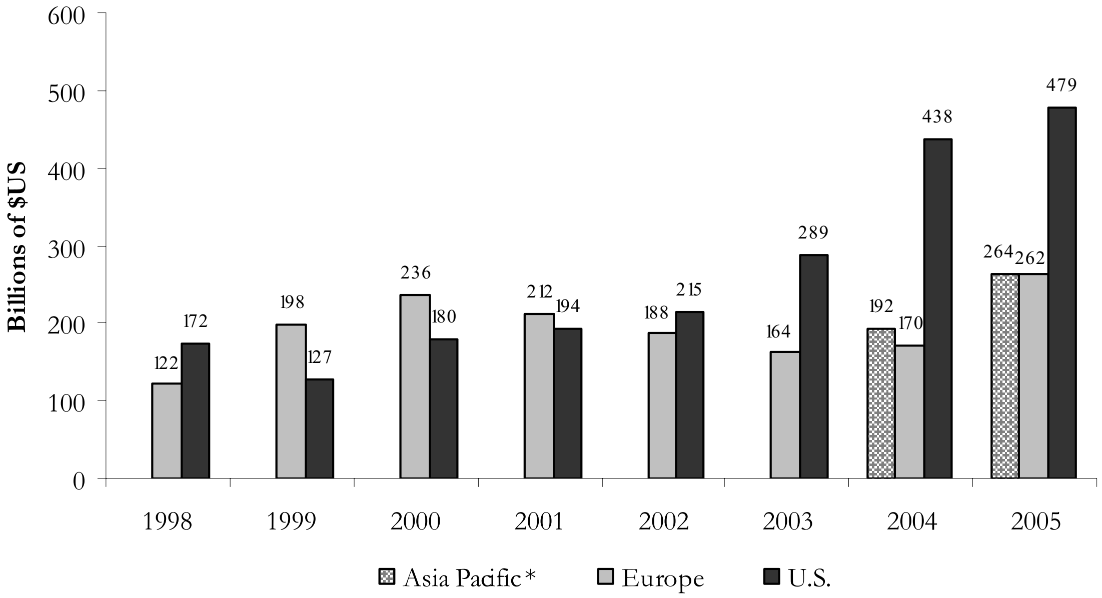
[2] Source: Bureau of Economic Affairs statistics.

[3] Source: Bureau of Economic Affairs statistics.

Why did cross-border direct real estate investment decline in the early 1990s? Real estate markets had expanded dramatically during the 1980s; real rents increased substantially; major markets worldwide experienced low vacancy levels (below 5 percent); and there was insufficient supply of high-quality office space, especially in Europe. Overbuilding during 1984–1990, followed by slow economic growth in 1990–1991, led to an overabundance of vacant commercial real estate in most major cities in the U.K. and U.S. The market value of real estate collapsed over the following years, resulting in depreciation and a gradual decline in real estate investment.

After a period of relatively low enthusiasm for real estate investment, capital flows to public and private real estate across Europe, the U.S. and Asia increased again after 1998 (see figure 1.1).

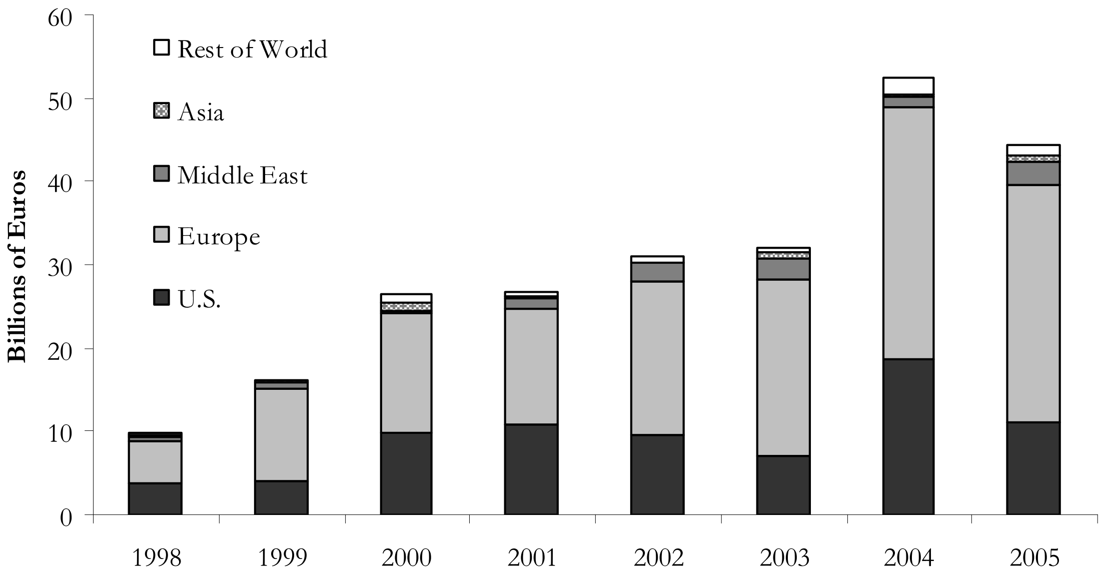
Figure 1.1 Net capital flow to real estate (1998–2005)



Notes. Total net capital flows are provided by DTZ Research (2006) and ING Real Estate Estimates. * indicates that data for Asia-Pacific are not available prior to 2004.

Especially in Europe, we see a significant change in cross-border investment activity. Figure 1.2 shows that cross-border investment activity increased more than four times in eight years (between 1998–2005).

Figure 1.2 European cross-border real estate purchasing activity by investor nationality

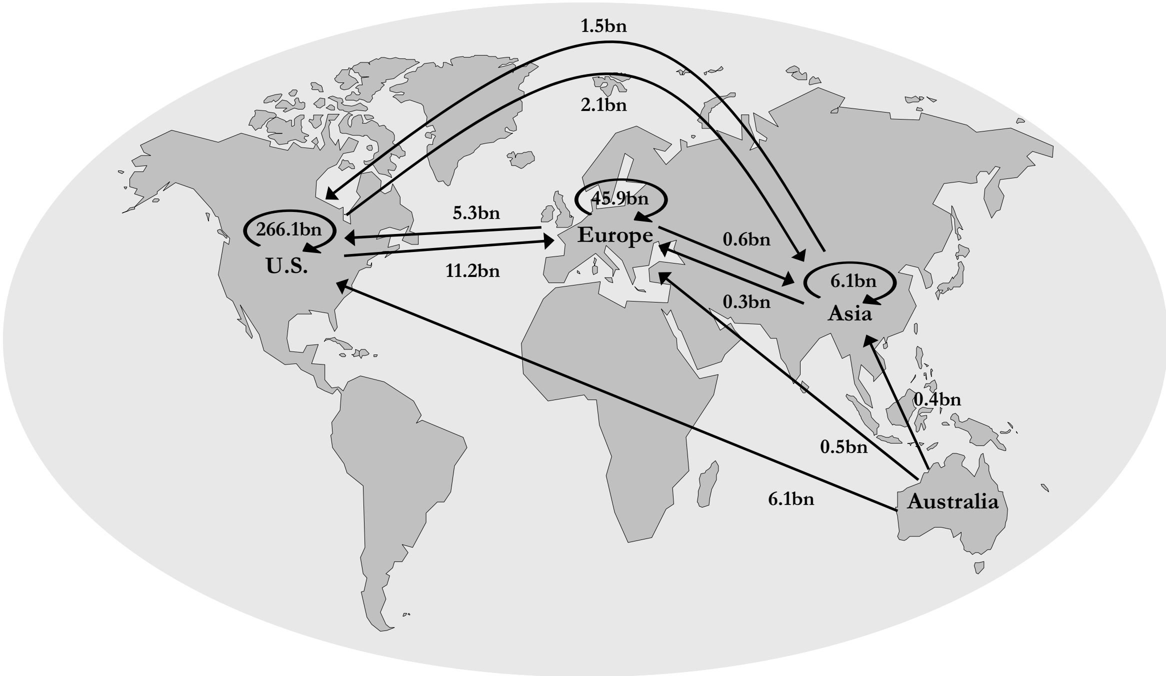


Notes. source is DTZ (2006).

Further evidence of international capital flows in real estate is provided by an overview of transactions in 2005 (see figure 1.3). U.S. real estate investors invested about US$ 266.1bn in their own country, US$ 11.2bn in Europe, and US$ 2.1bn in Asia. European investors made transactions worth US$ 45.9bn within Europe, US$ 5.3bn in the U.S. and US$ 0.6bn in Asia. Asian investors invested US$ 6.1bn in their own region, US$ 1.5bn in the U.S. and US$ 0.3bn in Europe. Almost all transactions by Australian investors were international in 2005. They invested US$ 6.1bn in the U.S., US$ 0.5bn in Europe and US$ 0.4bn in Asia.

The increased inflow of capital has made real estate a sizable asset class. DTZ research (2006) estimates the size of the total direct real estate market at about US$ 21.6 trillion, of which the invested global institutional property market is estimated to be US$ 8.0 trillion (US$ 3.1 trillion in Europe, US$ 1.6 trillion in Asia Pacific, and US$ 3.3 trillion in the U.S.). The total invested direct real estate market is nearly 30% of aggregated world equity markets of US$ 27 trillion.

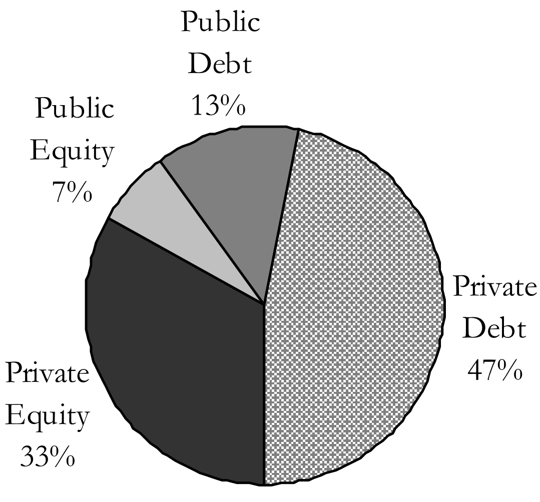
Figure 1.3 Global real estate transaction flows in 2005



Notes. source is DTZ (2006).

As shown in figure 1.4, global real estate market value can be divided into four funding segments. These segments are: public debt (mainly mortgage investment funds, government credit agencies, and commercial mortgage backed securities), private debt (mostly consisting of mortgages provided by banks, life insurance companies and pension funds, and unsecured debt to real estate investors), private equity (private financial institutions, life insurance companies, foreign investors, pension funds and private investors), and public equity (listed real estate funds).

Figure 1.4 Global real estate market value



Notes. source is DTZ (2006).

Table 1.1 Select asset class performance (annualized % returns) as of 4Q2003

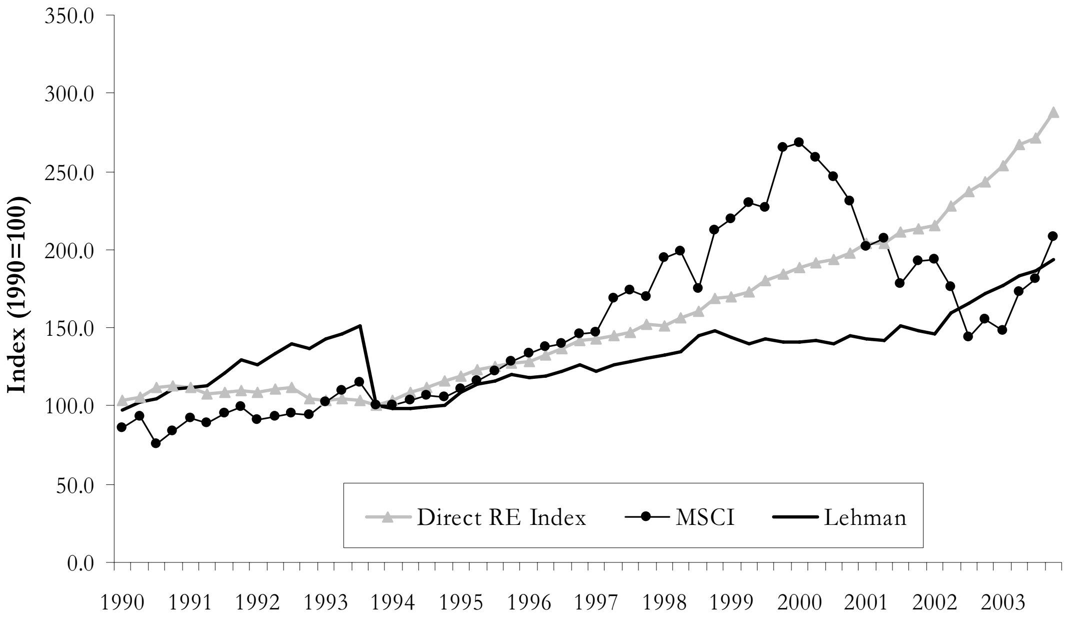
Region		5 Yr	10 Yr	15 Yr	Standard Deviation
Asia in US$					
Direct Real Estate	Direct RE Index	7.9%	4.6%	8.9%	8.4%
Real Estate Equities	GPR General	12.6%	1.9%	1.7%	26.6%
Equities	MSCI	2.1%	-1.0%	-1.8%	22.6%
Bonds	Lehman	n/a	n/a	n/a	n/a
Australia in A$					
Direct Real Estate	Direct RE Index	10.8%	10.7%	7.5%	3.3%
Direct Real Estate	PCA Index	10.6%	10.2%	6.9%	4.6%
Real Estate Equities	GPR General	11.6%	13.1%	14.1%	9.0%
Equities	MSCI	6.4%	7.5%	9.7%	12.4%
Bonds	Lehman	n/a	n/a	n/a	n/a
Europe in Euro€					
Direct Real Estate*	Direct RE Index	10.4%	9.8%	9.7%	6.3%
Real Estate Equities	GPR General	6.4%	5.7%	5.1%	9.6%
Equities	MSCI	-0.4%	9.1%	10.0%	17.4%
Bonds	Lehman	5.0%	n/a	n/a	n/a
UK in UK£					
Direct Real Estate	Direct RE Index	11.0%	11.2%	8.4%	4.6%
Direct Real Estate	IPD Index	10.4%	10.6%	8.3%	8.0%
Real Estate Equities	GPR General	7.2%	7.2%	5.9%	19.9%
Equities	MSCI	-2.3%	5.7%	9.6%	15.7%
Bonds	Lehman	5.1%	n/a	n/a	n/a
USA in US$					
Direct Real Estate	Direct RE Index	10.4%	10.9%	7.4%	3.4%
Direct Real Estate	NCREIF Index	9.4%	10.1%	6.7%	3.3%
Real Estate Equities	GPR General	11.2%	10.1%	9.7%	16.6%
Equities	MSCI	-1.2%	11.2%	12.4%	15.6%
Bonds	Lehman	6.6%	6.9%	8.4%	4.4%
World in US$					
Direct Real Estate	Direct RE Index	11.3%	11.2%	8.6%	4.4%
Real Estate Equities	GPR General	9.9%	5.2%	4.3%	14.9%
Equities	MSCI	-0.4%	7.6%	7.2%	16.0%
Bonds	Lehman	5.4%	6.8%	n/a	n/a

Notes. The direct real estate indices are calculated from the database discussed in Chapter 5. Information on the GPR General and Lehman was obtained from Thomson Financial Datastream. Morgan Stanley Capital International provided the total return indices for equities. Returns and standard deviations are annualized.

* a currency effect is included, because the currencies were different before the introduction of the Euro.

From a performance perspective, real estate has become one of the best performing investment categories. Table 1.1 shows the performance for both direct real estate and real estate securities, next to equities and bonds. Real estate has outperformed bonds and stocks in almost all regions on a 5 year and 10 year basis. Figure 1.5 gives the indices for total return performance of global direct real estate, real estate equities, equities, and bonds between 1Q1990 to 4Q2003. Direct real estate shows stable growth after 1995 despite falling stock prices after 1999.

Figure 1.5 Global return performance indices for asset classes (1Q1990–4Q2003)



Notes. This Figure shows the global index of direct real estate (calculated in Chapter 5), global equities (MSCI World), and global bonds (Lehman World). All indices are in US dollars. The values of the indices are set equal to 100 in the base year.

In recent years, the global real estate securities market has grown from US$ 130 billion in 1992 to a current total market value of nearly US$ 300 billion.[4] With the growth of international opportunities came an increasing need for data. To measure the performance of real estate securities, various national and even global indices have been created. Bigman (2002) describes four global indices: GPR General (27 countries), GPR 250 (22 countries), EPRA/NAREIT (19 Countries), and Salomon (19 countries), with regional indices for: Asia, Europe, and North-America. Eichholtz and Koedijk (1996) had already analyzed the global real estate securities market in the mid-1990s by describing the performance, standard deviation, and diversification potential by property type and continent.

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[4] Estimate by ING Real Estate Research & Strategy and published in Ferguson and Burton (2005).

There is more information about listed funds than about the private real estate market, because of the requirements of stock exchange committees and frequent trading of the shares on the stock exchange. The quality and availability of data has resulted in a body of literature on international investment strategies for listed real estate (see Worzala and Sirmans, 2003). In this dissertation, we will focus on private equity or direct real estate investment.

1.2 Aim and scope

As mentioned in the previous paragraph, two rationales for investing internationally in real estate are return opportunities and diversification. The return opportunities might be better in another country than the home country, due to structural or cyclical differences as discussed in Geltner et al. (2007). These differences could also lead to diversification benefits if the markets move in nonsynchronous ways. The aim of this dissertation is to analyze such return opportunities and diversification potential for direct real estate by looking at performance and performance drivers. Most research about this topic has focused on the analysis of returns for individual countries. This dissertation aims to expand the body of literature by looking at the performance drivers of global real estate and performance of regions relative to each other, similar to studies by Goetzmann and Wachter (2001) and Ling and Naranjo (1999). The rationale is the need for international real estate research for the investment industry as it moves towards market globalization. One of the many changes taking place in the investment business is the increasing demand for locally sourced research placed in a global context. Another development is the first truly global mandates being given to real estate fund managers. Globalization is becoming a reality, especially for large real estate investment management firms and their portfolio managers. Research on international real estate databases will lead to a better understanding of future returns, diversification and risk, which is the basis of any investment process.

The earliest direct real estate index starts in 1971, when Investment Property Databank (IPD) started collecting information about U.K. property market returns. For the U.S., the inception date of the National Council of Real Estate Investment Fiduciaries (NCREIF) index is the first quarter of 1978, while the Property Council Australia (PCA) launched its performance index in 1985. Over the past few years, IPD has expanded its coverage to 18 countries, and other international companies like Jones Lang LaSalle (JLL) have started collecting data on international markets in a consistent manner. In addition, a number of new data providers have emerged to fill the gaps in information. In general, transparency in direct real estate markets has improved as a result of growing international investment by pension funds and investment managers. As a result, new data now available for the first time allows us to test various hypotheses on international direct real estate markets that have previously been tested in only a few, relatively transparent markets or in one region alone. This is also the case when identifying the determinants of real estate returns. Previous studies focused on identifying the most important supply and demand drivers of commercial property for a single country. For example, Rosen (1984), Hekman (1985), Wheaton (1987) and Wheaton and Torto (1988) analyzed the U.S. and Gardiner and Henneberry (1991) and Giussaini and Tsolacos (1993) looked at the U.K. In this dissertation, we depart from earlier studies by examining the real estate market in a global context and evaluating the basic elements of office prices and rents. The rationale for taking a global perspective is twofold. First, capital markets are becoming increasingly global, thereby increasing the importance of global real estate analysis tools. Second, economic growth and supply variables display a larger dispersion in a global context than in a local context. This contributes to the effectiveness of empirical tests.

Another very important component of real estate return is the risk premium for international direct real estate. An estimate of the risk premium is central to projecting future investment returns, calculating the cost of capital, valuing real estate acquisitions, and determining fair rates of return. All these applications require an estimate of the prospective risk premium, whereas the only risk premium we can measure is the historical premium. In addition, most studies that look at establishing the risk premium for real estate focus on real estate investment trusts (REITs) (see for example Swanson et al., 2002). Studies on private real estate look at the factors that influence real estate returns and risk premiums (see Ling and Naranjo, 1997 and Ling and Naranjo, 1999). In this dissertation we expand the literature by looking at ex-ante and ex-post risk premiums across four regions, thereby making comparisons between regions possible. In addition, we attempt to analyze the drivers of the risk premium. We also test the convergence between regions, because this could impact the diversification potential. Looking at the drivers, we identify global factors that influence risk premiums.

One of the most important reasons for investing in real estate is its inflation hedge potential. The degree to which the inflation hedge component is part of the return has been well documented for almost all major real estate markets around the world. However, we extend the current literature by looking at 24 countries in one study and thereby analyzing the inflation hedge potential of markets relative to one another. In addition, we look at the impact of rent review characteristics and test which rent review type offers a better inflation hedge.

The literature has already devoted much attention to the benefits of international diversification using real estate equities (see Worzala and Sirmans, 2003). For example, Eichholtz (1997) examines international diversification by looking at investing in different regions versus different property types. Studies of non-listed real estate or direct real estate also discuss the diversification benefits of international investment (see Sirmans and Worzala, 2003). However, most of the studies advocate the inclusion of international real estate based on a mean-variance analysis, where applying the modern portfolio theory to direct real estate has some disadvantages. An alternative model developed by Heston and Rouwenhorst (1995) measures country and industry effects and provides a quantitative framework for analyzing portfolio selection. A recent paper by Hamelink and Hoesli (2004) applies this model to listed real estate securities and disentangles the effects of country, property type, size, and value/growth factors. In this dissertation, we apply this model for the first time to international non-listed real estate data. This allows us to disentangle the property-type performance and regional influences on international real estate returns. If we find that investing in real estate assets across regions results in higher diversification benefits than investing across property types, it suggests that international diversification reduces risk because real estate markets in different countries are less than perfectly correlated. However, we also look at the stability of the correlations between regions over time, because this will impact the potential for diversification. In addition, the indices created will help in assessing risk and return for the various regions and will help to determine an optimal international diversification strategy.

Currently available information is not at the same level for all property types. Three of the four empirical discussions analyze direct office markets in various countries around the world. There is generally more information available for the office market, and this is also one of the biggest, most accessible and liquid of the property types, especially for international direct real estate investors.

This dissertation is a collection of related studies written over several years. Each chapter makes use of the maximum available data at that moment. Consequently, the length of the data-series are slightly different over the chapters. Furthermore different econometric methods require different setup of the databases which may lead to different starting and ending dates for the data-series. For example the cross-section analysis in Chapter 5 requires at least one time serie for each region, therefore the shortest time series determines the period for the analysis.

Additionally, we apply a number of quantitative methodologies that have been applied in a very limited way to real estate investment data (both listed and non listed). One of the methods used in this dissertation is the panel data regression approach, which allows for efficient use of cross-sectional and time-series data. Efficient use of the data is very important, because we work with quarterly data over a relatively limited time period.

The combination of the quantitative methods and new data allows us to analyze performance and investigate the drivers for this performance, which is necessary to create a viable global direct real estate investment strategy.

1.3 Outline

This dissertation has 6 chapters. After the introduction, Chapter 2 starts by looking at the global drivers of direct real estate performance. This performance is linked to risk-premium and inflation hedge potential in Chapters 3 and 4. Chapter 5 looks at the diversification potential of direct real estate and more specifically diversification potential across regions versus across property types. Chapter 6 gives the conclusions of this dissertation.

To analyze the aspects that drive global real estate performance, Chapter 2 will provide an overview of the global determinants for direct office real estate returns. We will discuss the effects of economic growth, supply, and demand factors on changes in rent, changes in capital value, and total return. We will have a first look at the impact of inflation on the return on direct real estate, and find that the inflation level is a determinant for the total return. Additional analysis of the inflation hedge potential is presented in Chapter 4. To address the smoothness problem of appraisal-based price data and regulated rents, we employ the Generalized Method of Moments to estimate a dynamic panel-data model. This is also how we find that there is persistency in returns between consecutive periods.

The return on direct real estate also depends on the risk premium, which should provide compensation for the risk taken relative to the return on a risk-free alternative. Chapter 3 will discuss the magnitude and determinants of the global risk premiums on direct office real estate returns. We analyze ex-post and ex-ante risk premiums for Asia, Australia, Europe and the United States. The ex-ante risk premiums are estimated using three models: Gordon's growth model, the two-stage growth model and the periodic growth model. We look at determinants for the ex-ante risk premium by examining the impact of real estate, bond, equity, and economic risk indicators as well as real estate demand and supply variables. The conclusions are not straightforward, with ex-post risk premiums in particular depending on growth rate assumptions, which are proposed to be equivalent to inflation in existing literature. To analyze the diversification potential we look at convergence of risk premiums across regions. We find both convergence over time and in the cross-section. This would indicate that the diversification potential is declining over time and between regions. However, it is happening at a slow pace. Additional analysis of diversification will be performed in Chapter 5.

As stated above, the assumptions for estimating the risk-premium depend in part on the inflation compensation in rent contracts. To analyze the relation between rent contract and inflation, Chapter 4 will look at rent contract characteristics and the impact on the inflation hedge potential of direct office real estate investment, both for expected and unexpected inflation. Rent review methods and lease length are considered to have an influence on the inflation hedge potential. Our test of the influence of rent contract characteristics shows that most rent review groups have positive coefficients for expected and unexpected inflation. Changes in rent for contracts with graduated rent increases move with expected and unexpected inflation. Changes in capital value and total return for rent contracts with revaluated rent increases and indexed rent contracts move with expected and unexpected inflation. Rent contracts with flat rents seem to move with unexpected inflation, adjusting to the market rent at the end of the contract. However, the differences are not significant, only the unexpected inflation from the graduated rent contract moves significantly differently from the average for change in capital value and total return. Furthermore, the lease length seems to have a positive influence on the hedge capability, because the coefficients of the longer lease contracts are more positive.

Chapter 5 will disentangle the performance of international real estate into property type performance and region selection. This helps to create an international diversification strategy for direct real estate. We use constrained cross-section regression with dummy variables for regions and property types to measure the best risk reducer. We analyze the impact of currency changes on total returns by looking at a hedged and un-hedged portfolio, both stock and equally weighted. We find that geographic factors have the largest influence on the volatility of international real estate returns. The average variance of the regional effects is higher than the property type effects and therefore the regional effects have a higher influence on the variation of the total portfolio. Because of the higher influence on the total risk of the portfolio, investing in assets across regions will result in the highest diversification benefits. However, the regional effects are less stable through time, compared with the variance and correlation of the property type effects. Also the property type effect seems to become a more important factor for the return over time, especially when the return is expressed in local currency.

Chapter 6 will conclude with the summary and main findings. The results will contribute to the understanding of global direct real estate investment strategies and offer insights into practical applications of the results found. Furthermore, we will make suggestions for further research. As time passes and more data will become available, future research will be able to analyze long-term trends and offer opportunities to identify the components in more detail for the performance of international direct real estate.

Chapter 2

THE GLOBAL DETERMINANTS OF DIRECT OFFICE REAL ESTATE RETURNS[5]

2.1 Introduction

Traditionally, direct office real estate returns have been analyzed by estimating models for rents in a single country or a single region. Previous empirical studies show that rents are likely to respond to changes in economic growth and availability of square meters. Most studies show that changes in rents stem from differences in supply and demand (see, e.g., Rosen, 1984; Hekman, 1985; Wheaton, 1987; Wheaton and Torto, 1988; Gardiner and Henneberry, 1988, 1991; Giussaini and Tsolacos, 1993). Other studies demonstrate the relationship between inflation and real estate returns (see, e.g. Wurtzebach et al., 1991; Hartzell et al., 1987). Another widely documented finding is that rents slowly adjust to changing economic conditions due to regulations and other market inefficiencies (see, e.g. Sivitanides, 1995).

This study investigates the factors that affect changes in office prices and changes in rents. We attempt to identify the most important determinants of these changes and to understand the key implications for investors in real estate. For this purpose we use economic growth and real estate variables as demand and supply variables. Economic growth is estimated by changes in employment and gross domestic product (GDP) on a national level for Asia and Europe, and employment and gross metropolitan product (GMP) on an MSA level for the U.S. Real estate

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[5] This chapter is based on De Wit, I. and R. van Dijk (2003), The Global Determinants of Direct Office Real Estate Returns, *Journal of Real Estate Finance and Economics*, 26(1), 27-45.

variables are changes in vacancy and stock for the main office districts in Asia, Europe and the United States. The real estate information for Asia and Europe was collected from publications by Jones Lang LaSalle. Torto Wheaton Research is the source for our US office data, in combination with the National Real Estate Index. We extend the literature by examining total return, which is the sum of the change in capital appraisals and the rent as percentage of the last price.

We depart from earlier studies by examining the real estate market in a global context, rather than for a single country or region. We evaluate the basic elements of office prices and rents with a panel of 56 quarters and 46 office districts from the United States, Europe and Asia. The reason for looking around the world is twofold. First, capital markets are becoming more and more global, thereby increasing the importance of global real estate analysis tools. Second, economic growth and supply variables show a larger dispersion in a global context than in a local context. This contributes to the power of empirical tests. Another novelty in our approach is that we use a dynamic panel-data model. The model allows us to account for earlier finding that office rents react partially or with a time lag to changing economic conditions. A dynamic panel-data model can be interpreted as a partial adjustment model for the dependent variable, which might not only be changes in rents, but also changes in capital appraisal and total returns. The model can also be interpreted as a model in which not only current explanatory variables affect returns but also explanatory variables of previous periods. We compare the results from the dynamic panel-data model with static specifications.

Our main findings are that economic growth prospects and the gap between new supply and demand determine the relative attractiveness of offices as an investment vehicle. Our analysis shows that GDP/GMP and inflation positively influence real estate prices. Real estate prices are negatively influenced by changes in unemployment and vacancy rate. Rents are positively related to changes in the GDP/GMP in a univariate content. Stock, vacancy rate and unemployment affect rents negatively. Total returns are inversely related to the vacancy rate. The stronger the growth in GDP/GMP, the higher the total return. The same holds for the relationship between inflation and total returns. Differences between the findings from the static and dynamic model show that it is important to correct for the stickiness that is commonly found in real estate prices and rents.

The remainder of this chapter is organized as follows. Section 2.2 provides an overview of previous empirical studies of models for office rents. Section 2.3 describes how our data have been obtained and gives descriptive statistics on capital appraisals, yields, rents and total returns. Section 2.4 gives the hypotheses based on previous research, and provides the motivation for our chapter. Section 2.5 explains the econometric models and the construction of the variables used in our empirical analysis. Section 2.6 shows the results. Finally, section 2.7 gives the conclusions.

2.2 Literature on direct real estate models

Earlier empirical real estate research has produced various modeling techniques, which can be can be separated into two groups. The first group of techniques focuses on the determinants of office rents by using a single equation model, with the majority emphasizing demand variables. The supply side is, in most cases, assumed to be price inelastic in the short run. Inelastic behavior is explained by the slow adjustment process of the office market, due to inefficiencies in the market. These inefficiencies are caused by lack of full transparency, regulations and the time-consuming development process. The second group of techniques is the so-called structural models, which take both the demand and supply side of real estate into account by looking at market dynamics. Changes in rental levels are explained by simultaneous equation models or pure multiple time-series models such as VAR models.

From a geographical point of view, most office rent research has been applied to defined geographical areas. A comparison of different articles about various geographical regions shows that there is a high degree of similarity among economic variables that determine rent levels for office space.

For the North American market, Rosen (1984) has created one of the first structural office models. He looks at vacancy rates, and explains rent levels by the difference between the actual and natural vacancy rate. One of his findings is that rents rise, or fall, more rapidly the further the actual vacancy rate moves from the optimal vacancy rate. Hekman (1985) incorporates vacancy rate directly as determinant for office market rents. In such an analysis the vacancy rate is used as a supply-demand variable, because the vacancy rate reflects the influences of new stock, changes in existing stock and take-up in a certain period. Hekman (1985) finds a significantly negative influence of vacancy rates on office rents. Furthermore, he also finds that Gross Domestic Product significantly influences office rents, with higher GDP causing higher rents. Local unemployment has no significant impact on rental levels in his study. Wheaton (1987) and Wheaton and Torto (1988) find that office employment growth has a positive impact on office construction. They argue that this results from a similar cyclical behavior. Wurtzebach, Mueller and Machi (1991) and Hartzell, Hekman and Miles (1987) provide evidence for the relationship between inflation and real estate returns by showing that real estate provides an inflation hedge for different property types.

For the U.K., Gardiner and Henneberry (1988, 1991) employ both demand and supply variables in a single regression approach. They use GDP, employment, unemployment, and average income as a proxy for demand, while the supply variables consist of office stock. The aim of their model is to forecast rent levels for 1985 by using regional office rent data from 1977 to 1984. They find that GDP has forecasting ability. However, their total model can only explain and forecast rent levels in five regions in the U.K and has less forecasting ability in declining regions. Empirical research by Dobson and Goddard (1992) shows that change in employment is insignificantly related to real estate rents in four British regions between 1972 and 1987. In addition, real interest rates have a positive effect on real office rents. Giussaini and Tsolacos (1993) use co-integration analysis to find a link between national office rents and supply variables between 1977–1991 in the UK. However, since their office rents do not meet the criteria of the co-integration test, they proceed to investigate the determinants of office rents by applying multiple linear regressions. The result shows that GDP and service employment are important determinants of national office rents.

The first pan-European study of the major determinants of office rental values was carried out by Giussani, Hsia and Tsolacos (1993). They conclude that European rental values are determined by similar demand-side variables, of which GDP is the most important. Possibly as a result of data limitations, they find no significant results for the influence of the unemployment rate and interest rate on rental levels.

Three recent papers study determinants of real estate on a global scale. The paper by Case, Goetzmann and Rouwenhorst (1999) investigates the impact of changes in GDP on property returns. They find that changes in international GDP and country-specific GDP changes help to explain variations in real estate returns. Ling and Naranjo (2002) perform a cross-country analysis on listed real estate returns. Their findings suggest that excess real estate returns are not constant across countries. Moreover, this is consistent with the findings by Case, Goetzmann and Rouwenhorst (1999). They show that country-specific effects drive real estate returns, for example the impact of local production factors varies between countries. The paper by Eichholtz and Huisman (2001) investigates factors that explain cross-sectional differences between expected excess returns on international property shares. They examine international beta, size and interest rate as possible factors explaining this variation. The results show that beta has no significant explanatory ability. Size and interest rate variables have an important impact on excess property share returns. An extensive literature overview about the determinants of Real Estate Investment Trusts (REITs) returns has been presented by Corgel, McIntosh, and Ott (1995).

2.3 Data

Our data set consists of two components: real estate variables and macroeconomic indicators. The real estate variables are: capital value, net rent, vacancy and office stock expressed in square meters. The database consists of 46 major office districts in Asia (13), Europe (24) and the U.S. (9) on a quarterly basis from 1986 through 1999.

Appendix 2.A shows the office districts and annualized values of change in capital appraisal, changes in rents and total returns. The definitions of these three variables are discussed in section 2.5, methodology.

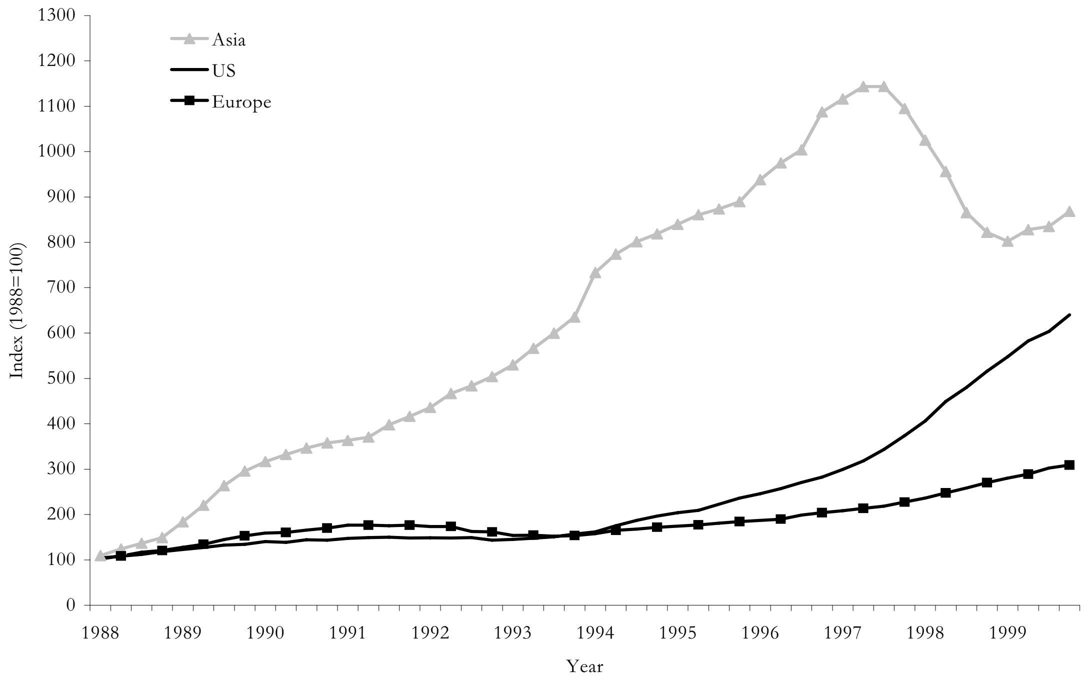
Table 2.1 provides descriptive statistics for Asia, Europe and the US as well as for the world as constructed by the 46 office districts. Figure 2.1 gives an index calculated for the average total return for Asia, the U.S. and Europe. During this period, Asia outperforms Europe and US, despite the Asia-crisis, which had a very big impact on real estate returns after the second quarter of 1997.

Table 2.1 Summary statistics

	World		**United States**		**Europe**		**Asia**	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Δ Capital value	2.50%	14.32%	0.84%	8.56%	2.83%	11.34%	3.24%	22.0%
	[#1909]		[#396]		[#1039]		[#474]	
Δ Rent	2.95%	11.08%	0.24%	6.38%	2.30%	8.82%	4.51%	16.04%
	[#2059]		[#396]		[#1067]		[#596]	
Total return	12.55%	13.32%	16.27%	9.08%	11.94%	11.86%	10.90%	18.30%
	[#1909]		[#396]		[#1039]		[#474]	

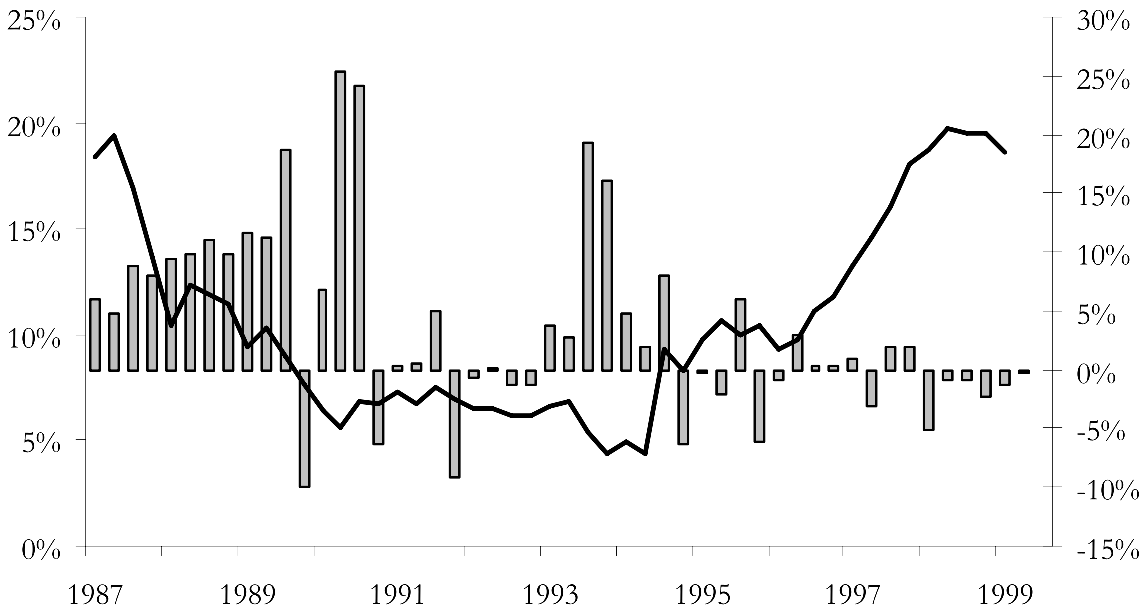
Notes. This table contains the means and standard deviations of the annualized return variables in our study. The symbol Δ signifies that the growth rate of the variable is used. The statistics were obtained after pooling all observations over the whole time-series. The period ranges from 1986 through 1999. The number of observations is given in brackets.

Figure 2.1 Total return index by region (1988–1999)



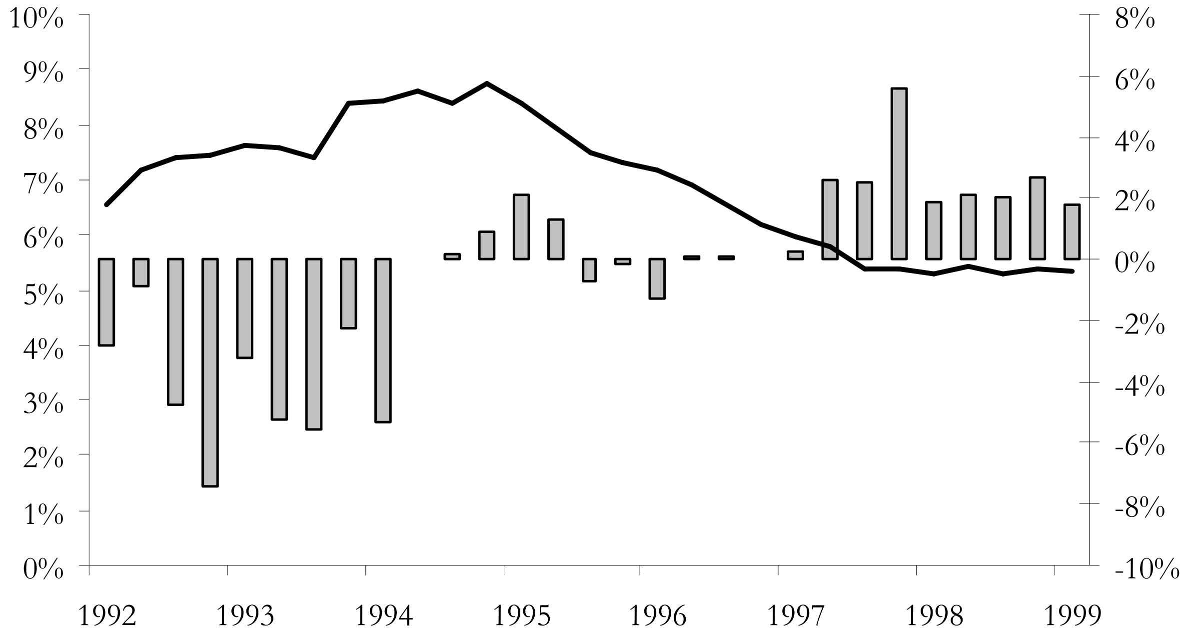
Notes. The total return series are calculated from Jones Lang LaSalle rent and yield data for Asia and Europe; Torto Wheaton in combination with the National Real Estate index is used for the U.S. The average return per continent is the average of the total return per office district included in our study. 1988 is base year and is equal to 100.

Figure 2.2 Vacancy versus rent change in Asia (1987–1999)



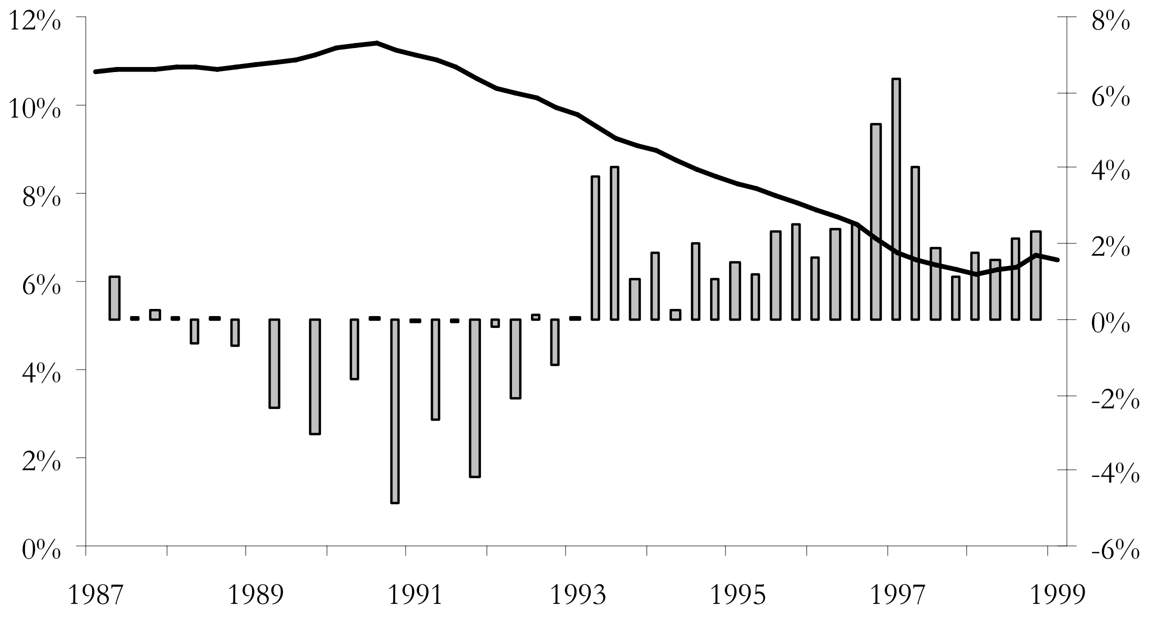
Notes. Average vacancy rate (line in figure with corresponding left-axis) compared to percentage change in rent level (bars in figure with corresponding right-axis) for Asia.

Figure 2.3 Vacancy versus rent change in Europe (1992–1999)



Notes. Average vacancy rate (line in figure with corresponding left-axis) compared to percentage change in rent level (bars in figure with corresponding right-axis) for Europe.

Figure 2.4 Vacancy versus rent change in the U.S. (1987–1999)



Notes. Average vacancy rate (line in figure with corresponding left axis) compared to percentage change in rent level (bars in figure with corresponding right axis) for the U.S.

An initial descriptive analysis suggests a very big impact of the Asia crisis on the average vacancy rate during this period, given in figure 2.2. The relationship between average change in rent and vacancy rate for Europe and the U.S. is shown in figure 2.3 and 2.4.

All the real estate indicators for Asia and Europe were provided by Jones Lang LaSalle, as published in their real estate market reports. Torto Wheaton subscribers' services provided vacancy and stock for nine office regions in the U.S. The nine selected office districts consist of a CBD and a number of sub-markets in a city. The geographical definition by Torto Wheaton Research of this area is based on commercial office property and is normally smaller than the defined MSA. Rent and capital value series are computed from the National Real Estate Index. The data providers are selected to create a consistent data set, in order to make a global analysis possible. They use similar definitions for our real estate indictors and all of them cover a large geographical area. Since time series are short in some counties, we collected quarterly data to make the time series dimension more substantial.

The macroeconomic indicators are GDP for Asia and Europe and GMP for the US, unemployment on a national level for Asia and Europe and MSA office employment for the US, inflation and long-term interest rates on a national level. Macroeconomic indicators for Asia were collected from the International Monetary Fund (IMF), supplemented by data from national statistical bureaus of the individual countries. Eurostat supplied data on a country level for eleven European countries. In the nine U.S. office regions, we collected Metropolitan Statistical Area (MSA) data from Standard & Poor's DRI-WEFA.

2.4 Hypotheses

Cross-border mergers in the financial sector and new information technologies within investment processes have encouraged globalization of financial markets. This in turn leads to greater interest in transnational investments and increases in international capital flows. Especially in Europe, investors look beyond their national borders for interesting investment opportunities. The search for higher returns and diversification are the most frequently encountered arguments for considering a global universe. Undoubtedly, the globalization trend in financial markets also increases interest in transnational investments within the direct real estate market. For real estate investors, advisors and occupiers the globalization trend has important consequences. First, the number of potential investment sites that has to be researched increases. Second, factors that have to be considered are no longer related to the home market, but to many national economies and multiple district-specific factors. This complicates the investment process and the role of advisors. Consequently, research aimed at finding the relationships between economic growth, district-specific factors and commercial property market performance on a global level is particularly important. This chapter examines potential relations empirically by considering 46 major office districts worldwide in a unified framework.

Some determinants of real estate return are already tested and accepted for country-specific models. Using these country-specific models we can make a number of hypotheses that are interesting to test on a global level:

Hypotheses:

- There is a significant negative relationship between change in rent, change in capital value, total return and changes in the gap between supply and demand, which is measured by the vacancy rate.
- There is a negative relationship between change in rent, change in capital value, total return and an indicator for the change in supply of office buildings, i.e. change in stock.
- GDP/GMP is positively related to real estate rents, capital value and total returns, and unemployment is negatively related to rent, capital value and total return. GDP/GMP and the unemployment rate are used as a proxy for demand.
- Change in inflation is a determinant for short-term adjustments in the real estate market, as revealed by its positive effect on change in rent. The long-term price mechanism (change in capital value and total return) is influenced by the level of inflation.
- Returns in real estate markets are persistent and there is a significant positive relation between current return and return in the previous period.

2.5 Methodology

Relative to previous studies, our data set is large since it consists of about 2000 rent and capital value observations. The typically low variation in the time-series dimension of real-estate data, however, mean that it is still important to use our real estate data efficiently. We concentrate, therefore, on panel-data models. Such models are able to combine the time-series dimension with the cross-sectional dimension. Consequently, parameters may be obtained more efficiently than by means of a pure time-series or cross-sectional approach. The remainder of this section is organized as follows. First, we give the structure of our econometric models and we describe briefly the econometric methods for estimating the models. Second, we discuss the construction of the capital return, change in rent and total return variables. Third, we give our proxies for the potential determinants of these three return variables.

We can benefit from existing empirical work in developing a theoretical framework and use the specifications as a guide to our econometric model. Dynamic relationships, for example, received considerable attention in previous empirical tests. A number of studies conclude that real estate returns show partial adjustment to changes in supply, demand and macroeconomic variables (e.g., Gardiner and Henneberry, 1988, 1991). Another set of studies concludes that real estate returns are affected by some variables after some time (e.g., McGough and Tsolacos, 1994). Building upon this insight, we consider not only static panel-data models, but also dynamic structures.

Static panel-data model

Our static panel-data model assumes that changes in real estate returns are caused by contemporaneous macroeconomic and supply and demand variables. In addition to these variables, office-district-specific variables that are relatively constant in time might affect the return variables that we study. For example, political risk factors and market non-transparency might lead to a relatively constant and office-district-specific risk premium in returns on investments in offices. We therefore opt for the random-effect specification to model the office-district-specific variables with a constant character. This specification has two advantages. First, we do not have to specify all constant office-district-specific variables, while we still can examine effects of the included current macroeconomic and supply and demand variables. Second, by assuming that the office-district-specific terms are random effects, they can be considered as part of the error terms. This makes the model relatively parsimonious. The random-effect specification has received considerable attention in the econometric literature (see for example Balestra and Nerlove, 1966; Wallace and Hussain, 1969; Maddala, 1971; Nerlove, 1971). Because of their simplicity, the random effects models may constitute a useful first step in the analysis of panel data. We now describe some further technical details of our models. We assume that the reaction coefficients or slope parameters are the same for all office districts and all periods. The model is represented by,

$$\mathrm{R}_{it} = \beta_1 x_{1it} + \ldots + \beta_K x_{Kit} + \mu_i + \upsilon_{it}, \tag{2.1}$$

where R_{it} denotes a particular return variable of office district i in period t, x_{kit} denotes a non-stochastic macroeconomic supply or demand variable and β_k is a parameter. There are K exogenous variables. The last two terms, μ_i and υ_{it} are the office-district-specific intercept and the overall remainder. Since both are considered as random, they can be redefined by the error term $u_{it}=\mu_i + \upsilon_{it}$. Besides the functional specification given in (2.1), we also have to make assumptions about the random terms such that an appropriate estimator can be chosen and inferences can be made. In this chapter, we assume that μ_i and υ_{it} are independent for all i and t, $E(\mu_i)=\mu$ and $E(\upsilon_{it})=0$ where E is the expectation operator. Both μ_i and υ_{it} are assumed to follow a normal distribution, $\mu_i \sim N(\mu, \sigma_\mu^2)$ and $\upsilon_{it} \sim N(0, \sigma_\upsilon^2)$. The remaining assumptions are that $E(\mu_i\, \mu_j)=0$ if $i\neq j$ and $E(\upsilon_{is}\, \upsilon_{jm})=0$ if $i\neq j$ or $s\neq m$. Given these assumptions for the random terms, the usual Generalized Least Squares (GLS) estimator can be applied. The covariance matrix of u_{it}, which is used by the (feasible) GLS estimator, is obtained by several auxiliary regressions. Mátyás and Sevestre (1992) provide the feasible GLS estimator if observations are missing, which is the case for our data set. This estimator uses all observations for which in a particular quarter all variables are present for a particular office district.

Dynamic panel-data model

The dynamic panel-data model contains not only the exogenous macroeconomic, supply and demand variables, but also a lagged endogenous variable among the explanatory variables. Using similar notation as in (2.1), the model is represented by

$$R_{it} = \beta_0 R_{i,t-1} + \beta_1 x_{1it} + \ldots + \beta_K x_{Kit} + \mu_i + \upsilon_{it}\,. \tag{2.2}$$

Including the lagged return variable $R_{i,t-1}$ among the explanatory variables is interesting for two reasons. First, the model allows for the partial adjustment in, i.e. the stickiness of, real-estate returns. This can be shown as follows. Consider the following theoretical model[6],

$$R_{it}^* = \beta_1^* x_{1it} + \ldots + \beta_K^* x_{Kit} + \mu_i^* + \upsilon_{it}^*, \tag{2.3}$$

where the symbol * denotes the unobservable non-sticky equivalent of the variables and parameters in (2.1). If we assume further that that the observed return variables relate to the unobservable non-sticky return variable as indicated by

[6] The introduction of the lagged variable $R_{i,t-1}$ makes that the before mentioned GLS estimator can not be applied. The reason is that the lagged exogenous variable $R_{i,t-1}$ and the error term of the model, $\mu_i + \upsilon_{it}$, are not independent from each other.

$$R_{it} - R_{i,t-1} = (1-\lambda)(R^*_{it} - R_{i,t-1}) + \varepsilon_{it} \ , \tag{2.4}$$

where λ measures the speed of adjustment and ε_{it} is an error term. If λ is positive and close to zero, the adjustment is almost immediate. Analogously, if λ is close to, but smaller than one, then the adjustment is slow. It is easy to verify that combining (2.3) and (2.4) results in a specification similar to the dynamic panel-data model in (2.2) such that β_0 is equal to λ. The second reason why a dynamic panel-data model is interesting is that it allows lagged exogenous variables to affect the current return. This can be important, given that previous studies found some delay in the reaction of returns to changed conditions. By recurrent substitution, the model in (2.2) can be rewritten as

$$R_{it} = \beta_0{}^t R_{i0} + \sum_{j=0}^{t-1} \beta_0{}^t \left(\beta_1 x_{1i,t-j} + \ldots + \beta_K x_{Ki,t-j}\right) + \frac{1-\beta_0{}^t}{1-\beta_0}\mu_i + \sum_{j=0}^{t-1} \beta_0{}^t \upsilon_{i,t-j} \, . \tag{2.5}$$

As mentioned GLS can not be applied therefore, the lagged term $R_{i,t-1}$ in (2.2) makes it possible for the return variable also to be influenced by lagged values of the exogenous, macroeconomic demand and supply variables. Arellano and Bond (1991) show that Hansen's (1982) Generalized Method of Moments (GMM) can be used to obtain a consistent estimator for (2.2).

Variables

The return variables we take for R_{it} are the capital return, change in rent and total return variables. The *capital return* variable is the percentage change in the local prime capital value per square meter over the previous quarter. The index P_{it} measures the value of one square meter in local currency. The *change in rent* variable, ΔD_{it}, is the percentage change in the rent that is generated by one square meter over the previous quarter in local currency. The *total return* variable equals,

$$R_{total\ return,it} = \frac{P_{it} - P_{i,t-1}}{P_{i,t-1}} + \frac{D_{it}}{P_{i,t-1}} \, . \tag{2.6}$$

Hence, the total return variable is the sum of the change in the capital appraisal value and the rent generated by the real estate.

We examine four variables that are related to office space supply and demand or to economic growth. First, the percentage *change in the stock* measures the growth in office space. A positive value reveals a growth in building activity and an increase in supply. The variable is office district specific. Second, percentage *change* *in vacancy rate* measures the influence of change on both supply and demand. This variable is also office-district specific. Third, the percentage *change in GDP/GMP* is a proxy for the growth of the economy. We assume that a positive growth rate leads to a larger demand for office space. The variable is country or MSA specific. Fourth, percentage *change in the unemployment rate* is another proxy for the growth of the economy. We assume that a positive change is negatively related to growth of the economy and demand for office space. The variable is country or MSA specific. We also incorporate two variables in the model to pick up effects of shifts in value of money. First, the *level of inflation* is used to account for variation in total returns and change in capital value, since we hypothesize that it affects the value of the office building. Second, the *change in inflation* is used to capture change in rent levels caused by changes in the value of money. The inflation variables are country specific.

2.6 Results

2.6.1 Analysis of correlations

Table 2.2 Correlations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Δ Capital value	1.00								
2. Δ Rent	0.75*	1.00							
3. Total returns	0.91*	0.69	1.00						
4. Δ Stock	−0.03	−0.16*	−0.07*	1.00					
5. Δ Vacancy	−0.23*	−0.27*	−0.24*	0.29*	1.00				
6. Δ GDP/GMP	0.09*	0.07*	0.10*	−0.09*	−0.02	1.00			
7. Δ Unemployment rate	−0.25*	−0.19*	−0.21*	−0.03	0.14*	−0.05*	1.00		
8. Level of inflation	−0.03	−0.01	0.07*	−0.15*	−0.04	0.09*	0.09*	1.00	
9. Δ Inflation	0.07*	0.08*	0.05*	0.03	0.02	0.01	−0.05*	0.08*	1.00

Notes. This table gives correlations. The symbol * indicates that a correlation is significant from zero at the five per cent level using the two-sided test methodology. The symbol Δ indicates that the growth rate of the variable is used.

Table 2.2 provides the correlations between our variables. The correlations that are significant at the five per cent level are marked by the symbol *. If not stated otherwise in the text below, significance refers to the five per cent level using a two-sided test. We are interested in the correlations since they give us a first sight of relations between variables. Moreover, they aid in specifying our regression models.

We will first discuss the correlations for appraisal and rent variables. The correlation between change in capital appraisal and change in rent equals 0.75. This high value is in line with expectations and suggests that these two variables have one or more common determinants. Consistent with this hypothesis are the magnitudes and signs of the correlations between these variables and the exogenous variables. For example the correlation between change in capital appraisal and change in vacancy equals -0.23, while the correlation between change in rent and change in vacancy equals -0.27. These correlations are significantly different from zero, the signs are as expected, and about the same. The correlations in Table 2.2 further indicate that change in stock is negatively related to the change in capital appraisal and to change in rent. Only the latter is significantly different from zero. Change in GDP/GMP is significantly positively related to change in capital appraisal and to the change in rent. This is consistent with the hypothesis that the stronger the economic growth, the higher the returns. The correlation between change in unemployment rate and change in capital appraisal is significantly negative. This also holds for change in unemployment rate and change in rent. These correlations might indicate a positive relationship between the growth of the economy and the returns on an investment in office space. The level of inflation is not significantly correlated with either change in capital appraisal or change in rent. Finally, change in inflation is significant and positively related to both change in capital appraisal and change in rent.

Turning to the total return variable, we see that correlations between exogenous variables and the total return variable are, in general, in accordance with correlations regarding capital appraisals and rents. A notable exception is the level of inflation variable, which is significantly correlated with total returns, whereas it was not significantly related to change in capital appraisal and rents. This suggests that the level of inflation affects the rent yield on the investment, which is the second term on the right-hand side of (2.6). The correlation between the level of inflation and this second term is 0.74.[7] Our finding supports the hypothesis that an investment in real estate provides an inflation hedge in the long run.[8]

The remaining correlations in Table 2.2 show that the exogenous variables are significantly correlated with each other. For example, correlation between change in vacancy and change in stock equals 0.29. Seven other correlations are significant as well. Overall, the correlations suggest that a multivariate analysis is interesting and maybe even essential for uncovering the determinants of real estate returns. However, some multicollinearity problems might be encountered due to these correlations.

2.6.2 Regression analysis

In Table 2.3, regression results are reported to investigate further the relation between returns on capital changes, macroeconomic conditions and supply and demand. In these regressions, changes in capital appraisals are regressed on changes in available stock, vacancy rate, GDP/GMP, unemployment rate and change in inflation. For the univariate regressions we correct for missing observations by deleting district-period observation for which the return variable or at least one of the regressors is non-observed in that particular regression. We centralize the variables around zero and standardize them by their standard deviations.

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[7] We further examined this hypothesis by regressing the rent yield on the inflation level and changes in the variables stock, vacancy rate, GDP/GMP, unemployment rate. We used the global universe. The variables were centralized around zero and standardized by their standard deviations. This facilitates their interpretation. We found that the change in vacancy rate and the inflation level affect the rent yield significantly negatively and positively, respectively, in the statistical sense. The magnitude of the parameter estimate of the latter was, however, about fifteen times larger. The other parameter estimates were insignificant. We used the random effect estimator.

[8] This conclusion is based on the fact that we model the cross-sectional variation in rent yield, while the findings for the change in capital value and change in rent are more related to the time-series dimension.

Table 2.3 Determinants of capital returns

Previous Period's Capital Return	ΔStock	ΔVacancy Rate	ΔGDP/GMP	ΔUnemployment Rate	ΔInflation
Panel A: Simple regressions: static panel					
	-0.034				
	(-1.22)				
		-0.231			
		(-9.38)			
			0.105		
			(4.13)		
				-0.250	
				(-10.7)	
					0.068
					(2.82)
Panel B: Multivariate regression: static panel					
	-0.002	-0.216	0.047	-0.066	-0.030
	(-0.06)	(-6.93)	(1.31)	(-2.18)	(-0.99)
Panel C: Multivariate regression: dynamic panel					
0.449	0.020	-0.055	0.133	-0.082	-0.006
(5.16)	(0.23)	(-3.43)	(1.65)	(-2.01)	(-0.48)

Notes. This table contains the parameter estimates of the regression of capital returns on potential determinants. Between parentheses are *t*-values. Panel A provides simple regressions. Panel B gives the multivariate regressions for the static panel-data model. Panel C shows estimation results for the dynamic panel-data model. All variables are centralized around their means and standardized by their standard deviation. This facilitates the interpretation of the magnitude of the parameter estimates. The number of office districts in the regression equals 46. The data period covers 56 quarters beginning in March 1986. We applied the random-effect estimator to obtain the results in Panels A and B. The GMM method is used to estimate the dynamic panel-data model in Panel C.

This facilitates their interpretation: the estimated effect of an increase in a macroeconomic variable or a demand and supply variable by one standard deviation equals the estimated parameter. This allows us to examine the economic significance alongside the statistical significance relatively easily. Panel A shows the univariate regression results using the random-effects specification. The findings are consistent with the tentative conclusions drawn from the correlations in Table 2.2. Capital returns are higher among the office districts that have positive changes in GDP/GMP and inflation. The unemployment rate is significantly negatively related to capital returns. These three variables, as proxy variables for economic growth, show that economic activity stimulates capital returns. The parameter estimate for the vacancy rate variable shows an increase in available office space has a relatively strong and significantly negative effect on capital rents. Only the magnitude of the parameter estimate for the unemployment rate variable is larger. Panels B and C contain coefficients obtained from multivariate regressions: Panel B, those from the static panel-data model and Panel C, from the dynamic panel-data model that allows for partial adjustment and lagged effects. The signs of the parameter estimates are the same as found in Panel B. However, the parameter estimate of the change in the inflation variable is not significant any more at all common significance levels. The coefficient of the GDP/GMP variable is only significant in Panel C at the ten percent level. The mentioned multicollinearity problem might cause this drop. The coefficients of the vacancy rate and unemployment rate variable are still significantly negative. The lagged dependent variable in Panel C appears to reflect partial adjustment or lagged response, but the inclusion of this variable alters the estimates and *t*-values in the regression only moderately.

Table 2.4 Determinants of changes in rents

Previous Period's Change in Rents	**ΔStock**	**ΔVacancy Rate**	**ΔGDP/GMP**	**ΔUnemployment Rate**	**ΔInflation**
Panel A: Simple regressions: static panel					
	-0.166 (-6.21)				
		-0.256 (-10.9)			
			0.092 (3.75)		
				-0.192 (-8.39)	
					-0.006 (-0.26)
Panel B: Multivariate regression: static panel					
	-0.126 (-4.17)	-0.259 (-8.73)	-0.014 (-0.48)	-0.050 (-1.72)	0.007 (0.24)
Panel C: Multivariate regression: dynamic panel					
0.496 (7.62)	-0.072 (-1.99)	-0.056 (-5.22)	0.065 (0.74)	-0.042 (-2.20)	0.001 (1.50)

Notes. This table contains the parameter estimates of the regression of changes in rents on potential determinants. Between parentheses are *t*-values. Panel A provides simple regressions. Panel B gives the multivariate regressions for the static panel-data model. Panel C shows estimation results for the dynamic panel-data model. All variables are centralized around their means and standardized by their standard deviation. This facilitates the interpretation of the magnitude of the parameter estimates. The number of office districts in the regression equals 46. The data period covers 56 quarters beginning in March 1986. We applied the random-effect estimator to obtain the results in Panels A and B. The GMM method is used to estimate the dynamic panel-data model in Panel C.

In Table 2.4, regression results are given to examine the relationship between changes in rents and macroeconomic indicators, supply and demand characteristics. The organization of the table is similar to Table 2.3. This also holds for the methodology. The regression analyses in Panel A show, in general, similar univariate relations as suggested by the correlations. An exception is, however, the coefficient of the change in the inflation variable, which is negative and insignificant. Panels B and C suggest a negative effect from a positive change both in available stock and in the vacancy rate on the rent variable. In office districts where office space is increasing and becoming less scarce, rent decreases. Panels B and C also suggest that lower unemployment stimulates increases in rent. In panel B the coefficient of the unemployment variable is significant at the ten percent level and in panel C at a five percent level. This is in line with expectations that rents increase due to a larger work force and potentially higher demand for office space. The coefficients of the GDP/GMP and change in inflation variable are insignificant at all conventional significance levels. The lagged dependent variable in Panel C appears to reflect partial adjustment or lagged response.

Table 2.5 Determinants of total returns

Previous Period's Total Return	**ΔStock**	**ΔVacancy Rate**	**ΔGDP/ GMP**	**ΔUnemployment Rate**	**Inflation Level**	**ΔInflation**
Panel A: Simple regressions: static panel						
	-0.058					
	(-1.99)					
		-0.222				
		(-9.59)				
			0.119			
			(4.66)			
				-0.230		
				(-10.0)		
					0.263	
					(2.52)	
						0.031
						(1.39)
Panel B: Multivariate regression: static panel						
	-0.015	-0.190	0.034	-0.046	0.424	0.023
	(-0.46)	(-6.89)	(0.96)	(-1.67)	(3.15)	(0.82)
Panel C: Multivariate regression: dynamic panel						
0.580	0.101	-0.044	0.360	-0.047	0.052	0.001
(6.73)	(1.43)	(-2.93)	(2.60)	(-1.01)	(3.96)	(0.52)

Notes. This table contains the parameter estimates of the regression of total returns on potential determinants. Between parentheses are *t*-values. Panel A provides simple regressions. Panel B gives the multivariate regressions for the static panel-data model. Panel C shows estimation results for the dynamic panel-data model. All variables are centralized around their means and standardized by their standard deviation. This facilitates the interpretation of the magnitude of the parameter estimates. The number of office districts in the regression equals 46. The data period covers 56 quarters beginning in March 1986. We applied the random-effect estimator to obtain the results in Panels A and B. The GMM method is used to estimate the dynamic panel-data model in Panel C.

In Table 2.5 regression results are provided to examine further the relation between the total returns from real estate and macroeconomic, supply and demand characteristics. The organization of the table is similar to Tables 2.3 and 2.4. The coefficients of the vacancy rate variable are significantly negative in all three panels. The scarcer office space becomes, the higher the total returns. This is consistent with our hypothesis. The unemployment variable enters with a negative sign in each of the three specifications, but is only statistically significant in Panel A at the five percent level and in Panel B at the ten percent level. The parameter estimate for the inflation level variable is positive and significant in the three panels. The lagged total return variable shows that total returns exhibit autocorrelation. This can be due either to the smoothing of capital appraisals or the constant character of rent yields, or both. In our case the inclusion of the lagged return variable leads to a material difference with respect to inference of the coefficient of the GDP/GMP variable. In Panel C the parameter estimate of the GDP/GMP variable is significantly positive. The findings for the unemployment variable, the inflation level and the GDP/GMP variable illustrate the positive effect of economic growth on total returns.

2.7 Conclusions

With respect to our hypotheses we can conclude that change in GDP/GMP and change in inflation positively affect changes in real estate prices. Furthermore, real estate prices are negatively influenced by changes in unemployment and vacancy rate. Only change in the stock variable seems to have no significant effect on changes in real estate prices. Rents are positively affected by changes in the GDP/GMP in a univariate content. Determinants that have a negative influence on the change in rent level are the change in stock, vacancy rate and unemployment. Change in inflation seems to have no direct influence on rents.

Vacancy rate change and change in unemployment have the most influence on change in the value of office buildings. The change in the value of an office building is, however, strongly related to change in value in the previous period. Rent changes are also strongly related to rent changes in previous quarters, therefore we can accept our hypothesis that: returns in real estate markets are persistent and there is a significant positive relationship between current return and return in the previous period. Overall we can conclude that change in the vacancy rate and in the unemployment rate are the most important indicators to include in a long term return analysis on a multi-national level.

Appendix 2.A Return components for each office district

Office district	Δ Capital value	ΔRent	Total returns
Asia			
Bangkok	1.80 [47]	2.08 [47]	5.17 [47]
Beijing	-10.07 [07]	-2.23 [47]	-4.93 [07]
Hong Kong Central	2.61 [50]	1.74 [50]	5.61 [50]
Hong Kong Tsimshatsui	-0.76 [35]	-2.35 [35]	2.01 [35]
Hong Kong Wanchai Causeway Bay	1.66 [35]	-1.05 [35]	4.92 [35]
Jakarta	5.73 [47]	4.24 [47]	8.49 [47]
Kuala Lumpur City Center	-2.62 [31]	4.22 [47]	1.23 [31]
Kuala Lumpur Decentralized Area	-0.91 [31]	2.06 [47]	2.57 [31]
Outside Of Kuala Lumpur City	-0.60 [31]	4.06 [47]	3.08 [31]
Manila Makati	6.44 [47]	7.48 [47]	9.84 [47]
Manila Ortigas	6.05 [47]	9.01 [47]	9.11 [47]
Shanghai Puxi	0.57 [28]	-4.46 [50]	11.75 [28]
Singapore Raffles Place	-4.31 [38]	2.38 [50]	-3.31 [38]
Europe			
Amsterdam	3.55 [54]	3.17 [54]	6.84 [54]
Antwerp	1.90 [42]	1.89 [42]	6.00 [42]
Barcelona	0.44 [40]	-0.37 [40]	4.07 [40]
Berlin	-1.42 [37]	-0.79 [37]	1.13 [37]
Brussels	2.01 [54]	1.91 [54]	5.35 [54]
Budapest	-0.58 [30]	-2.01 [30]	4.98 [30]
Dublin	5.07 [42]	3.89 [42]	7.13 [42]
Dusseldorf	1.27 [54]	1.33 [54]	3.66 [54]
Frankfurt	2.75 [54]	2.67 [54]	5.32 [54]
Hamburg	1.79 [54]	1.73 [54]	4.19 [54]
London City	0.51 [53]	0.63 [53]	3.26 [53]
London West End	1.82 [53]	2.45 [53]	4.25 [53]
Luxembourg	-0.59 [35]	-0.22 [35]	2.39 [35]
Lyon	0.25 [36]	0.98 [36]	4.75 [36]
Madrid	3.18 [48]	1.53 [48]	5.60 [48]
Milan	-1.56 [36]	-0.70 [40]	1.01 [36]
Munich	1.74 [48]	2.30 [53]	4.30 [48]
Paris Golden Triangle	-2.56 [38]	-0.16 [42]	0.41 [38]
Prague	-1.70 [30]	-3.63 [30]	3.83 [30]
Rotterdam	1.38 [54]	1.04 [54]	4.83 [54]
Stockholm	8.20 [24]	6.30 [24]	11.16 [24]
The Hague	1.56 [54]	1.32 [54]	4.93 [54]
Utrecht	2.16 [54]	1.88 [54]	5.57 [54]
Warsaw	-4.40 [15]	-4.23 [30]	1.47 [15]
US			
Atlanta	-0.16 [44]	0.25 [44]	8.37 [44]
Boston	0.48 [44]	1.64 [44]	7.87 [44]
Chicago	-0.66 [44]	0.63 [44]	6.34 [44]
Houston	1.71 [44]	2.47 [44]	9.81 [44]
Los Angeles	-1.42 [44]	-0.85 [44]	5.13 [44]
Manhattan	-0.01 [44]	0.72 [44]	7.25 [44]
San Francisco	0.85 [44]	2.82 [44]	7.89 [44]
Seattle	1.81 [44]	2.32 [44]	8.92 [44]
Washington	1.16 [44]	0.91 [44]	7.56 [44]

Notes. This appendix contains annualized return components for each region in our database. The returns are in percentages. The symbol Δ denotes that the change of the variable is used. The number of available quarters is given between brackets.

Chapter 3

GLOBAL RISK PREMIUMS ON DIRECT OFFICE REAL ESTATE RETURNS

3.1 Introduction

The risk premium is a key factor in the real estate investment decision-making process. This risk premium should reflect compensation for the risk taken relative to the return on a risk-free alternative. The magnitude of direct real estate risk premiums is, however, often hard to quantify because of the limited data available for direct real estate. The analysis of risk premiums over time and across continents is even less documented. These issues are addressed in the stock market literature (see, for example, Chan et al., 1992; Freeman and Davidson, 1999; Asness, 2000; Fama and French, 2002; Ilmanen, 2003). Most of the relevant real estate studies focus on establishing the risk premium for real estate investment trusts (REITs) (see, for example Swanson et al., 2002) and on the factors that influence real estate returns and risk premiums (see, Bond, Karolyi, and Sanders, 2003; Liu and Mei, 1992). Ling and Naranjo (1997), and Ling and Naranjo (1999) analyze the factors influencing the risk premium for direct real estate. Other studies on direct real estate include Geltner (1993), which reports a historical total return risk premium of 1.3% for the US between 1978–1991. In this chapter, the risk premium is calculated as the difference between the historical total return on the NCREIF index and a risk free alternative. Chau (1997) analyzes the relation between risk premiums in Hong Kong and political uncertainty, addressing economic and real estate indicators. A study by Tarbert and Marney (1999) focuses on the risk premiums for direct real estate in the United Kingdom. They examine the differential between actual returns on property and gilts.

There are two approaches that can be adopted to determine risk premiums for an asset class. The first method is to compare the realized returns on the asset class with the risk-free rate. These risk premiums are called ex-post and can be considered as estimates for the expected future risk premiums. The ex-post risk premium is measured using historical returns on real estate. This is the historical return for each city minus the risk-free rate for the country. Since the historical data are on a quarterly basis, we subtract a country specific 3-month rate, e.g. that on Treasury Bills, as the appropriate risk free rate as applied in Brown and Matysiak (2000). Many people argue that the historical risk premium, if measured over a long enough time span, gives an unbiased estimate of the prospective premium. Equity research suggests that academics expects typically subscribe to this view, and that their own forecasts are heavily influenced by the historical record. Therefore, research by Dimson, March and Staunton (2002) leads to the question of whether a historical risk premium really does provides a reasonable estimate of the prospective premium. In their research they also argue that there could be transition periods where historical risk premium may be different from expectations.[9] They conclude that it is therefore important not to extrapolate unadjusted, historical equity premiums into the future. Rather, one should use historical means of informing the quest for a sensible estimate of the forward-looking risk premium. In addition, since direct real estate return data are only available for a relatively short time period, the results become more sensitive to the period examined.[10] This is especially important if there are relatively big differences between expected future scenarios for the economy and realized scenarios. To take into consideration these difficulties with the ex-post risk premium calculation, we also apply a second method of measuring the risk premium. This second method estimates forward looking or ex-ante risk premiums by using the information in current valuations and applying valuation models. The valuation model that we use is based on the present value of an infinite sequence of cash flows. As described by Geltner and Miller (2001) "In general, the constant-growth perpetuity model

[9] "Other things being equal, the higher the required risk premium, the lower the value on the stream of cash flows. So when the required risk premium goes up, the realized risk premium is reduced over the transition period. Conversely, when the required premium goes down, the historical risk premium will be larger over the transition period. Once the transition is complete, of course, equity returns will have an expected return that reflects the new required risk premium. Since transitions from a high to a lower required risk premium may occupy many years, the historical premium may overstate consensus expectations." Dimson, March and Staunton (2002)

[10] "In a valuation framework the risk premium should be forward-looking, reflecting the uncertainty of future cash flows. This is consistent with using the risk premium to estimate the expected value of an asset. In practice, however, historic estimates are usually taken as the starting point to estimate the expected risk premium. The realized market risk premium is simply the difference between the return on the risky portfolio and the risk-free return measured over the same period" Brown and Matysiak (2000).

represents a basic way to understand the value of any infinitely lived income-producing asset, as a relationship among current level of net cash flow produced by the asset, the likely long term average rate of growth in that cash flow, and the expected annual total return required by the investors in that asset. As such, this model is broadly applicable to commercial property and provides a basic understanding of the cap rate, defined as the current annual income divided by the value of the property". The advantage of using valuation models is that the risk premium can be interpreted as an ex-ante risk premium that is consistent with historical and current prices. The ex-ante risk premium is then defined as the differential between the internal rate of return that equates the current value of the real estate to model outcome, and a long-term government bond yield. Critical for the valuation model is the incorporation of the growth in income. The first valuation model, based on Gordon's growth model, allows the income stream to be reviewed once every year (see Brown and Matysiak, 2000). This assumption is based on indexation of rents which are reviewed once a year. The second model, the two-stage growth model, allows income to grow at the short term rate and have a long term growth component. This could be the case if income growth at the initial phase is different from the stable growth rate for the long term (for example if there are value enhancing investments necessary at acquisition). However, since rents are not always reviewed annually in all countries (see Chapter 4), the valuation models based on Gordon's growth model and two-stage growth model might not always be applicable. The valuation based on the period growth model allows the number of years between rent reviews to differ. Furthermore, to keep our conclusions independent of the choice of the valuation model, we examine all three different models: a variant of Gordon's growth model, two-stage growth model, and periodic growth model. The latter has been applied by Fraser (1993), Brown and Matysiak (2000) and McGough and Tsolacos (2001).

Eichholtz and Koedijk (1996), Eichholtz, et al. (1998), Liu and Mei (1998), and Ling and Naranjo (2002) studied the impact of country-specific and region-specific factors on listed international real estate securities. This chapter analyzes risk premiums for direct real estate at a global level and compares risk premiums between regions. We have constructed a global investment universe that includes office districts in 60 cities, located in 24 different countries. These countries cover most of the world's developed markets as well as emerging markets. The sample period is from the first quarter of 1988 through the fourth quarter of 2004.

The data show that risk premiums differ systematically across regions. Moreover, risk premiums seem to be time dependent. At a global level they trended positively from about one and a half percent in 1988 to about five percent at the end of 2004, mainly as a result of the decline in the yield of the risk-free alternative over the same period. To explain variation in risk premiums we link risk factors that are specific to the bond market and the equity market to the office real estate risk premium. Specifically, we show that the risk premium on real estate decreases if interest rates become more volatile, and if the global equity market becomes more volatile. This could indicate that real estate is considered to be a safe haven in periods of relatively high uncertainty. Investors turn to real estate when equity markets and bond markets become more volatile. Furthermore, we find that increased volatility in the real estate yield and office-rent income is positively related to risk premiums. These findings support the idea that investors require a higher return for increased uncertainty.

The global average risk premium for Gordon's growth and two-stage growth model is 3.8% for the equally weighted aggregation and 2.7% and 2.8% for the stock weighted aggregation. The periodic growth model is 3.3% and 2.4% for the equally and stock weighted models.

The remainder of this chapter is organized as follows. Section 3.2 provides an overview of the data that have been obtained and gives descriptive statistics. Section 3.3 describes the methodology that we have applied to calculate the risk premiums. In section 3.4 we analyze the results and relate our findings to the direct real estate market in each region. Section 3.5 states our conclusions.

3.2 Data

Our data set consists of real estate data, equity indices, and macro-economic variables. The real estate database consists of 60 major office districts in cities in Asia/Pacific (15), Europe (25) and the United States (20) on a quarterly basis from the first quarter of 1988 through the last quarter of 2004. The cities are selected based on the quality and availability of data, size of the office space market and economic importance for the surrounding region.

All the real estate indicators for Asia/Pacific and Europe were provided by Jones Lang LaSalle, as published in their real estate market reports. For the twenty office districts in the United States rent (income) and percentage quarterly change in market value per square feet (appreciation) are obtained from the National Council of Real Estate Investment Fiduciaries (NCREIF) index. Torto Wheaton subscribers' services provided vacancy rate and stock data for twenty central business districts for the selected MSAs in the United States. These data providers have been selected to create a consistent data set, in order to make a global analysis possible.

The Asian/Pacific and European real estate indicators in the data set are local net rent per square meter, capital value or price per square meter, initial yield (rent/capital value), vacancy rate, and stock. Local net rent is the average effective rent per square meter observed or reported for the Central Business District (CBD) or for high quality investment grade office property in local currency.

Unless otherwise stated, all our variables are in local currency. Capital value or price is the average price per square meter of prime office space in the CBD, based on transactions in each time period. Initial yield is calculated by dividing the net rent by the capital value. For the U.S., we extracted the real estate indicators from the NCREIF database using total returns, income returns, appreciation returns, and price per square foot for all office properties in an MSA.[11] Vacancy rate is rentable space as a percentage of total inventory of the main office space. Vacancy includes all space on the market for rent; this includes the so called "shadow-space" or space available for sub-lease. Stock is the total inventory or net rentable area of commercial office space in the office district in a city, in square meters.

Appendix 3.A gives an overview of the selected cities. The table shows statistics on average initial yield for office properties (Yield), average yield on the long-term government bond (Long-Term Bond Yield), and the average inflation rate (Inflation rate). Initial yield, government bond yield and inflation rate are used to determine risk premiums as described in the methodology section. The table also provides standard deviations for the real estate yield, long term bond yield and inflation rate (σ Yield, σ Long-Term Bond Yield and σ Inflation Rate). The number of quarterly yield observations is in parentheses.

Table 3.1 provides descriptive statistics for Asia, Australia, Europe, and the U.S., constructed from the 60 office markets in major cities. Figure 3.1 gives the calculated total return index for Asia, Australia, Europe, and the U.S. Over this period, Australia and Asia outperform Europe and the U.S., while the Asian crisis had a very big impact on the total return after the second quarter of 1997. Within the period, Asia outperforms until 1999 and Australia outperforms after 2000.

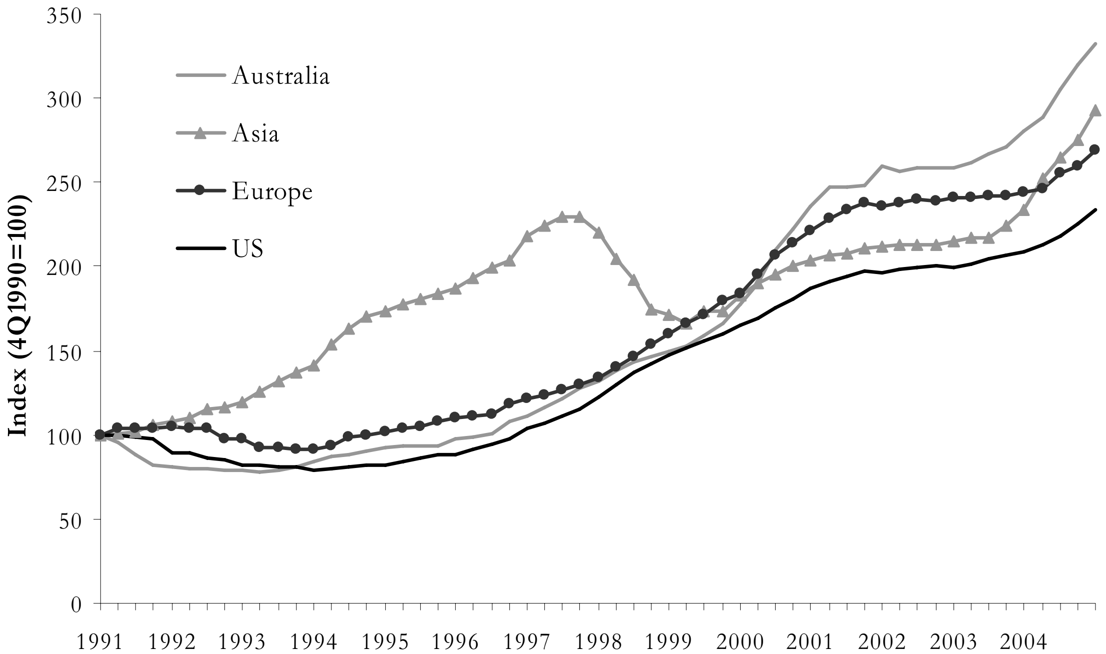
[11] The return information from the NCREIF Property Index is the source most frequently used in research to calculate the risk premium for the U.S. Furthermore, we also calculate the ex-ante risk premium for the U.S. using datasets constructed from the National Real Estate Index and use rent data from Torto Wheaton Research, see footnote 19.

Table 3.1 Summary statistics

	Asia [# 556]		Australia [# 408]		Europe [#1523]		U.S. [#1360]	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Real Estate Yield	9.04%	5.72%	8.10%	1.32%	6.69%	1.64%	7.99%	1.65%
Total Return	2.81%	7.71%	2.19%	5.06%	2.16%	5.40%	1.38%	3.60%
Long Term Bond Yield	9.68%	6.01%	7.19%	1.78%	7.26%	4.16%	6.28%	1.47%
Inflation Rate	4.17%	6.73%	2.48%	1.55%	3.08%	3.46%	3.01%	1.46%

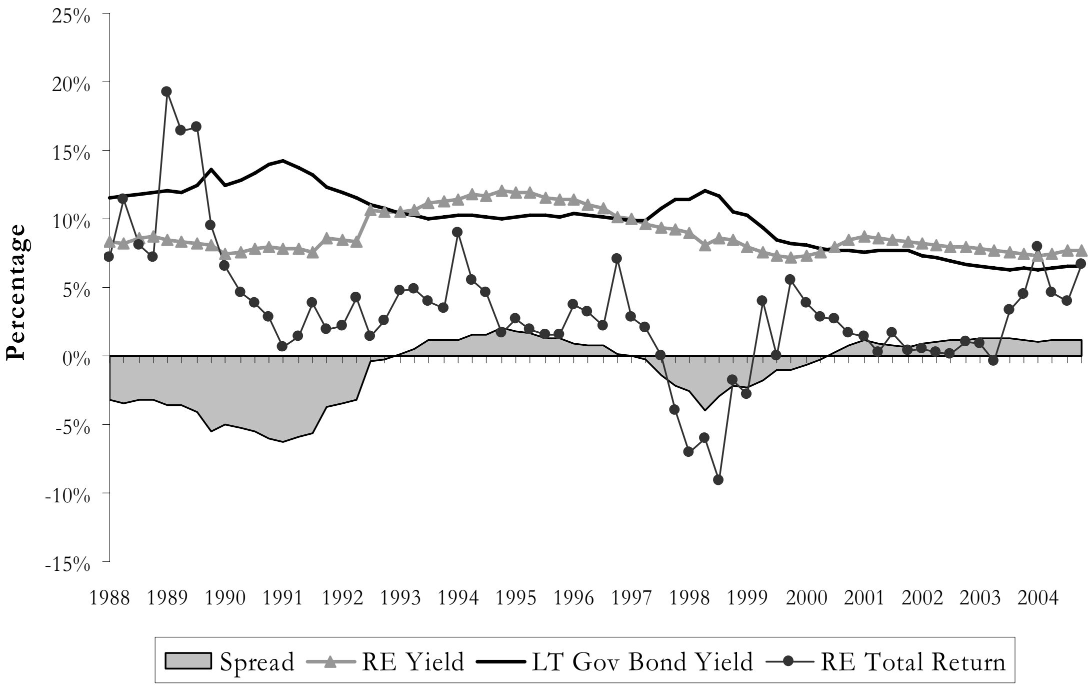
Notes. This table contains the means and standard deviations of the office real estate yield, quarterly total return, long term bond yield, and inflation rate. The statistics were obtained after pooling all observations over the whole time-series. The period ranges from 1Q1988 through 4Q2004. The number of observations is given between brackets.

Figure 3.1 Total return index by region (4Q1990–4Q2004)



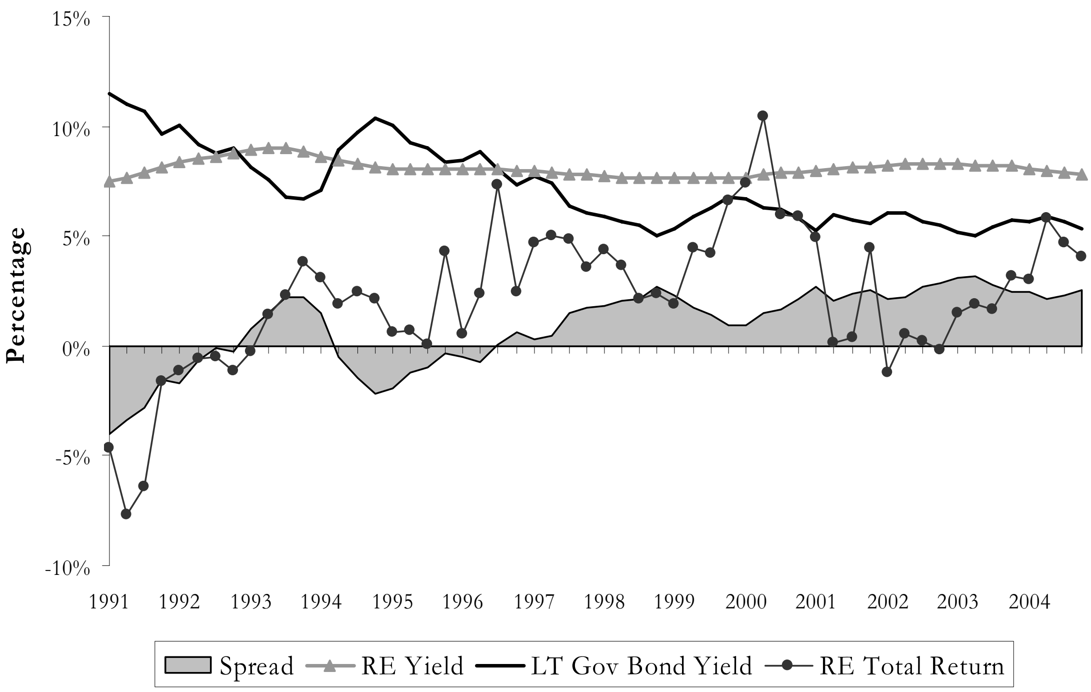
Notes. The total return series are calculated from Jones Lang LaSalle rent and yield data for Asia, Australia, and Europe; the NCREIF total return index for the 20 MSAs is used for the U.S. The average return per region is the average of the total return per office district included in our study. 4Q1990 is base year and is equal to 100. The total return indices created start in 4Q1990 because there are no return data in the dataset for Australia before 4Q1990.

Figure 3.2 Yield and return for Asia (1Q1988–4Q2004)



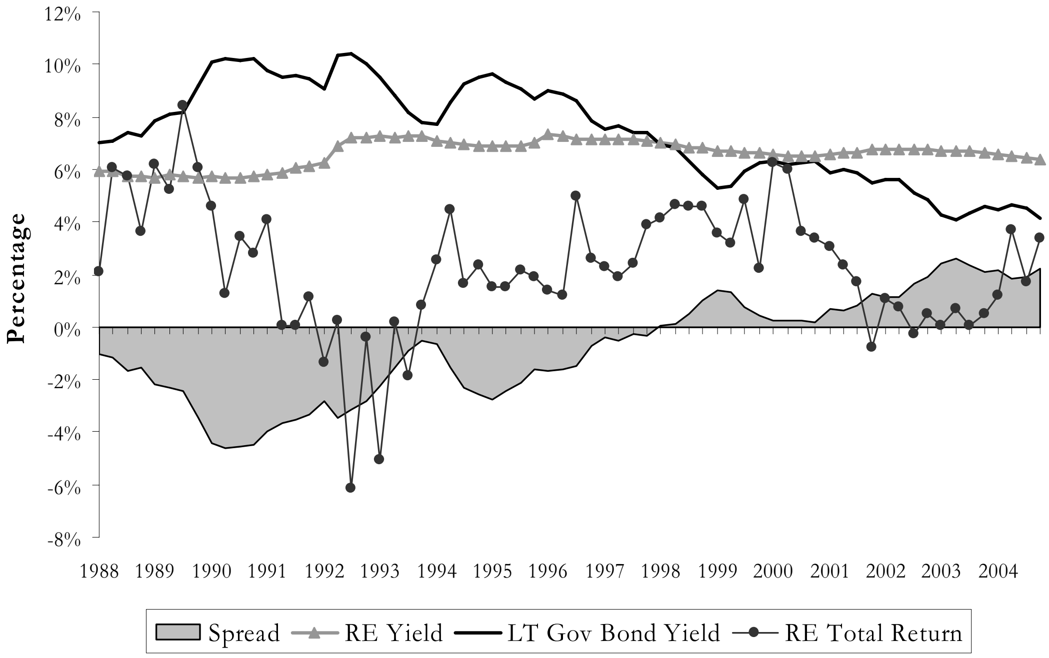
Notes. Spread is the yield on office real estate in Asia, minus the yield on long term government bonds. RE Yield is the average office real estate yield for Asian cities in the dataset, LT Gov. Bond Yield is the average long term government bond yield. Real estate total return represents the average equally weighted total return for office markets in Asia.

Figure 3.3 Yield and return for Australia (1Q1990–4Q2004)



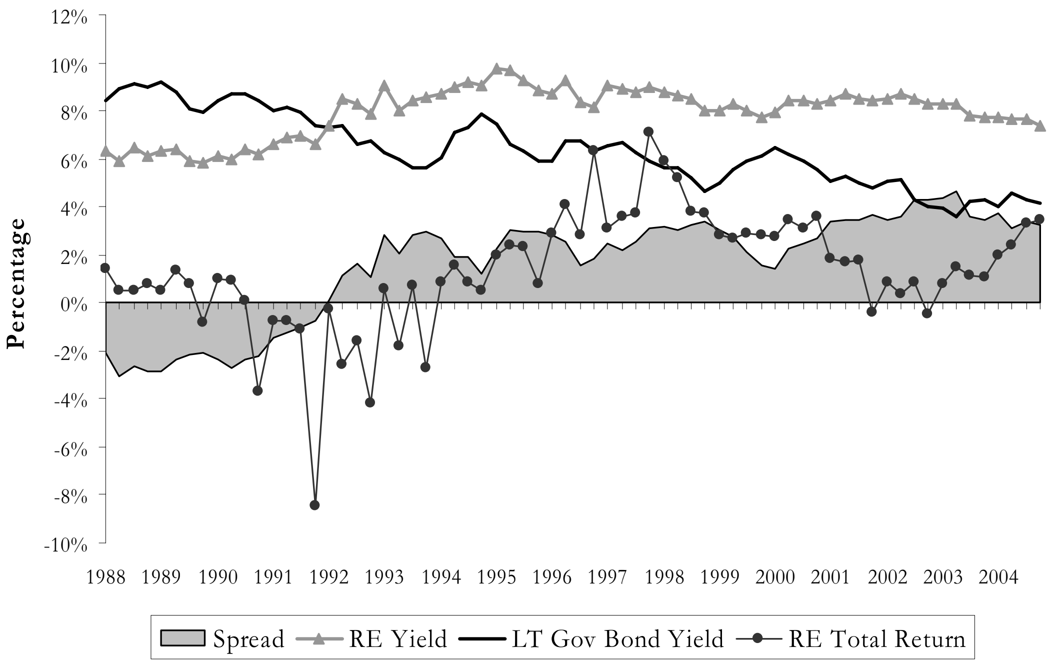
Notes. Spread is the yield on office real estate in Australia, minus the yield on long term government bonds. RE Yield is the average office real estate yield for Australian cities in the dataset, LT Gov. Bond Yield is the average long term government bond yield. Real estate total return represents the average equally weighted total return for office markets in Australia.

Figure 3.4 Yield and return for Europe (1Q1988–4Q2004)



Notes. Spread is the yield on office real estate in Europe, minus the yield on long term government bonds. RE Yield is the average office real estate yield for European cities in the dataset, LT Gov. Bond Yield is the average long term government bond yield. Real estate total return represents the average equally weighted total return for office markets in Europe.

Figure 3.5 Yield and return for the U.S. (1Q1988–4Q2004)



Notes. Spread is the yield on office real estate in the U.S., minus the yield on long term government bonds. RE Yield is the average office real estate yield for the U.S. cities in the dataset, LT Gov. Bond Yield is the average long term government bond yield. Real estate total return represents the average equally weighted total return for office markets in the U.S.

This is confirmed if we look at the first descriptive analysis (see figure 3.2) for Asia. It indicates a very big impact from the Asian crisis, with a negative spread between yield on office real estate versus yield on long term government bond. The rising office real estate yield immediately after the Asian-crisis could indicate that capital values adjusted quicker than office rents.

Figure 3.3 shows the yield and return indicators for Australia, where the office real estate yield seems to be very stable and the long term interest rate shows a declining trend. This results in a positive spread between office real estate yield and long term government bonds from end-1996.

Figure 3.4 shows the average yield and return for office markets in Europe. The average European office real estate yield is lower than the other regions, mainly as a result of relatively low yields in Germany and low yields in very supply-constrained office markets. The average government bond yield has declined; this has occurred at an even faster rate as yields in Central European countries started to converge toward government bond yields in countries that were already part of the European Union monetary system. Figure 3.5 shows the average yield and return for office markets in the 20 selected MSAs in the U.S. We can see that the spread between the office real estate yield and government bond yield is positive after 1992. Moreover, the spread increased as result of a faster decline in the government bond yield versus the average office real estate yield.

For Australia, Asia, and Europe country-specific data for short and long-term government bond yields, consumer price inflation, gross domestic product, and unemployment rates were obtained from Thomson Financial Datastream. Economic data for the U.S. are provided by Economy.com on an MSA level for consumer price index, gross metropolitan product, and unemployment. We used the Morgan Stanley Capital International (MSCI) total return equity indices for Asia, Australia, Europe, the United States and the global universe for measuring the influence of the equity market.

3.3 Methodology

3.3.1 Risk premium model

The risk premium is the required rate of return on the real estate investment, $R_{Real\ estate}$, minus that on a risk-free alternative. [12] This gives

$$Risk\ premium_{iq} = R_{Real\ estate,\ iq} - R_{Risk\ free\ rate,\ iq}, \tag{3.1}$$

where *i* represents the real estate office market in a city/MSA for quarter *q*. There are two methods for identifying the risk premium [13], ex-post or ex-ante. The ex-post risk premium is measured using historical returns on real estate. This is the historical return for each city minus the risk-free rate for the country. Since the historical data are on a quarterly basis we subtract a country specific 3-month rate, e.g. Treasury Bill, as the appropriate risk-free rate as applied in Brown and Matysiak (2000). The ex-ante risk premium is forward looking and is the expected total return of a given asset over a future period minus the return one could earn during that period from investing in a riskless asset (see Geltner and Miller, 2001). The ex-ante risk premium is based on valuation models to estimate the appropriate required rate of return for real estate. In this study, we will apply three alternative valuation models and report our results for each of the models. We examine (I) Gordon's growth model, (II) a two-stage valuation model, and (III) the periodic growth model presented in Fraser (1993), Brown and Matysiak (2000) and McGough and Tsolacos (2001). The periodic growth model adjusts the basic discount cash flow model for real estate by assuming that long term leases are subject to periodic rent reviews.

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[12] The choice of risk-free rate needs to match the holding period of the investment returns. For example, if you are measuring returns annually, then the appropriate ex-post risk-free rate of return needs to coincide with a one-year holding period. The ex-post risk-premium is calculated using quarterly returns. The appropriate risk-free rate employed is the return on Treasury Bills over three months. The ex-ante risk premium is forward-looking and therefore it is suggested that the risk premium is estimated using the expected long-term return on the market less the long-term risk-free rate (see Brown and Matysiak, 2000).

[13] An alternative method is to determine the market risk premium as the difference between the return on the market and the interest rate, where the market portfolio has a beta of 1.0 and an expected risk premium of r_m - r_f. The capital asset pricing model states that the expected risk premium on each investment is proportional to its beta (Brealey and Myers, 1996).

Method I: Gordon's growth model

Gordon's growth model is frequently found in the financial literature, especially in the context of equity and firm valuation. The model can be applied to value an asset if the asset generates relatively stable income to infinity. The Gordon growth model is also known as a single-stage discount model since current growth is assumed to continue forever. If the cash flows, i.e. property rents, are expected to grow at a constant rate g, then the model equates the capital value or price of office real estate, P_{iq}, in city i and quarter q in the following manner,

$$P_{iq} = \frac{Rent_{iq} \cdot (1 + g_{iq})}{R_{Real\ estate,\ iq} - g_{iq}}, \tag{3.2}$$

where,

P_{iq} = price of real estate,
$Rent_{iq}$ = the initial property rent,
g_{iq} = growth rate of rent in perpetuity,
$R_{Real\ estate,\ iq}$ = required rate of return on the investment in real estate.

For ease of notation, we drop the subscripts i and q. Rewriting (3.2) gives,

$$R_{Real\ estate} = \frac{Rent \cdot (1 + g)}{P} + g\,. \tag{3.3}$$

Although the form of the equation is simple, actually using this Gordon growth formula is not straightforward since it requires a value for the expected growth rate g. The expected growth rate of rents g is intrinsically unknown. To measure expected long term growth we need to analyze how expectations are formed. There is a substantial amount of literature on the theory of expectation formation and the measurement of expected price changes. Examples of research on estimating expectations include Dougherty and Van Order (1982), Harris (1989) and Hendershott and Hu (1981). For the purpose of this study, the assumption that people's expectation about future rental price changes depend on historical and current rental price has been used. In order to estimate the expected long-term rental growth, long term real estate rental price series are required.[14] Long term

[14] In addition, expected rent growth should reflect expectations about economic growth and contract renewals. Besides economic developments, future deterioration and obsolescence of buildings affect growth rates of rents. For example, requirements for the exterior, services and space configuration change over time.

rental growth series are not available for the specific property type and countries in our dataset. As a result, in this chapter (similar to, for example, Chau, 1997 and Brown and Matysiak, 2000), expected long-term rental growth is assumed to be not significantly different from expected long term inflation[15], assuming a real rental growth close to zero. Expected rental growth is estimated as the moving average of the annual current and historical percentage change in the consumer price index (CPI). It is difficult to determine the number of periods for the moving average. Moving averages of different quarters are used, but since most rent contracts contain inflation corrections, this would support the use of the last 12 months inflation rate as growth estimate. We use the percentage four-quarter change in the CPI of the country or MSA in which the office market is located as an estimate of inflation.

Method II: Two-stage growth model

The two-stage growth model assumes that future cash flows will first grow at a growth rate equal to g_1 and thereafter at a growth rate equal to g_2 forever. If we define T as the number of quarters in which the cash flows grow at a rate equal to g_1 then the theoretical or fair value of real estate equals,

$$P = \sum_{t=1}^{T} \frac{Rent \cdot (1+g_1)^t}{(1+R_{Real\ estate})^t} + \frac{Rent \cdot (1+g_1)^T \cdot (1+g_2)}{(R_{Real\ estate} - g_2) \cdot (1+R_{Real\ estate})^T} . \tag{3.4}$$

Given (3.4) and estimates of the price of real estate, rent and future growth rates, numerical algorithms provide $R_{Real\ estate}$, i.e. the implied cost of capital. For each city district we estimate short-term growth using our 12-month realized inflation for the city district. For the long-term growth estimate, we use an estimate of world inflation, which is the stock weighted average of the city-district inflation estimates. Consequently, we assume that long-term growth or long-term inflation is the same for all region districts. Equation (3.4) requires an assumption of T. We use T= 20 quarters (5 years). To test the robustness of our conclusions, we also examine T=30 and T=40. Our conclusions about the determinants of the risk premiums, which we report in the next section, remain the same.

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[15] Brown and Matysiak (2000) suggest that a proxy of the growth rate is inflation, based on the assumption that property is likely to hedge against inflation over long periods. Further evidence suggests that property is a better hedge against inflation in the longer term, rather than in the short term.

Method III: Periodic growth model

The third valuation model we examine is the periodic growth model,

$$P = \frac{Rent}{R_{Real\ estate} - R_{Real\ estate} \cdot \left(\frac{(1+g)^{T^*} - 1}{(1+R_{Real\ estate})^{T^*} - 1} \right)} \tag{3.5}$$

where T^* is the period between two rent reviews and g is a constant growth rate. We again use the city-specific inflation rate as an estimate for the constant growth rate. Similar to (3.4), solving for $R_{Real\ estate}$ requires the use of a numerical procedure. The main difference from the Gordon growth model is that (3.5) assumes that the rents are not adjusted each period, but only once in T^* periods. We use $T^*=20$ quarters, which implies that we assume that, on average, rents are adjusted every five years. As a robustness check we also study $T^*=30$ and $T^*=40$. Our conclusions about the determinants of the risk premiums, which we report in the next section, remain the same.

Comparing the three models

The Gordon's growth model and the period growth model are used most to analyze the ex-ante risk premium and yield for real estate in existing literature. The Gordon's growth model is used because of the inflation indexation component in rent contracts, which should result in annual rent reviews with a growth factor equal to the inflation rate. However, while this holds within the lease contract period, the rent level will in most cases be adjusted to the market rent at the time of negotiation of a new lease. In addition, the re-adjustment to market rent might change the cash flow of large portfolios due to frequent ending and starting of new lease contracts. The period growth model assumes a rent review period after which rents are reviewed and adjusted. However, the review period might change or be different and the review period only holds within the duration of the lease contract. Since it is not fully clear from the literature which model to select, we do not assume ex-ante a preference for one model above the other models. Ideally, our results and conclusions should be similar for each model. However, as these models calculate the required rate of return in different ways, we can expect differences in the results. The main difference between Gordon's growth model and the two-stage growth model is that in Gordon's model the growth rate is only a function of the inflation in the country where the city is located. In the two-stage model the growth rate is, alongside the country-specific growth rate g_1, also the result of the long-term growth rate g_2. The long-term growth rate is based on an estimated world inflation rate. As a result we would expect that Gordon's growth model gives higher required rate of return estimates than the two-stage model if a country has a higher inflation rate than world inflation. The two-stage growth model gives higher required rate of return estimates if the inflation in a country is lower than world inflation.

The periodic growth model assumes that rent and growth rates are not adjusted each quarter, but once every five years. This means that in an environment of high rent growth rates, Gordon's growth model and two-stage growth model should have higher required rate of return estimates than the periodic growth model. The increase is adjusted immediately in the required rate of return in Gordon's growth model and the two-stage growth model, whereas the periodic growth model assumes a constant growth for five years and then makes a jump to the new rent and growth level.

3.3.2 Determinants of the risk premium

As documented in the literature, real estate returns and the risk premium for real estate are impacted by various economic and real estate market risk factors. This relationship is expressed by the Arbitrage Pricing Theory (APT) and assumes that the expected risk premium depends on the sensitivity to a number of factors (Brealey and Myers, 1996). Literature finds that the risk premium for real estate is impacted by changes in economic, real estate, bond, and equity market variables (Karolyi and Sanders, 1998; Gyourko and Keim, 1992) on a local and global level (Griffin, 2002; Bond, Karolyi, and Sanders, 2003). We will analyze the impact of the volatility of these variables on the ex-ante risk premiums calculated by using three different models: Gordon's growth, two-stage growth, and periodic growth model.

In addition to deriving estimates for the average global risk premium, the main goal of this chapter is to explain changes in risk premiums over time and the differences across the regions. For this purpose we use a standard time-series regression technique at the regional level. Time-series of the region-specific risk premiums and explanatory variables are constructed by aggregating city-specific data to region-specific data. The aggregation is done is two ways: equally weighted and stock weighted.[16] The time series model in first differences is given by,

$$\Delta\, Risk\ premium_{sq} = \beta_{0s} + \beta_1 \cdot \Delta x_{1sq} + \ldots + \beta_K \cdot \Delta x_{Ksq} + e_{sq}\,, \tag{3.6}$$

[16] We opted for aggregating over the city-districts within a region to account for the fact that some of the exogenous variables are region-specific. We imposed the restriction that the parameters (or factor risk premiums) are constant across the regions, since the time-series is too short to allow for region-specific parameters (or factor risk premiums). We take first differences to derive a regression model in which the exogenous and endogenous variables are stationary series.

where x_{ksq} is the observable variable k in quarter q for region s, k=1,…,K and e_{sq} is the error term. The symbol s denotes the series for Australia, Asia, Europe and the United States. β_{0s} and β_k are parameters. The symbol Δ indicates that we take the first differences of a variable. We assume further that $E(e_{nq}\cdot e_{mt})=\sigma_n\sigma_m$ if $q=t$ and $E(e_{nq}\cdot e_{mt})=0$ if $q\neq t$, where E is the expectation operator. Hence, the model allows the error terms to be contemporaneously correlated across the sectors; a global shock might impact all regions at the same time.

Note that each region has its own constant, which allows for region-specific factors that are not among the exogenous variables. Since the model is stated in first differences, the constants pick up the observed trends in risk premiums. A two-stage Seemingly Unrelated Regression estimation technique (SUR) is applied to estimate the model parameters. If we use stock-weighted variables, we also weigh—within the estimation process—each of the four time series with their region-specific stock weights.

In this chapter, we examine the following potential determinants of the risk premium: (i) vacancy rate, (ii) variation in employment rate, (iii) variation in inflation, (iv) variation in interest rate, (v) variation in initial yield, (vi) variation in percentage changes in capital value, (vii) variation in percentage changes in rent, (viii) region-specific variation in equity prices, and (ix) variation in global equity prices. The last variable is obtained after filtering global effects on regional equity prices.[17] The vacancy rate variable is examined to test the influence of demand and supply effects on the risk premium. Variation in the variables is approximated by their time-varying standard deviation measured over the previous 12 quarters (3 years).

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[17] The region-specific changes in equity prices are the residuals of the regression of the region-specific equity return on the global equity return.

3.4 Results

3.4.1 Ex-post risk premium

Table 3.2 Calculated ex-post risk premium for the regions and the aggregate

	Asia	Australia	Europe	U.S.	All Regions
			Average		
Equally Weighted	6.14%	0.21%	2.58%	0.77%	1.99%
Stock Weighted	2.21%	1.33%	1.83%	1.31%	1.36%
			Standard deviation		
Equally Weighted	9.4%	6.9%	5.4%	5.0%	4.0%
Stock Weighted	8.7%	8.0%	6.5%	5.5%	5.2%

Notes. This table shows the result of the calculated ex-post risk premiums. The risk premium is the average return on the real estate investment, $R_{Real\ estate}$, minus a risk-free alternative. We use country-specific three month Treasury Bill yields as a proxy for the risk free rate.2 $Risk\ premium_{iq} = R_{Real\ estate,\ iq} - R_{Risk\ free\ rate,\ iq}$, where city/country i and quarter q.

Table 3.2 gives the average ex-post risk premium by region. For Asia the equally weighted risk premium is 6.14% and the stock weighted risk premium is 2.21%. The difference between the two risk premiums can be explained by the size of the Tokyo office market. This office market is the largest in Asia and has a lower risk premium. It also reduces the risk as measured by standard deviation. Figure 3.6 gives the excess returns[18] for Asia between 1988–2004, where the negative excess returns after 1997 show the impact of the Asian crisis. Table 3.2 shows that both the equally and stock-weighted risk premiums for Australia are relatively close to the U.S. risk premium. Also both regions show a higher stock weighted than equally weighted ex-post risk premium, indicating that in these regions the larger cities have more volatile returns. This is confirmed by the standard deviation for the regions. Europe has a risk premium between Asia and Australia/the U.S. The standard deviation, however, is a little higher than the U.S., but lower than Australia. The average equally weighted risk premium for Europe is higher than the stock weighted risk premium, showing that the bigger office markets have a lower risk premium. This is the opposite for the U.S., where the equally weighted risk premium is lower than the stock weighted risk premium. This shows that the office markets in larger cities/MSAs have a higher risk premium. The average stock weighted risk premium for the U.S. is the lowest among all regions. The stock

[18] The excess return in a period is the total return on direct real estate in an city or MSA minus the risk-free alternative (country specific three month interest rate, e.g. Treasury Bill).

weighted average risk premium on office in the U.S. is the same as that found by Geltner (1993). The global (i.e. all regions) equally and stock weighted average risk premiums are 1.99% and 1.36%, respectively. The all regions or global risk premium has a lower standard deviation than any individual region by itself, showing the diversification benefits of investing across various regions. Over time the excess returns in figure 3.10 for the all regions are in line with Australia, Europe, and the U.S. (figures 3.7–3.9), where the excess returns are negative at the beginning of the nineties and for a period after the third quarter of 2001.

Figure 3.6 Excess return for Asia

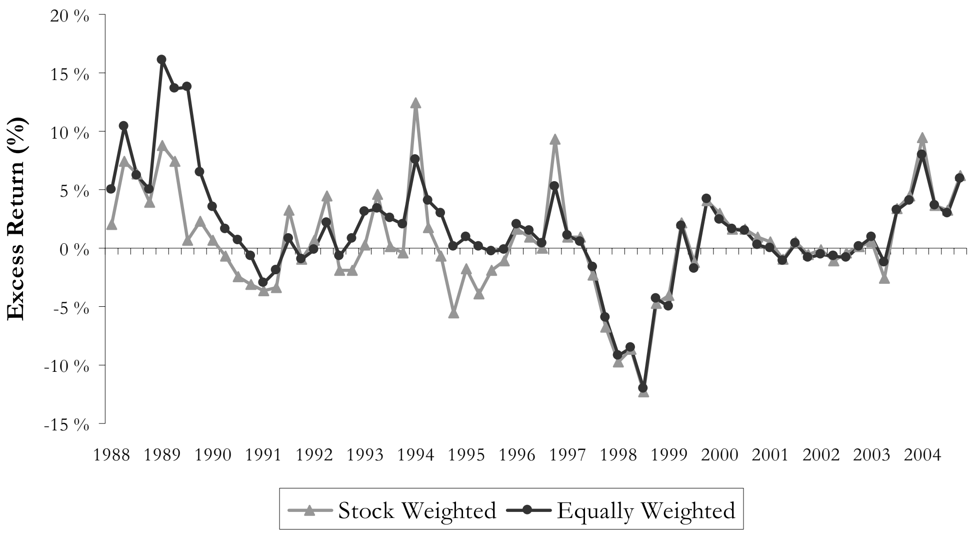


Figure 3.7 Excess return for Australia

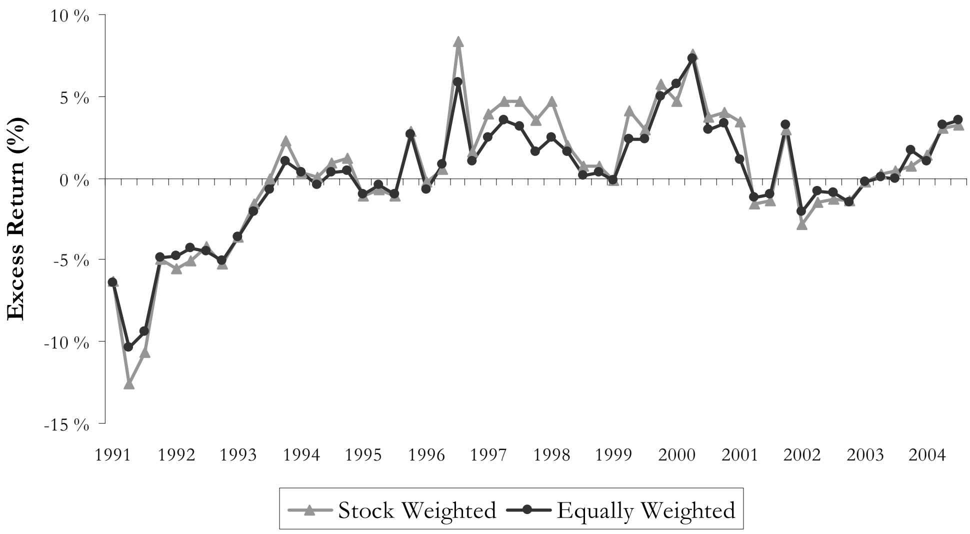


Figure 3.8 Excess return for Europe

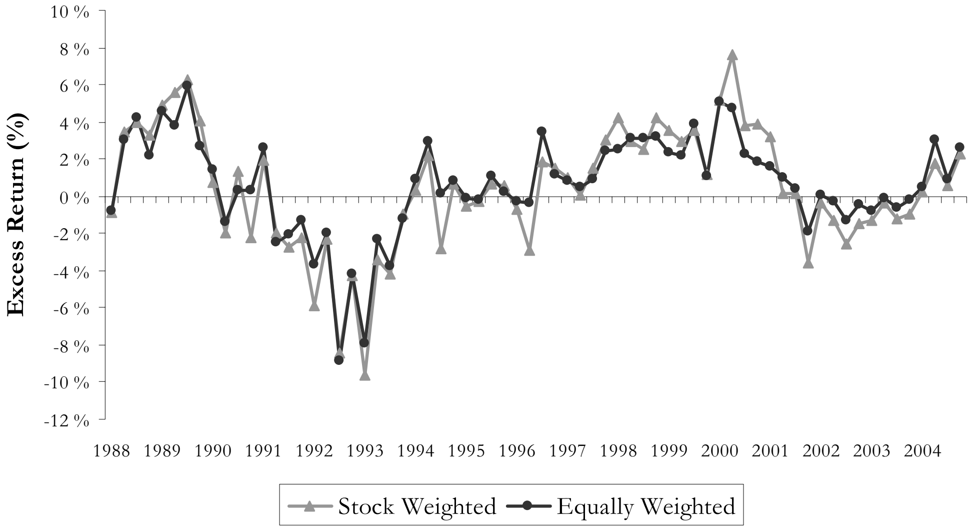


Figure 3.9 Excess return for the United States

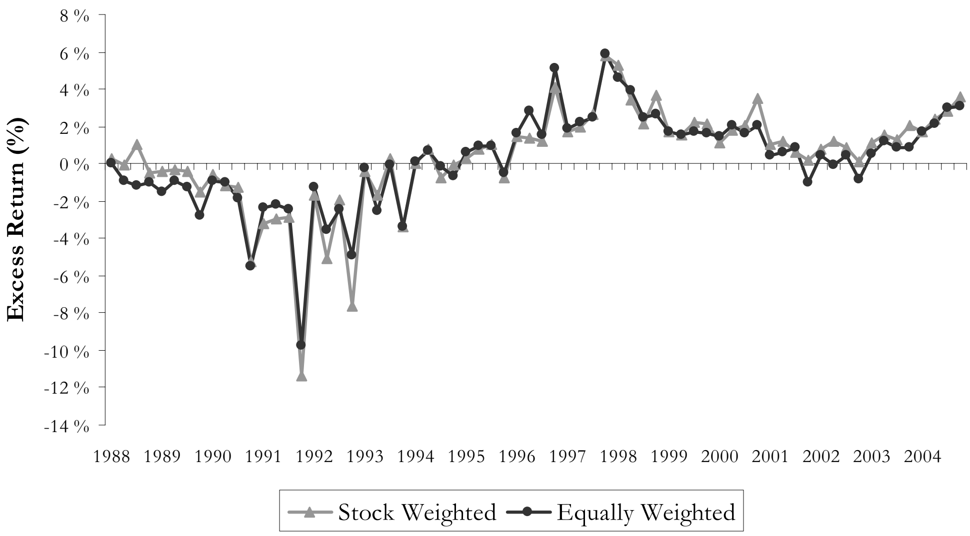
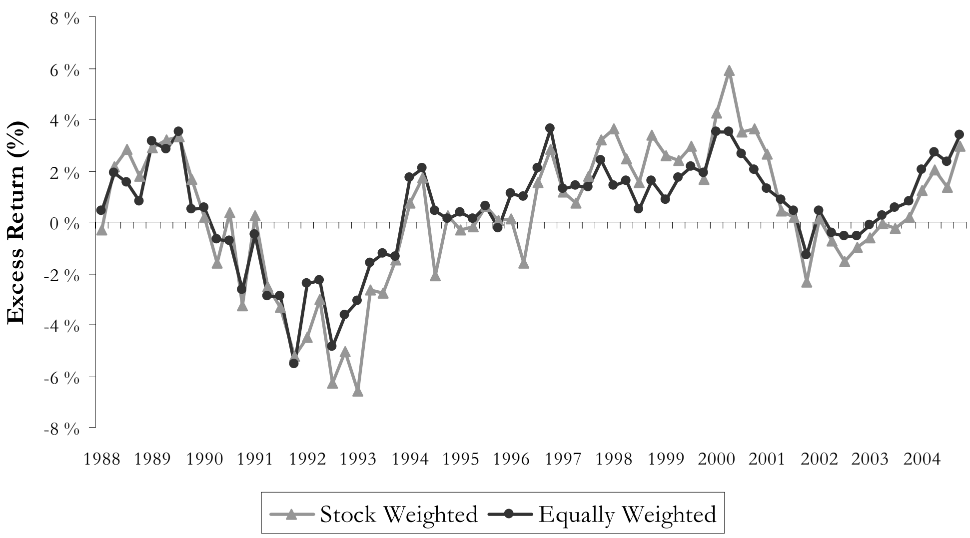


Figure 3.10 Excess return for all regions



3.4.2 Ex-ante risk premium

We discuss the ex-ante risk premium for each region in this section; starting with Asia/Pacific, followed by Europe, and ending with the U.S. We compare the risk premium across cities and look at potential explanations for the differences from a property market perspective. Finally, we interpret any relatively large variations between the risk premiums from the three models.

Asia/Pacific

Table 3.3 shows the estimated average ex-ante risk premiums for Asia/Pacific for the three different models. Shanghai (11.7%-12.2%) and Beijing (10.4%-11.0%) have a relatively high risk premium. In the Chinese market, Hong Kong has a much lower risk premium. Tokyo, Jakarta, and Singapore have the lowest risk premiums among our selection of Asian cities for all three models. For Australia the risk premium ranges from 1.6% to 5.1%, with Canberra and Adelaide at the higher end and Melbourne at the lower end of the range.

Table 3.3 Calculated ex-ante risk premium for Asian and Australian cities

		Average			Standard Deviation		
		Gordon's Growth	Two-Stage Growth	Periodic Growth	Gordon's Growth	Two-Stage Growth	Periodic Growth
China	Beijing	10.9%	11.0%	10.4%	4.9%	4.8%	4.6%
China	Hong Kong	3.1%	3.2%	2.7%	6.0%	4.5%	5.4%
China	Shanghai	12.2%	12.2%	11.7%	7.0%	7.0%	6.7%
Indonesia	Jakarta	0.9%	- 0.2%	- 0.8%	13.7%	13.1%	11.7%
Japan	Tokyo	1.4%	2.4%	1.3%	1.9%	1.9%	1.9%
Malaysia	Kuala Lumpur	2.5%	2.4%	2.0%	1.2%	1.2%	1.1%
Philippines	Manila	3.2%	2.6%	1.9%	3.4%	3.3%	3.2%
Singapore	Singapore	- 0.3%	0.2%	- 0.4%	1.5%	1.3%	1.4%
Thailand	Bangkok	4.9%	4.8%	4.3%	1.8%	1.7%	1.6%
Australia	Adelaide	4.9%	4.9%	4.5%	2.6%	2.4%	2.4%
Australia	Brisbane	3.2%	3.2%	2.8%	2.4%	2.2%	2.3%
Australia	Canberra	5.0%	5.1%	4.6%	2.6%	2.4%	2.4%
Australia	Melbourne	1.9%	1.9%	1.6%	2.6%	2.4%	2.5%
Australia	Perth	3.9%	3.8%	3.5%	2.0%	1.8%	1.9%
Australia	Sydney	2.6%	2.6%	2.3%	2.2%	1.9%	2.1%

Notes. This table shows the result of the calculated risk premiums using Gordon's growth model, two-stage growth model, and periodic growth model.

For the Chinese cities Shanghai and Beijing, political and economic risks have led real estate investors to demand a high average risk premium over the period analyzed. Hong Kong's economy differs from Shanghai and Beijing, probably because the real estate market and economy are more mature. In Australia, the risk premium seems to be a function of market size, where the smaller cities (Canberra, Adelaide, Perth, and Brisbane) require a higher risk premium than the two largest office markets in Australia (Sydney and Melbourne). The Tokyo office market has traditionally seen low risk premiums because of the large inflow of capital and the relatively low cost of capital. Jakarta has been hit, during the observed period, by both the Asian-crisis and the changing political environment, causing large fluctuations in the real estate market. Singapore offers a low risk premium because of its stable market conditions and limited new supply.

For most markets the absolute differences between the findings from the three models are small. Possible exceptions are Tokyo and Jakarta. To understand the differences between the results of the three models we have to analyze the input for the required rate of return calculation: rent, price, and growth rate. Over the long run, rent is expected to increase at the rate of inflation as explained in the methodology section. For the Asia/Pacific region, the differences between the calculated required rate of returns using Gordon's growth model and the two-stage growth model are in accordance with our expectations. When Gordon's growth model gives higher risk premiums than the two-stage growth model, the city-specific growth rate of rent is assumed to be higher than the world growth rate. This is a direct consequence of an inflation assumption for the city that is higher than world inflation. Higher risk premiums for the two-stage model point to a lower growth rate than the world growth rate, as a result of a lower inflation assumption. The periodic growth rate model assumes that rents and growth rates are not adjusted continually, but once every five years. In a rent growth environment this should lead to lower estimates for the periodic growth model.

Europe

Table 3.4 shows the risk premiums for cities in Europe, and we see that the risk premium for Lisbon and the Central European cities, Prague and Budapest, are relatively high compared to other European cities. In general, the bigger office markets with higher quality office space have lower risk premiums. In Belgium, Antwerp has a higher risk premium than the larger, more government orientated office market of Brussels. In France, the Lyon office market is much smaller than the Paris office market and has much lower liquidity. For Germany, Berlin has a slightly higher risk premium than Düsseldorf, Hamburg, Munich, and Frankfurt. The low risk premium in Milan and Stockholm is probably the result of their relatively stable market size and economic conditions. In the Netherlands, Amsterdam has a slightly lower risk premium relative to Rotterdam, The Hague, and Utrecht. The results for the three models for Warsaw are very different; this could be due to the impact of our growth assumption. In Gordon's growth model the historic inflation of Warsaw (Poland) probably leads to overly high estimated long-term growth. The two-period model probably provides a more realistic estimate of the risk premium than Gordon's growth model. Risk premiums on the Iberian Peninsula differ. The Lisbon office market has more than double the risk premium of Barcelona and Madrid. London has, despite higher volatility in rent, a risk premium of between 2.4% and 2.8%.

Table 3.4 Calculated ex-ante risk premium for European cities

		Average			Standard Deviation		
		Gordon's Growth	Two-Stage Growth	Periodic Growth	Gordon's Growth	Two-Stage Growth	Periodic Growth
Austria	Vienna	1.9%	2.0%	1.6%	0.8%	0.7%	0.8%
Belgium	Antwerp	4.1%	4.2%	3.7%	1.5%	1.4%	1.5%
Belgium	Brussels	1.9%	2.3%	1.7%	3.2%	2.1%	3.1%
Czech republic	Prague	8.4%	8.0%	7.2%	3.9%	3.7%	3.1%
France	Lyon	4.7%	4.8%	4.4%	1.0%	1.0%	1.1%
France	Paris	1.8%	2.0%	1.6%	1.7%	1.6%	1.7%
Germany	Berlin	1.9%	2.2%	1.7%	2.1%	1.5%	2.0%
Germany	Düsseldorf	1.2%	1.7%	1.1%	2.8%	1.9%	2.7%
Germany	Frankfurt	1.1%	1.6%	0.9%	2.8%	1.9%	2.7%
Germany	Hamburg	1.1%	1.6%	1.0%	2.8%	1.9%	2.7%
Germany	Munich	1.1%	1.6%	1.0%	2.9%	2.0%	2.8%
Hungary	Budapest	7.0%	6.0%	4.6%	3.0%	2.8%	2.1%
Ireland	Dublin	2.7%	2.5%	2.3%	3.3%	3.0%	3.3%
Italy	Milan	1.3%	1.0%	1.0%	2.1%	2.3%	2.2%
Luxembourg	Luxembourg	3.2%	3.3%	3.0%	1.5%	1.4%	1.5%
Netherlands	Amsterdam	2.9%	2.9%	2.6%	1.6%	1.3%	1.6%
Netherlands	Rotterdam	3.3%	3.3%	3.0%	1.7%	1.4%	1.6%
Netherlands	The Hague	3.2%	3.2%	2.9%	1.7%	1.4%	1.6%
Netherlands	Utrecht	3.2%	3.3%	2.9%	1.7%	1.4%	1.6%
Poland	Warsaw	2.8%	2.3%	1.2%	3.2%	3.0%	2.7%
Portugal	Lisbon	6.9%	6.7%	6.4%	1.1%	1.1%	1.1%
Spain	Barcelona	3.3%	2.9%	2.8%	1.8%	1.9%	2.0%
Spain	Madrid	2.4%	1.9%	1.9%	2.3%	2.5%	2.5%
Sweden	Stockholm	1.1%	1.4%	0.9%	2.2%	2.1%	2.2%
United Kingdom	London	2.8%	2.5%	2.4%	1.8%	1.6%	1.7%

Notes. This table shows the result of the risk premiums calculated using Gordon's growth model, two-stage growth model, and periodic growth model.

For Europe the differences between the three models are what we would expect. The cities in the higher growth countries—Budapest, Prague, and Warsaw—show the highest risk premium estimates for the Gordon's growth model. This is also the case in the Southern-European Lisbon, Barcelona, Madrid, and Milan. Furthermore, the high growth city of Dublin and somewhat surprisingly, London also seem to be also included in this group of strong growth cities. The other European countries have shown more modest growth, resulting in higher risk premiums for the two-stage model. To compare these results to the periodic growth model, we have to keep in mind that in most European cities, rents have gradually increased over the 1990s. This will affect the results, because the periodic growth model does not reflect the growth of rents directly. It only reflects rent growth once every five years. This results in a lower average risk premium in the periodic growth model for the European cities.

The United States

For the United States, as shown in table 3.5, Minneapolis, San Jose, St. Louis, and San Diego have the highest risk premiums. Markets with lower rents relative to capital value such as Los Angeles, San Francisco, and Houston have lower risk premiums. Houston has an average risk premium of 4.2% for Gordon's growth model and 4.1% for the two-stage growth model; the risk premium for the period growth model is a little lower, at 3.8%. San Francisco has a slightly higher risk premium among the selected cities in the US, of 4.3% for Gordon's growth model and 4.1% for the two-stage growth model, and 3.9% for the periodic growth model. Looking at all the results for the twenty cities in the U.S., we can conclude that differences between Gordon's growth and two-stage growth models are minimal, at between 0 and 20 basis points. The differences between Gordon's growth model and the periodic growth model are a little wider, between 20 and 50 basis points. This means that as a result of periodic adjustments to rent, there is a difference of 20 to 50 basis points on average over the time period. Since the risk premiums for the U.S. are relatively high compared with other regions, we verified the robustness of the results by using two additional datasets for the twenty cities in the U.S. The first dataset is compiled from the rent and price (capital value) per square foot from the National Real Estate Index (NREI). The second dataset is a combination of Torto Wheaton Research (TWR) office net rent and price per square foot with NREI. The calculated risk premiums for the three models are similar to our results presented in this chapter based on the dataset compiled from NCREIF.[19]

[19] Using rent and price from the NREI index we calculated equally and stock weighted risk premiums (minimum and maximum values for the twenty cities between brackets) for the U.S. between 1986-2002: 5.14% and 4.78% for Gordon's growth model (3.9%-6.3%), 5.08% and 4.72% for the two stage growth model (3.9%-6.2%), and 3.28% and 2.99% for the periodic growth model (3.4%-5.7%). For the TWR rent in combination with the NREI price we calculated the stock weighted risk premium for the U.S. between 1988-2002: 5.30% for Gordon's growth model (4.6%-7.1%), 5.21% for two stage growth model (4.5%-7.0%), and 4.84% for the periodic growth model (3.8%-7.2%).

Table 3.5 Calculated ex-ante risk premium for the U.S. cities

		Average			Standard Deviation		
		Gordon's Growth	Two-Stage Growth	Periodic Growth	Gordon's Growth	Two-Stage Growth	Periodic Growth
United States	Atlanta	4.5%	4.5%	4.2%	2.0%	2.0%	1.9%
United States	Boston	5.5%	5.3%	5.0%	1.9%	1.9%	1.9%
United States	Chicago	4.8%	4.7%	4.4%	1.3%	1.3%	1.3%
United States	Cincinnati	5.4%	5.3%	5.0%	2.0%	2.0%	2.0%
United States	Dallas	5.2%	5.2%	4.8%	2.2%	2.1%	2.1%
United States	Denver	4.7%	4.9%	4.6%	3.0%	2.0%	2.2%
United States	Houston	4.2%	4.1%	3.8%	2.4%	2.4%	2.3%
United States	Los Angeles	4.3%	4.1%	3.9%	1.8%	1.8%	1.8%
United States	Miami	5.2%	5.1%	4.7%	2.3%	2.2%	2.2%
United States	Minneapolis	6.1%	6.0%	5.6%	2.1%	2.1%	2.1%
United States	New York	5.1%	4.9%	4.6%	1.4%	1.5%	1.4%
United States	Philadelphia	5.0%	4.9%	4.6%	2.0%	2.1%	2.0%
United States	Phoenix	5.6%	5.5%	5.1%	2.6%	2.5%	2.4%
United States	San Diego	5.8%	5.6%	5.3%	1.8%	1.7%	1.7%
United States	San Francisco	4.3%	4.1%	3.9%	2.1%	2.0%	2.0%
United States	San Jose	6.1%	6.0%	5.6%	3.4%	2.7%	3.0%
United States	Seattle	5.7%	5.6%	5.3%	1.4%	1.3%	1.3%
United States	St. Louis	6.0%	6.0%	5.6%	1.5%	1.5%	1.5%
United States	Tampa	5.6%	5.6%	5.2%	1.5%	1.3%	1.4%
United States	Washington	5.2%	5.1%	4.8%	1.4%	1.4%	1.4%

Notes. This table shows the result of the calculated risk premiums using Gordon's growth model, two-stage growth model, and periodic growth model.

Table 3.6 Calculated ex-ante risk premium

		Average			Standard Deviation		
	Weight	Gordon's Growth	Two-Stage Growth	Periodic Growth	Gordon's Growth	Two-Stage Growth	Periodic Growth
Asia	Equally	3.94	3.90	3.26	2.14	1.97	1.94
Asia	Stock	3.37	3.45	2.86	1.52	1.37	1.33
Australia	Equally	3.58	3.59	3.23	2.34	2.10	2.20
Australia	Stock	3.07	3.08	2.73	2.32	2.07	2.19
Europe	Equally	2.56	2.65	2.16	1.88	1.64	1.85
Europe	Stock	1.84	2.05	1.59	1.81	1.59	1.82
U.S.	Equally	5.14	5.07	4.73	1.34	1.36	1.35
U.S.	Stock	5.00	4.89	4.58	1.26	1.32	1.28
All regions	Equally	3.78	3.77	3.33	1.33	1.29	1.35
All regions	Stock	2.72	2.83	2.41	1.46	1.38	1.49

Notes. This table shows the result of the calculated risk premiums using Gordon's growth model, two-stage growth model, and periodic growth model.

Figure 3.11 Stock-weighted risk premium for Asia

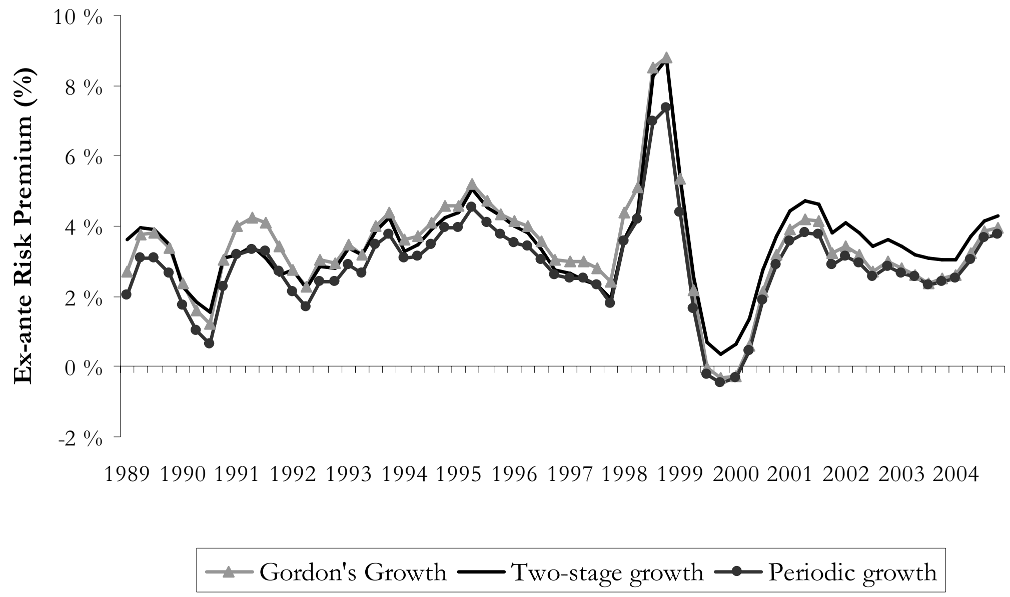


Figure 3.12 Stock-weighted risk premium for Australia

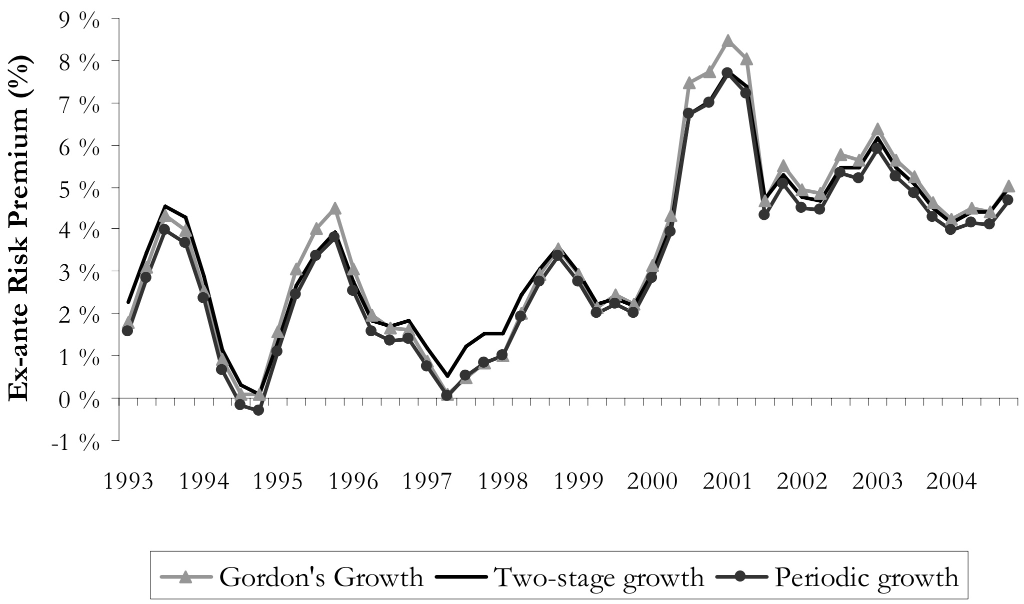


Figure 3.13 Stock-weighted risk premium for Europe

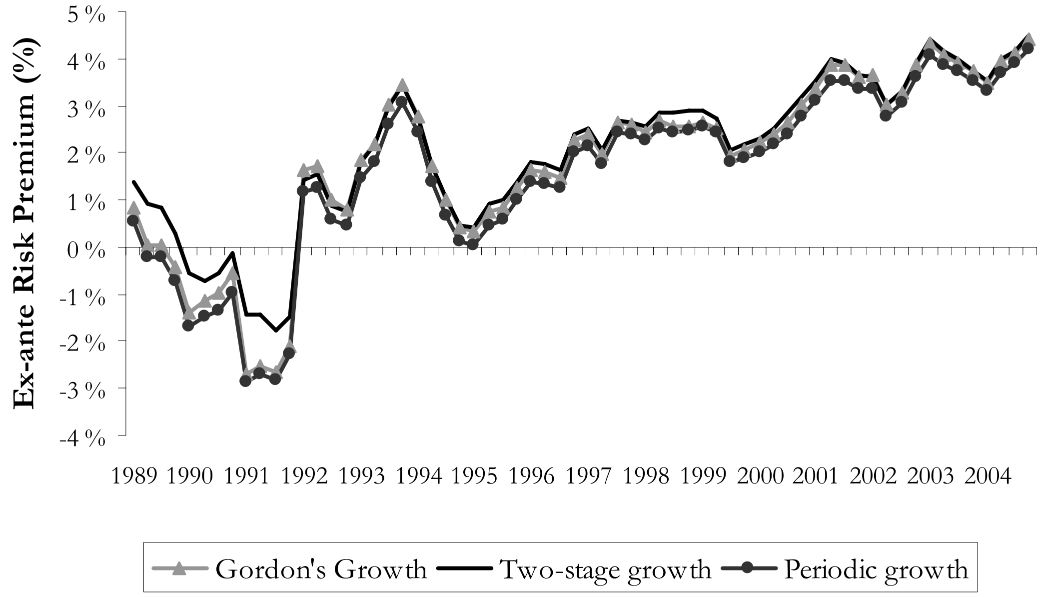
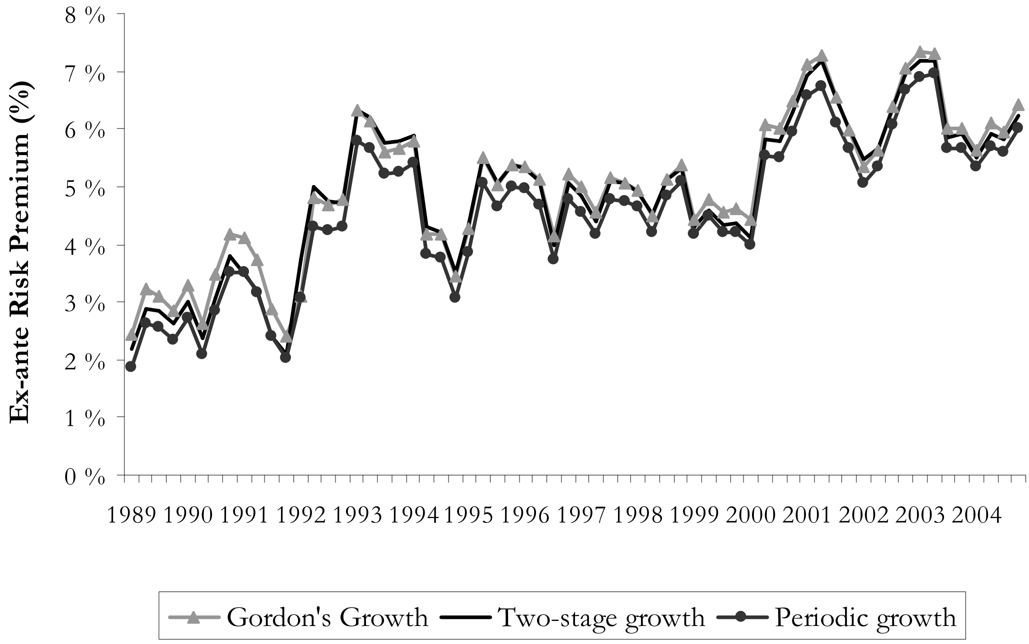


Figure 3.14 Stock-weighted risk premium for the United States



Discussion of risk premiums for regions

In this section we discuss the aggregated risk premiums by region. To achieve this, we add the calculated risk premiums by quarter, both equally weighted and stock-weighted. The latter is based on the relative market size of a city's office district. This results in two separate series for each of the three models for Asia, Australia, Europe, and the U.S. Figures 3.11, 3.12, 3.13 and 3.14 show the results for the stock-weighted series. Table 3.6 provides averages and standard deviations of the estimated risk premiums for the regions both stock weighted and equally weighted. The three models provide estimates that are relatively close to each other. The results presented in table 3.6 depend on the yield on real estate and risk free alternative, but also on the growth rate assumption. As described in the methodology section we assume in this chapter that the growth rate is a function of inflation over the previous year, because rent contracts generally include an inflation correction component. To test whether the actual rent growth has been equal to inflation, we recalculated the risk premiums using the achieved average rent growth rate over the sample period. This approach assumes that the actual rent growth in the future is known in advance.

Table 3.7 Estimated ex-ante risk premium based on average actual rent growth

		Average			Standard Deviation		
	Weight	Gordon's Growth	Two-Stage Growth	Periodic Growth	Gordon's Growth	Two-Stage Growth	Periodic Growth
Asia	Equally	3.00	2.92	2.46	2.59	2.41	2.62
Asia	Stock	1.95	2.39	1.54	3.00	2.32	2.93
Australia	Equally	2.70	2.59	2.48	1.79	1.79	1.79
Australia	Stock	2.90	2.64	2.60	1.76	1.77	1.76
Europe	Equally	0.86	0.84	0.71	1.77	1.87	1.81
Europe	Stock	1.19	1.17	1.00	2.12	2.15	2.12
U.S.	Equally	1.90	2.36	1.93	2.07	1.99	2.06
U.S.	Stock	1.31	1.84	1.38	2.08	1.99	2.07
All regions	Equally	1.66	1.80	1.51	1.85	1.82	1.86
All regions	Stock	1.31	1.44	1.17	2.12	2.08	2.10

Notes. This table shows the result of estimated risk premiums using Gordon's growth model, two-stage growth

Table 3.7 shows the results for the three different models for each of the regions and the aggregate. The average ex-ante risk premium for Gordon's growth model, the two-stage growth model[20] and the periodic growth model are lower, demon-

[20] For the two-stage model we assumed average world rent growth for the long-term growth (g_2).

strating that the actual achieved rent growth is lower than inflation.[21] This would argue against the generally accepted idea that real estate prices follow inflation because of rent adjustments for inflation, and it indicates that inflation and rent growth differ over specific periods.

In order to put our results for the regional ex ante risk premium into perspective, especially since the ex-ante risk premium of the U.S. is relatively high, we would like to elaborate further on previous research. Geltner and Miller (2001) also analyze the risk premium on real estate and focus on the U.S. by using the NCREIF Property Index (NPI). They first look at the ex post risk, which averages 3.42% during the 1970–98 period on the types of institutional quality commercial properties represented by NCREIF index. As they describe it, the problem with this approach is that the historical results are ex-post risk premiums, not ex-ante expectations, and do not necessarily represent current expectations of investors. The second approach uses a nationally- based survey of investors return expectations. The Korpacz Yield Indicator (KYI) gives total return expectations (free-and-clear going-in IRR) on unlevered investments in institutional quality commercial property. The results imply a high degree of stability of the stated ex ante real estate returns. It is suggested that the characteristics of survey-based measures of investors could be the result of the stability in the stated return expectations. However, a stable expected total return does not necessarily imply a stable risk premium, as the risk-free interest rate varies over time. In fact, the survey-based results imply an ex-ante real estate risk premium of around 300 to 400 basis points during the 1980s. In the early 1990s, with interest rates down to the 6% to 7% level, the stated 12% real estate return implied a risk premium of 500 to 600 basis points. Thus, a nearly constant expected total return has not implied such a constant ex ante risk premium. It is also pointed out that the survey total return is consistently at least 200 basis points higher than the objective evidence about real estate performance by the NPI. However, the NPI is backward-looking history, while the KYI is forward-looking expectation, so the two need not equate exactly. Furthermore, the historical period covered by the NPI was characterized by much higher average inflation than investors were generally expecting going forward during the 1990s. Thus measured on a real basis, the gap between the ex ante and ex post risk premium would be even wider. It also seems difficult to reconcile the stability of the KYI with the fall in interest rates and rise in property values during the late 1990s. A third method is observing current cap rates to get an indication of

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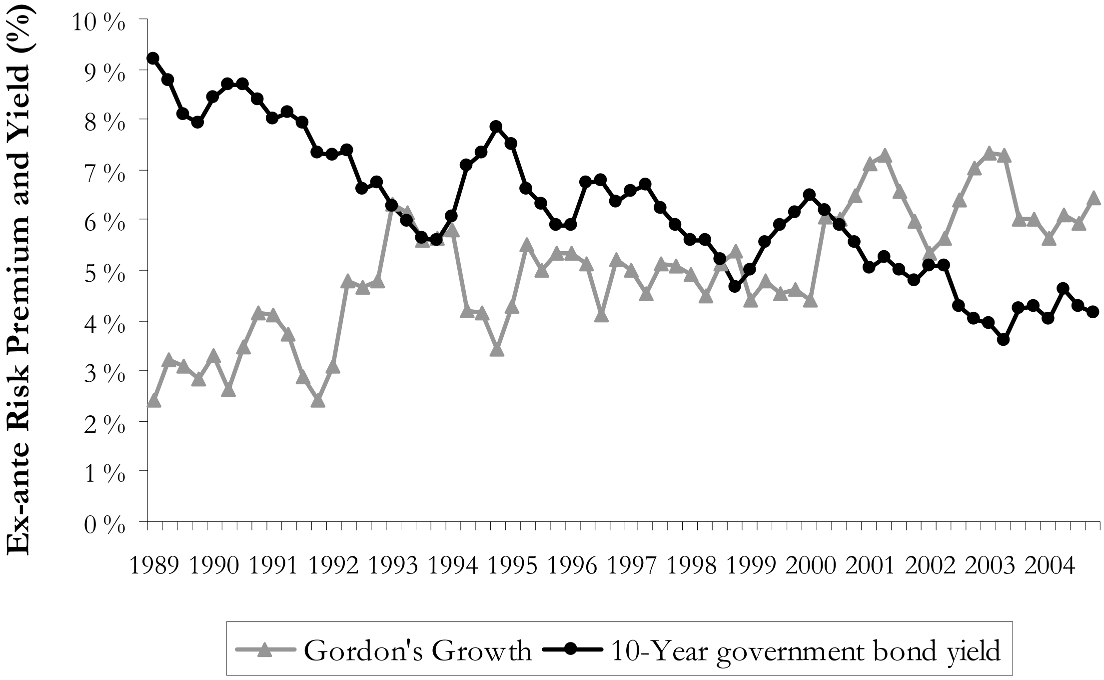
[21] Assuming that the growth rate is equal to the average rent growth rate, results in negative risk premiums for certain cities in our dataset. In Asia the risk premium for Gordon's growth model is -11.2% for Jakarta and -4.2% for Tokyo. These two cities have seen decreasing rents between 1988-2004. In Central European average prime office rents decreased as more high quality office space became available.

total return expectations. Geltner and Miller (2001) use a constant-growth in perpetuity model as an indication of expected total return. Using expected cap rate information plus an adjusted growth rate gives an ex-ante IRR during the 1990s averaging around 10% for the types of institutional-quality commercial property covered by the Korpacz survey, implying a risk premium of 300 to 400 basis points.

Using the information in the previous paragraph and applying it to the results of our analysis would suggest that the situation described has continued and that we still have a high degree of stability in ex-ante real estate return expectations. As the risk-free rate has continued to decline over the last years, this would lead to risk premium levels for real estate above the levels of the early 1990s. As shown in figure 3.15, the relatively high increase in risk premium for the U.S. between 1989–2004 is mainly the result of the decline in the yield on the risk-free alternative over this time period. The correlation coefficient between the calculated ex-ante risk premium and the 10-year government bond is -0.847. The stock weighted risk premium, calculated using Gordon's growth model, is increasing as the yield on the 10-year government bond is decreasing, indicating that the yield (rent/price) on real estate is not declining at the same pace as the yield on 10-year government bonds.

Figure 3.15 U.S. Risk premium relative to the long term bond yield for the U.S.



Discussion of global risk premium

Figure 3.16 shows the risk premium for stock-weighted time series. The global risk premium (aggregation of all regions) for the equally weighted model is 3.8% using Gordon's growth model, 3.8% for the two-stage growth model, and 3.3% for the periodic growth model. It is a little lower for the stock weighted calculations: 2.7%, 2.8%, and 2.4%. This lower risk premium for the stock weighted global risk premium would indicate that the larger office markets have lower risk premiums. Figure 3.17 shows the ex-ante stock weighted global risk premium for Gordon's growth model, based on two growth rate assumptions: inflation in the previous year and actual average rent growth. Ex-post and ex-ante risk premiums follow a similar trend over the long run and the ex-post risk premium is more volatile. Furthermore, the ex-ante risk premium shows an upward trend, which is mainly the result of the decline in the risk-free rate for the countries in our database. And although the calculated ex-post risk premiums are more in line with expectations ("knowing that our expectations are heavily influenced by historical records" Dimson, March and Staunton, 2002) it might indicate that the ex-ante risk premium is high, but not completely unrealistic given the very high returns for direct real estate in more recent years.

Figure 3.16 Stock-weighted global risk premium

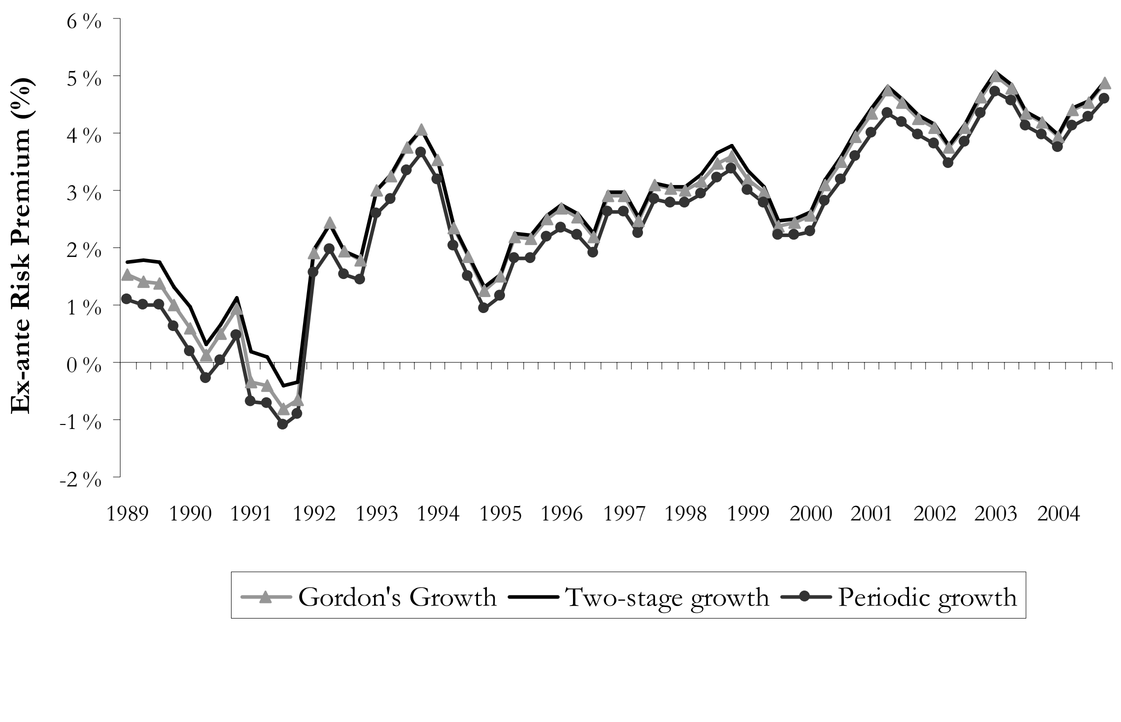
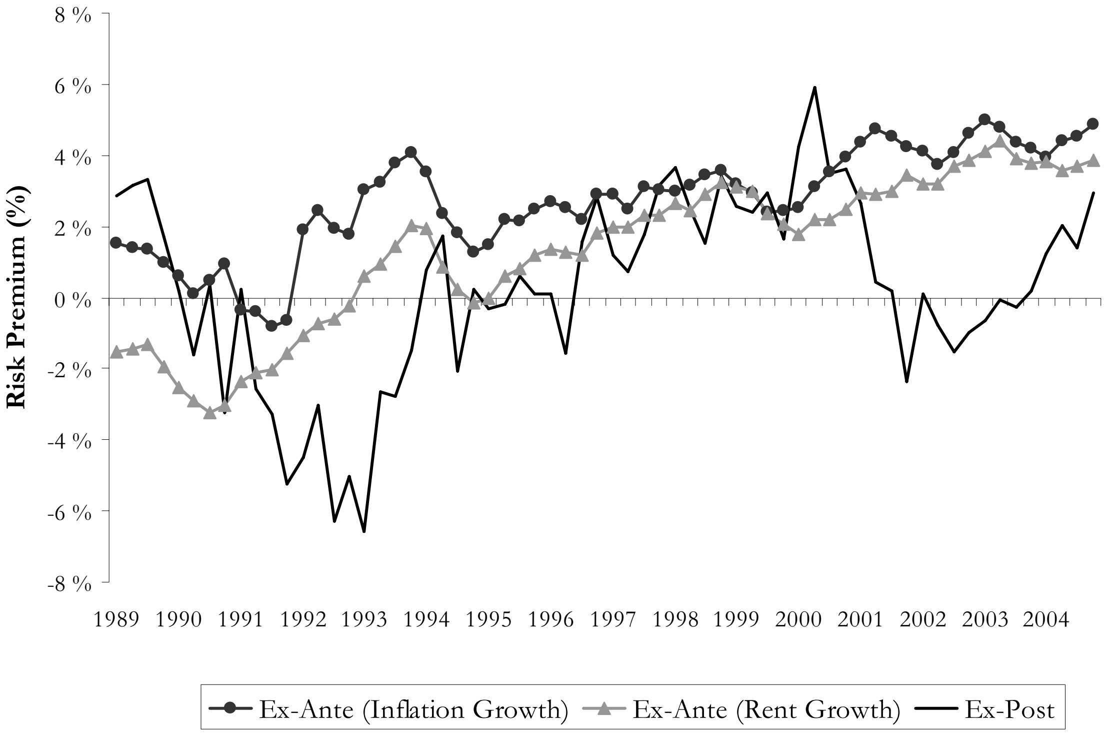


Figure 3.17 Stock-weighted ex-ante and ex-post global risk premium



3.4.3 Convergence of risk premiums between regions

Our next analysis measures the extent to which risk premium levels are converging across regions. Arguments for convergence result from the globalization of information, capital flows and investments. Convergence of risk premiums is investigated by regressing growth rates of risk premiums on initial levels. Baumol (1986) and Mankiw, Romer and Weil (1992) among many others use a similar approach to demonstrate convergence in their time series. A negative-slope parameter is interpreted as an indication of convergence. Regions that have relatively low risk premiums at the beginning are moving towards a global average. This type of convergence is labeled as β-convergence. A different concept of convergence refers to a reduction in cross-sectional variance or dispersion over time. This type of convergence is labeled as σ-convergence. Quah (1993) shows that a negative-slope parameter in the test for β-convergence can be fully consistent with the absence of σ-convergence. On the other hand, σ-convergence is a sufficient condition for β-convergence.

To test for β-convergence we use the following regression equation,

$$Risk\ premium_{sq} - Risk\ premium_{s,q-1} = \alpha_s + \beta_s \cdot Risk\ premium_{s,q-1} + e_{sq}, \quad (3.7)$$

which includes a region-specific constant α_s and a region-specific slope parameter β_s that measures β-convergence. The e_{sq} is the usual error term. In this dynamic regression equation the risk premium converges to $-\alpha_s / \beta_s$ provided that $0 < (1+\beta_s) < 1$.

Table 3.8 β-convergence

	Intercept (α)			Slope parameter (β)			Steady-state Risk Premium ($-\alpha/\beta$)		
	I	II	III	I	II	III	I	II	III
				Panel A: Equal slope parameters					
Asia	0.58 (3.20)	0.61 (3.31)	0.56 (3.18)	-0.17 (-4.73)	-0.17 (-4.57)	-0.16 (-4.71)	3.5	3.6	3.0
Australia	0.59 (3.37)	0.59 (3.61)	0.52 (3.35)	Same	Same	Same	3.5	3.5	3.2
Europe	0.49 (4.18)	0.49 (4.30)	0.44 (4.12)	Same	Same	Same	2.9	2.9	2.7
United States	0.93 (4.15)	0.92 (4.34)	0.85 (4.43)	Same	Same	Same	5.5	5.5	5.1
				Panel B: Equal intercepts					
Asia	0.51 (4.25)	0.45 (3.84)	0.43 (3.72)	-0.15 -3.50)	-0.14 (-3.26)	-0.15 (-3.40)	3.1	3.3	3.0
Australia	Same	Same	Same	-0.14 (-3.43)	-0.13 (-3.36)	-0.13 (-3.32)	3.3	3.6	3.9
Europe	Same	Same	Same	-0.17 (-3.72)	-0.14 (-3.35)	-0.16 (-3.60)	2.7	3.2	2.8
United States	Same	Same	Same	-0.09 (-3.94)	-0.08 (-3.64)	-0.09 (-3.86)	5.4	5.4	5.1
				Panel C: Equal intercepts and slope parameters					
All regions	0.37 (3.47)	0.30 (3.10)	0.31 (3.36)	-0.09 (-3.68)	-0.07 (-3.32)	-0.08 (-3.60)	4.3	4.2	4.0

Notes: This table shows the results of the regression:

$$Risk\ premium_{sq} - Risk\ premium_{s,q-\tau} = \alpha_s + \beta_s \cdot Risk\ premium_{s,q-\tau} + e_{sq},$$

where α_s and β_s are parameters. The e_{sq} is the usual error term. The symbols q and s denote the quarter and the region. The Columns I, II and III give the estimation results for the Gordon's growth model, two-stage growth model and periodic growth model, respectively.

Table 3.8 shows the regression results. Panel A gives the results using the restriction that all slope parameters are equal, i.e. $\beta_s = \beta$. This assumes that the speed of convergence for all regions is the same, but not necessarily to the same steady state value. Panel B gives the results using the restriction that all intercepts are equal, i.e. $\alpha_s = \alpha$. This assumption implies that each region has its own growth rate for its risk premium. Results from Panel C assume that all slope parameters equal and that all intercepts are equal. This equation tests whether all regions have the same speed of adjustment to the same steady-state value. Columns I, II and III give the estimation results for Gordon's growth model, the two-stage growth model, and the periodic growth model respectively. All slope parameters are significantly[22] negative and small in magnitude. They vary between −0.07 and −0.09. This indicates that the risk-premiums of the regions indeed converge, but at a slow rate. Panel A and B show that the risk premium of the regions seem to converge to different steady-state levels. The estimates for the steady-state risk premium for Europe lie between 2.7% and 3.2%, which makes Europe the region with the lowest estimated risk premium. The highest estimates for the steady-state risk premiums are for the United States, which are between 5.1% and 5.5%. If we assume that there is only one steady-state world risk premium, Panel C indicates that this risk premium is between 4.0 and 4.3 percent. In general, the findings show that our results are relatively insensitive to the method used to determine the risk premium.

To test for σ-convergence, we first determine for each quarter the average absolute distance between the four region-specific risk premiums. Our distance measure for quarter q, D_q, equals

$$D_q = \frac{1}{12} \sum_{all\ regions\ s \neq v} \sum_{all\ regions\ v} \left| Risk\ premium_{qs} - Risk\ premium_{qv} \right|, \tag{3.8}$$

where $|.|$ is the absolute difference operator. Hereafter, we estimate the first order autoregressive model, $D_q = \alpha + \rho \cdot D_{q-1} + e_q$. The α is the constant of the regression. If the parameter ϱ is between 0 and 1, then σ-convergence is likely. Using the stock-weighted estimates for the risk premiums, our estimates for ϱ are 0.66 (0.10), 0.64 (0.10) and 0.67 (0.09) for the Gordon, two-stage and periodic growth model respectively. The standard errors are in parentheses. These results suggest that the parameter ϱ is significantly smaller than 1 and that the cross-sectional variance of the risk premiums of the different regions becomes smaller over time. However, total convergence is unlikely since the intercepts (α) are significantly different from zero. For the Gordon, two-stage and periodic growth model the estimated intercepts are 0.79, 0.72 and 0.72, respectively. We obtain similar conclusions if we use the equally-weighted estimates for the risk premiums.

[22] If not otherwise stated, significance refers to the 5% significance level.

3.4.4 Variation in risk premiums: Regression analysis

Table 3.9 Regression results

	Equally Weighted			Stock Weighted		
	Gordon's Growth	Two-Stage Growth	Periodic Growth	Gordon's Growth	Two-Stage Growth	Periodic Growth
Vacancy rate	-0.078	-0.086	-0.079	-0.045	-0.054	-0.049
	(-1.19)	(-1.33)	(-1.21)	(-0.84)	(-1.09)	(-0.95)
σ(unemployment)	0.088	0.108	0.095	0.045	0.073	0.055
	(1.55)	(2.02)	(1.71)	(0.69)	(1.25)	(0.86)
σ(inflation)	-0.083	-0.051	-0.054	-0.033	-0.014	-0.021
	(-1.44)	(-0.91)	(-0.96)	(-0.53)	(-0.25)	(-0.33)
σ(interest rates)	-0.109	-0.128	-0.097	-0.143	-0.128	-0.143
	(-2.10)	(-1.90)	(-1.68)	(-2.61)	(-2.49)	(-2.68)
σ(initial yield)	0.137	0.128	0.129	0.107	0.090	0.082
	(2.16)	(2.03)	(2.03)	(2.02)	(1.99)	(1.77)
σ(Δ capital value)	0.017	-0.010	-0.002	0.037	0.005	0.022
	(0.24)	(-0.15)	(-0.02)	(0.50)	(0.07)	(0.31)
σ(Δ rent)	0.122	0.131	0.126	0.067	0.081	0.070
	(1.99)	(2.16)	(2.09)	(1.13)	(1.46)	(1.23)
σ(local equity)	0.079	0.077	0.089	0.027	0.006	0.028
	(1.47)	(1.43)	(1.65)	(0.43)	(0.11)	(0.45)
σ(global equity)	-0.186	-0.225	-0.188	-0.268	-0.306	-0.270
	(-2.93)	(-3.24)	(-2.90)	(-2.79)	(-3.07)	(-2.81)

Notes. This table shows the results of the regression:

$$\Delta\ Risk\ premium_{sq} = \beta_{0s} + \beta_1 \cdot \Delta x_{1sq} + \ldots + \beta_9 \cdot \Delta x_{9sq} + e_{sq}$$

where x_{ksq} are the exogenous variables in quarter q for region s, $k=1,\ldots,9$ and $e_{sq} \sim N(0,\sigma^2{}_s)$ is the error term. The symbol s denotes the series for Australia, Asia, Europe and the United States. β_{0s} and β_k are parameters. The exogenous variables are given in the first column. We run equally weighted and stock weighted regressions. For the stock weighted regressions we employ the stock weightings of the region-districts to construct the times series of the variables. The stock weighting of the regions are applied to weight the time series in the regression. Between parentheses are t-values given.

Based on the assumptions of the APT, model we analyze the impact of real estate, bond, equity, and economic risk indicators as well as demand and supply real estate variables on the risk premium. This study aims to explain the time-series variation in the risk premium, as time variation of excess returns for REITs was analyzed by Ling, Naranjo and Ryngaert (2000).

We regress estimated risk-premiums on capital markets and economic variables to find their determinants. Table 3.9 shows the parameter estimates of the regressions for the three different valuation models, both for the equally weighted and stock weighted risk premium. In total we discuss six parameter estimates for each variable. The first variable is vacancy rate, which measures the difference between supply and demand. It seems to have no influence. None of the six parameter estimates are significant. The volatility in the unemployment rate seems to have no influence, except for the equally weighted two-stage growth model. We find some evidence of a negative effect of increased inflation risk on the risk premium. Interest rate volatility has a significantly negative impact on real estate risk premiums for four out of six estimates at a 95% confidence level and the remaining two at a 90% confidence level. Increased uncertainty in the bond market seems to reduce the required risk compensation on a real estate investment. This result is similar to findings for the equity risk premium as documented in Asness (2000). He found that increased volatility of the bond market decreases the risk premium of the equity market. The next three variables in our regressions are proxies for the risks directly related to investments in real estate rents. The variables measure time-series variation in rents, capital values and the ratio of the rent and capital value, i.e. the initial yield. The regression results suggest that fluctuations in initial yields increase risk premiums as well. The parameter estimates for five out of the six regressions are positive and significant at a 95% level and for one, at a 90% level. The findings show further that the volatility of change in rents has a significant positive effect on the risk premium; however, this is not significant for the stock weighted risk premium. Not consistent with our expectations, the volatility of change in capital value has an insignificant impact on the risk premium. The last two variables are proxies for risk in the equity markets: the global equity market and the local equity market. The parameter estimates of the global equity risk variable indicate that a higher volatility of the equity market lowers the real-estate equity premium. If we compare the parameter estimates and their *t*-values for equal versus stock-weighted, it seems that the relationships are stronger using stock-weighted data. This could indicate that cities with more real estate inventory, in general, bigger cities, are linked more closely to the global economy. Parameter estimates for the local equity risk are not significantly different from zero.

3.5 Conclusions

This chapter determines ex-post and ex-ante real estate risk premiums for 60 major office districts around the world. We estimate the ex-ante risk premium based on three valuation models; Gordon's growth model, the two-stage growth model, and the periodic growth model from capital values and rent data. By aggregating (both equally and stock weighted) the risk premium for the city/MSA risk we estimate risk premiums for office districts in four continents. For Asia/Pacific, Beijing and Shanghai have a relatively high risk premium. Tokyo, Jakarta, and Singapore are at the lower end of the risk premium range. In Europe, the Central European cities of Prague and Budapest appear to have a higher risk premium. Estimated risk premiums for cities in the U.S. have relatively small differences. Looking at the regional differences we can conclude that Europe has the lowest risk premium, followed by Australia. The relatively high risk premium for the U.S. is mainly the result of the declining yield on the long term government bond in the U.S. We obtained similar results for the U.S. by using two different datasets for the 20 office districts.

Our results rely in part on the growth rate assumptions. As shown in this chapter, the average growth rate for rent is lower than inflation over the observed period. The next chapter will analyze the relationship between rent contract types and inflation, by looking at the inflation hedge potential of direct office real estate.

On a global level we find a risk premium of 3.8% for the Gordon's growth and two-stage growth model for the equally weighted aggregation. The stock-weighted aggregation has an average value of 2.7% and 2.8% for the two models. The periodic growth model shows slightly lower risk premiums of 3.3% and 2.4% for the equally and stock weighted models. The stock weighted aggregated risk premium is lower than the equally weighted, indicating that bigger office markets have relatively lower risk premiums. The global ex-ante and ex-post risk premium seem to follow a similar trend, but the ex-post risk premium is more volatile.

We find convergence between risk premiums across continents both over time and in cross-sectional variance. However, this is happening slowly, thereby making differences in risk premiums very important in making a global direct real estate investment allocation.

We demonstrate a new set of risk factors that are significantly related to the real estate risk premiums. Our selected risk factors are successful in explaining variations in risk premiums. First, risks directly related to real estate are important. The volatility of initial yield and rent variable has a significant positive effect. Second, the risk in capital markets other than the real estate market is relevant. The volatility of interest rates, which is a main driver of uncertainty in the bond market, and global equity market risk, have a negative impact on the real estate risk premium.

Appendix 3.A Average real estate office yield, bond yield, and inflation rate

		Yield	σ Yield	Long-Term Bond Yield	σ Long-Term Bond Yield	Inflation Rate	σ Inflation Rate	
Asia/Pacific								
China	Beijing	16.9%	6.6%	7.9%	2.4%	1.6%	0.7%	[53]
China	Hong Kong	5.9%	1.3%	7.2%	1.2%	4.2%	5.5%	[68]
China	Shanghai	18.1%	8.7%	7.9%	2.5%	1.6%	0.8%	[50]
Indonesia	Jakarta	8.9%	1.6%	21.1%	4.6%	12.2%	14.8%	[68]
Japan	Tokyo	3.5%	1.0%	3.0%	2.0%	0.7%	1.4%	[68]
Malaysia	Kuala Lumpur	8.0%	0.6%	8.7%	1.9%	2.9%	1.4%	[53]
Philippines	Manila	9.9%	1.3%	15.1%	4.7%	7.6%	3.8%	[68]
Singapore	Singapore	4.2%	0.8%	6.1%	0.8%	1.5%	1.4%	[60]
Thailand	Bangkok	9.3%	0.7%	8.5%	2.5%	3.9%	2.6%	[68]
Australia	Adelaide	9.4%	0.5%	7.2%	1.8%	2.5%	1.6%	[56]
Australia	Brisbane	7.7%	0.2%	7.2%	1.8%	2.5%	1.6%	[56]
Australia	Canberra	9.5%	0.5%	7.2%	1.8%	2.5%	1.6%	[56]
Australia	Melbourne	6.5%	1.1%	7.2%	1.8%	2.5%	1.6%	[56]
Australia	Perth	8.4%	0.9%	7.2%	1.8%	2.5%	1.6%	[56]
Australia	Sydney	7.1%	0.7%	7.2%	1.8%	2.5%	1.6%	[56]
Europe								
Austria	Vienna	5.6%	0.3%	6.1%	1.2%	2.3%	1.1%	[39]
Belgium	Antwerp	8.1%	0.2%	6.5%	1.9%	2.1%	0.8%	[63]
Belgium	Brussels	6.6%	0.5%	6.6%	1.9%	1.7%	1.9%	[68]
Czech republic	Prague	10.4%	1.5%	9.2%	4.2%	6.6%	5.2%	[51]
France	Lyon	8.7%	0.6%	6.1%	1.7%	1.7%	0.6%	[57]
France	Paris	6.1%	0.5%	6.2%	1.8%	1.9%	0.8%	[59]
Germany	Berlin	5.4%	0.3%	5.7%	1.6%	1.8%	1.7%	[58]
Germany	Düsseldorf	5.3%	0.2%	5.9%	1.6%	1.7%	2.0%	[68]
Germany	Frankfurt	5.1%	0.3%	5.9%	1.6%	1.7%	2.0%	[68]
Germany	Hamburg	5.2%	0.2%	5.9%	1.6%	1.7%	2.0%	[68]
Germany	Munich	5.2%	0.4%	5.9%	1.6%	1.7%	2.0%	[68]
Hungary	Budapest	10.4%	1.3%	19.7%	8.1%	14.1%	7.7%	[51]
Ireland	Dublin	6.0%	0.7%	6.7%	3.4%	2.9%	1.4%	[63]
Italy	Milan	5.6%	0.3%	7.9%	3.5%	3.5%	1.5%	[57]
Luxembourg	Luxembourg	6.9%	0.2%	6.2%	1.7%	2.1%	0.9%	[57]
Netherlands	Amsterdam	6.4%	0.4%	6.3%	1.5%	2.5%	0.9%	[68]
Netherlands	Rotterdam	6.8%	0.4%	6.3%	1.5%	2.5%	0.9%	[68]
Netherlands	The Hague	6.7%	0.4%	6.3%	1.5%	2.5%	0.9%	[68]
Netherlands	Utrecht	6.7%	0.5%	6.3%	1.5%	2.5%	0.9%	[68]
Poland	Warsaw	10.8%	1.4%	17.5%	7.1%	8.4%	6.2%	[36]
Portugal	Lisbon	8.5%	1.1%	5.1%	1.6%	3.0%	0.8%	[37]
Spain	Barcelona	6.5%	0.8%	7.8%	3.8%	3.7%	1.4%	[61]
Spain	Madrid	6.1%	0.7%	8.3%	3.9%	4.1%	1.6%	[68]
Sweden	Stockholm	6.0%	0.5%	6.3%	2.1%	1.2%	1.2%	[45]
United Kingdom	London	6.0%	0.5%	7.2%	2.2%	3.6%	2.3%	[68]

Notes. This appendix contains real estate, bond and inflation rate components that we used to calculate the risk premium. The columns Yield (rent/capital value), Long-Term Bond Yield, and Inflation Rate provide the yield per city, bond rate for a country, and the inflation rate for a country or MSA. The columns σ Yield, σ Long-Term Bond Yield, and σ Inflation Rate give standard deviations. The number of available quarters is given between brackets.

Appendix 3.A Average real estate office yield, bond yield, and inflation rate (Cont'd)

		Yield	σ Yield	Long-Term Bond Yield	σ Long-Term Bond Yield	Inflation Rate	σ Inflation Rate	
United States								
United States	Atlanta	7.8%	1.5%	6.3%	1.5%	2.7%	1.2%	[68]
United States	Boston	8.0%	1.4%	6.3%	1.5%	3.3%	1.4%	[68]
United States	Chicago	7.6%	1.2%	6.3%	1.5%	2.9%	1.2%	[68]
United States	Cincinnati	8.6%	1.7%	6.3%	1.5%	2.7%	1.0%	[66]
United States	Dallas	8.2%	2.0%	6.3%	1.5%	2.7%	1.2%	[68]
United States	Denver	7.5%	2.1%	6.3%	1.5%	3.2%	1.3%	[68]
United States	Houston	7.3%	1.8%	6.3%	1.5%	2.8%	1.5%	[68]
United States	Los Angeles	7.3%	1.6%	6.3%	1.5%	2.9%	1.4%	[68]
United States	Miami	8.0%	2.0%	6.3%	1.5%	2.9%	1.2%	[68]
United States	Minneapolis	8.9%	1.6%	6.3%	1.5%	3.0%	0.9%	[68]
United States	New York	7.8%	1.1%	6.3%	1.5%	3.2%	1.3%	[68]
United States	Philadelphia	7.8%	1.7%	6.3%	1.5%	3.0%	1.3%	[68]
United States	Phoenix	8.2%	2.0%	6.3%	1.5%	3.2%	1.6%	[68]
United States	San Diego	8.1%	1.2%	6.3%	1.5%	3.5%	1.5%	[68]
United States	San Francisco	7.0%	1.5%	6.3%	1.5%	3.2%	1.4%	[68]
United States	San Jose	8.5%	1.1%	6.0%	1.2%	3.3%	3.1%	[58]
United States	Seattle	8.0%	1.1%	6.0%	1.3%	3.4%	1.5%	[59]
United States	St. Louis	9.0%	1.9%	6.3%	1.5%	2.8%	1.3%	[68]
United States	Tampa	8.4%	0.7%	5.3%	0.9%	2.3%	1.4%	[36]
United States	Washington	8.1%	1.0%	6.3%	1.5%	3.0%	1.4%	[68]

Notes. This appendix contains real estate, bond and inflation rate components that we used to calculate the risk premium. The columns Yield (rent/capital value), Long-Term Bond Yield, and Inflation Rate provide the yield per city, bond rate for a country, and the inflation rate for a country or MSA. The columns σ Yield, σ Long-Term Bond Yield, and σ Inflation Rate give standard deviations. The number of available quarters is given between brackets.

Chapter 4

RENT INDEXATION AND INFLATION HEDGING IN GLOBAL OFFICE MARKETS

4.1 Introduction

As described by Campbell and Viceira (2003), one of the most important decisions many people face is the choice of a portfolio of assets for their retirement savings. These assets may be held as a supplement to defined-benefit public or private pension plans; or they may be accumulated in a defined-contribution pension plan, as the major source of retirement income. In either case, a rapidly increasing number of assets is available including inflation-indexed bond funds. Inflation-index bonds are particularly interesting as safe assets for a long-term investor, because they support a stable standard of living in the long term. Institutional investors also face complex decisions. Some institutions invest on behalf of their clients, but others, such as foundations and university endowments, are similar to individuals in that they seek to finance a long-term flow of discretionary spending. The investment options for these institutions have also expanded enormously since the days when a portfolio of government bonds was the norm. In the current strategic asset allocation mix, inflation-linked bonds can be a very important investment tool in the menu of available assets as there is a growing awareness of inflation risk. Pension funds and their investment managers are increasingly recognizing the need for inflation-linked assets to match long-term liabilities, and look to real estate as one of the alternatives for providing these.

The ability of real estate to provide an inflation-linked cash flow has been one of the most important arguments for investing in real estate. Ibbotson and Siegel (1984) point out that real estate is a far better inflation hedge than other asset classes, except for Treasury Bills. The inflation hedge capability of real estate is linked to inflation compensation in rent contracts, which are even used to create inflation-linked products. For example, IEF Capital[23], which uses high quality shopping center and office lease contracts in the Netherlands to create inflation indexed bonds, inflation swaps[24], and inflation exchange contracts. However, inflation linked contracts with a direct link to ex-post inflation are mainly used in Europe.[25] Other rent contract types[26] used around the world might have different links with inflation. There are contracts based on graduated rent reviews, which could offer inflation compensation against expected inflation because of the steps-ups during the lease contract. With the flat rent contract, the inflation hedge potential depends on market rent conditions. The revaluated rent could offer inflation hedge potential for ex-post or ex-ante inflation, depending on the real estate appraiser. The central question then becomes; are there contract types that offer a better inflation hedge? Furthermore, the inflation link is based on the agreements made about changes in rent during the contract period. At the end of the contract period, rents can be adjusted upwards or downwards to bring them in line with market rents. This could mean that the inflation compensation does not hold outside the lease contract period. For a large portfolio with frequently ending and beginning lease contracts, market rent conditions become more important, thereby reducing the effect of rent contract guarantees like indexation.

It is generally assumed that the inflation hedge argument holds for all property types in all markets. However, rent cycles are different for different property types and previous studies have also indicated that there are some differences between countries and across markets. Furthermore, Ball et al. (1998) argue that there is every reason to expect that property, like all the other main asset classes, will provide long-term protection against inflation, that is, real returns over a reasonable period are likely to be positive. However, there is little evidence to support the argument that there is full compensation for expected and unexpected inflation on a period to period basis.

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[23] IEF Capital is a joint venture between Inflation Exchange Fund and Bouwfonds Asset Management.

[24] Using a series of 20- to 30-year swaps with nationals of about € 120 Million, IEF Capital has paid this inflation to Dutch pension funds including health sector fund PGGM and metalworking fund BPMT, to improve matching of future liabilities.

[25] The inflation link for rent contracts within Europe is similar. However, these might have some different conditions which could impact the inflation hedge potential: for example, in Italy, the rent may be raised annually by a percentage not exceeding 75% of the increase in the cost of living or in France where the indexation is linked to the National Cost of Construction Index (source: Freeman's European Property, 2004). See table 4.2 for an overview of rent review and lease characteristics.

[26] An explanation of the rent contract types is given in section 4.2. The rent change provisions in the lease contracts are based on a classification by Geltner and Miller (2001)

We are extending current literature by looking at the inflation hedge capability of international direct or non-listed office real estate investment in 54 office districts in 24 countries around the world on a quarterly basis from the first quarter of 1988 through the last quarter of 2004. We analyze what influence differences in rent review types might have on the inflation hedge potential. To do this, we divide the rent review types into four groups: flat rent, graduated rent, revaluated rent, and indexed rent. For each of these groups, we will test the potential of hedge capabilities against expected and unexpected inflation. Furthermore, we test whether the results differ significantly from one another. We focus on the office markets because the most consistent data are available and they are generally among the biggest, most accessible and liquid of the property types, especially for international direct real estate investors.

The Fama and Schwert (1977) methodology is used to test inflation hedge hypotheses for appraisal-based indices, created from total return data, for office properties in various countries around the world. For the U.S., Hartzell et al. (1987) find that non-listed real estate is a good inflation hedge against both expected and unexpected inflation. Furthermore, they demonstrate that office properties are a hedge against expected inflation. Rubens et al. (1989) look at several types of assets, including non-listed real estate. They find that non-listed real estate is a sufficient hedge against unexpected inflation. For the U.K., Limmack and Ward (1998) come to the conclusion that, using the T-Bill as proxy, office real estate is a good hedge against expected inflation. If the ARIMA estimate is used, they find that office real estate is a good hedge against unexpected inflation. Tarbert (1996) and Barber and White (1995) find evidence in support of the U.K. office market as a hedge against unexpected inflation, using T-Bills as a proxy. Applying an ARIMA estimate, they come to the conclusion that office returns are a better hedge against expected inflation. Newell (1996) finds that Australian office real estate is an inflation hedge for both expected and unexpected inflation. Finally, Ganesan and Chiang (1998) demonstrate the hedge capabilities of office real estate in Hong Kong. These results show that the property markets differ and in consequence, their inflation hedge capabilities differ.

One of the few papers to make an international comparison of inflation hedge capabilities of real estate is by Liu, Hartzell, and Hoesli (1997). They investigate listed real estate in seven countries and find mixed evidence, that in most countries listed real estate does not seem to be a better inflation hedge than common equity shares. Studies by Gyourko and Linneman (1988), Murphy and Kleiman (1989), Chan et al. (1990), Liu and Mei (1992) Yobaccio et al. (1995) look at real estate investment trusts (REITs) as an inflation hedge. They all find that REITs are not a good hedge against either expected or unexpected inflation.

To address the issue of understanding the relationship between real variables and asset return, Coleman et al. (1994) suggest that real estate's ability to hedge inflation is in part a function of the conditions in the real estate market. They compute the elasticity of returns on U.S. office buildings with respect to inflation and compare these figures to office vacancy rates. They report that "when markets are in equilibrium the elasticity is close to 1.0, indicating a strong correspondence between changes in inflation and changes in return. When markets are not in equilibrium, the power of the hedge falls to 50% or below its prior strength". To estimate the impact of changing market fundamentals on the inflation hedge potential of real estate Hartzell and Webb (1993) include the vacancy rate alongside expected and unexpected inflation. This method is also applied by Wurtzebach et al. (1991). They find that real estate is not as good an inflation hedge during periods with high vacancy rates. Furthermore, they find major differences between the hedging capability of office and industrial real estate, where the structural imbalances in the office market affect the inflation hedging characteristics.

These studies apply the Fama and Schwert (1977) methodology, which divides inflation into an expected and unexpected component. Crucial are the assumptions used for expected inflation. We will estimate expected inflation using three different methods: short-term interest rate (as suggested in Fama, 1975), a method developed by Fama and Gibbons (1982), and an ARIMA based forecast.

This chapter is organized as follows. In section two, we give an overview of the hypotheses which will be explored in this chapter. In section three, we describe the data and provide summary statistics for real estate market indicators, inflation rates and interest rates for the countries in our database; section four provides the methodology. Section five discusses the results and interprets the findings. Section six gives the conclusions.

4.2 Hypotheses

In this chapter we analyze the relationship between inflation, both expected and unexpected and change in rental value, change in capital value, and total return on real estate. The rental value of real estate is determined in the market and might be able to compensate for both expected and unexpected inflation. Most previous literature about the inflation hedge capability of direct real estate also assumes a positive relationship between total return and expected and unexpected inflation. However, Hoesli et al. (1997) suggest that the relationship between change in capital value and total return and unexpected inflation might be negative in the short-term, because "when inflation expectations rise, the expected real value of future income falls and so the capitalization rate value should rise. If the level of unexpected inflation is positively related to the change in expectations, and as rental income is unrelated to unexpected inflation, real estate capital value should be negatively related with unexpected inflation." Since most previous literature assumes that the relationship between change in capital value and total return is positive we test this relationship in the hypotheses. However, we will review our findings to see if our results support the assumed negative relationship between change in capital value, total return and unexpected inflation, as suggested by Hoesli et al. (1997).

The second hypothesis that we would like to investigate in this chapter addresses the central question: are there contract types that offer a better inflation hedge for investors? One of the most important reasons to assume that real estate investment is a good inflation hedge relates to the characteristics of the income-producing rent component. The rent determines both the cash flows from the investment and the value of the property. Rent contracts are often structured to protect the landlord from inflation in operating expenses of running a building, thereby keeping the real income for the landlord constant. Since the income component is corrected for inflation, the value of the building will also be adjusted for inflation and will therefore result in an appreciation return on real estate. These characteristics should make real estate a good inflation hedge. However, lease terms differ around the world and inflation compensation is not always part of the lease contract. On top of this, especially for relatively short lease contracts, property owners run the risk of not being compensated for inflation as market conditions have changed at the time the lease expires. Since lease review terms seem critical, we would like to categorize countries into groups based on the generally used rent lease review terms for office properties.

Geltner and Miller (2001) identify five rent change provisions in lease contracts: (1) Flat rents: this contract provides a constant rent for the term of the lease, generally used with short term leases or longer term leases during low inflation periods. (2) Graduated rent: this lease contract includes step-ups (or steps) at specific points in time during the contract. This is negotiated before entering a contract. (3) Revalued rent: a revaluation lease specifies that the rent will be reviewed at certain points in time during the contract. It does not however specify the amount or percentage of the rent increase. Instead, the lease contract specifies that the rent change will be determined by a real estate appraiser. This contract type is sometimes referred to as upward only, while other lease types will also allow for downward adjustments. (4) Indexed rent: rents are periodically adjusted based on a pre-agreed index. Most known is compensation based on the consumer price index (CPI) or cost of living. An alternative might be indexation based on construction costs. Furthermore, partial adjustment to CPI is also possible, since operating expenses do not always rise as fast as consumer prices. (5) Percentage rent; part of the rent payment is determined by the income or turnover of the tenant. This lease contract type is mostly used in contracts for retail space and is therefore not a category in our global office dataset.

As rent payments are only directly linked to inflation in the fourth contract type, this raises the interesting question of whether real estate returns in countries with a rent indexed contract offer a better inflation hedge than countries with predominantly other, non-index adjusted, contract types. A further refinement would be that graduated rent contracts could have a part of the inflation expectation already incorporated in the step-ups and that revaluated rent contracts will already incorporate the inflation expectations of the real estate appraiser.

The third hypothesis will test whether the inflation hedge capability is also influenced by the length of the lease contract as documented by Hartzell et al. (1987). They look at the duration of a real estate asset which is a function of the lease contract and market conditions. Longer lease contracts generally have an inflation compensation component through indexed rent, revaluated rent or graduated rent contracts. These types of rent contracts offer the landlord some inflation compensation during the period covered by the lease. Alternatively, flat rent contracts tend to be short and do not have an inflation compensation component. The inflation compensation for an office building with a fixed short term lease contract therefore depends on the change in market rent.

Since it is assumed that longer lease contracts have some form of inflation protection, especially against expected inflation, a third question is whether real estate investments in countries with longer lease contracts offer a better inflation hedge. To test this, we divide the countries into three groups: leases of one to three years, three to five years, and five years and longer.

Hypotheses:

- There is a positive relationship between change in rent, change in capital value and total return and expected inflation and unexpected inflation.
- Different rent review options in lease contracts result in different inflation hedge potential for expected and unexpected inflation.
- Longer lease contracts with rent adjustments during the lease offer a better inflation hedge.

Alternatively, the inflation hedge capability of office market real estate returns is relatively independent of the underlying lease contract characteristics. Furthermore, the return on a large real estate portfolio will mimic the return movement of the market with frequently ending and beginning rent contracts.

4.3 Data

Our data set consists of real estate data, equity indices, and macro-economic variables. The real estate database includes 54 major office districts in cities in the Asia/Pacific region (15), Europe (19), and the United States (20) on a quarterly basis from the first quarter of 1988 through the last quarter of 2004. The cities are selected based on the quality and availability of data, size of the office space market, and economic importance for the surrounding region. Appendix 4.A provides an overview of the office markets included in our data set.

All the real estate indicators for Asia/Pacific and Europe were provided by Jones Lang LaSalle, as published in their real estate market reports. For the twenty office districts in the U.S., total return and percentage quarterly change in market value per square foot (appreciation) are obtained from the National Council of Real Estate Investment Fiduciaries (NCREIF) index.[27] Torto Wheaton subscribers' services provided net asking rent[28], vacancy rate, and stock data for the downtown office market for the selected MSAs in the United States. These data providers have been selected to create a consistent data set, in order to make a global analysis possible.

The Asian/Pacific and European real estate indicators in the data set are local net rent per square meter, capital value or price per square meter, initial yield (net rent/capital value), vacancy rate, and stock. Local net rent is the average effective rent per square meter observed or reported for the Central Business District (CBD) or for high quality investment grade office property in local currency. Unless otherwise stated, all our variables are in local currency. Capital value or price is the average price per square meter of prime office space in the CBD, based on transactions in each time period. Based on net rent (D_{it}) per quarter per square meter, yield, and price (P_{it}) per square meter we created a total return index (R_{it}) on a quarterly basis from the first quarter of 1988 through the last quarter of 2004, where the total return is the sum of capital appreciation and rent generated by the property.

For the U.S. we extracted the real estate indicators from the NCREIF database using total returns, income returns, appreciation returns, and price per square foot for all office properties in an MSA. Vacancy rate is rentable space as a percentage of total inventory of the downtown office market. Vacancy includes all space on the market for rent; this includes the so called "shadow-space" or space available for sub-lease. Stock is the total inventory or net rentable area of commercial office space in the downtown office district in a city, in square meters.

Appendix 4.A gives an overview of the office market return characteristics of the cities in our database. The table shows statistics on the average total return for office properties, average rent changes, average change in capital value. The table also provides standard deviations for the return and real estate indicators (σ TR,

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[27] NCREIF total return data is used in studies to test the inflation hedge potential of U.S. direct real estate by Wurtzebach et al. (1991), Hartzell and Webb (1993).

[28] Net asking rent provided by Torto Wheaton Research for the U.S. MSAs is the most comparable to net rent provided by JLL for Asia/Pacific and Europe.

$\sigma\Delta$ Rent, and $\sigma\Delta$ Capital Value). The number of quarterly total returns observations is shown in parentheses.

Table 4.1 Average total return, inflation, and short term interest rate by country

	Total Return	σ Total Return	Inflation	σ Inflation	Short Term Interest Rate	σ Short Term Interest Rate	
Australia	2.2%	3.5%	0.6%	0.3%	1.5%	0.4%	[55]
Belgium	2.3%	3.1%	0.5%	0.4%	1.3%	0.7%	[62]
China	4.4%	3.9%	0.5%	0.1%	1.3%	0.9%	[52]
Czech Republic	2.4%	4.7%	1.7%	2.0%	1.8%	0.9%	[50]
France	1.8%	3.8%	0.4%	0.3%	1.3%	0.7%	[58]
Germany	0.5%	4.9%	0.4%	1.2%	1.1%	0.5%	[57]
Hong Kong	3.5%	12.1%	4.0%	3.1%	1.1%	0.5%	[68]
Hungary	2.7%	4.2%	3.3%	2.4%	4.2%	1.9%	[50]
Indonesia	3.4%	12.1%	2.7%	3.8%	4.1%	3.5%	[68]
Ireland	3.3%	7.1%	0.7%	0.5%	1.6%	1.1%	[62]
Italy	1.8%	5.5%	0.8%	0.4%	1.7%	1.0%	[56]
Japan	- 1.3%	4.1%	0.2%	0.6%	0.9%	0.5%	[68]
Luxembourg	1.9%	5.1%	0.5%	0.4%	1.2%	0.6%	[56]
Malaysia	1.9%	2.0%	0.7%	0.6%	1.2%	0.5%	[52]
Netherlands	2.7%	3.4%	0.6%	0.4%	1.8%	0.8%	[68]
Philippines	4.6%	5.6%	2.0%	1.5%	3.1%	0.9%	[68]
Poland	1.8%	4.7%	1.7%	1.6%	3.3%	1.7%	[35]
Portugal	3.3%	9.2%	0.8%	0.5%	0.8%	0.2%	[28]
Singapore	0.3%	6.0%	0.4%	0.4%	0.4%	0.2%	[59]
Spain	2.9%	7.9%	1.0%	0.7%	1.9%	1.1%	[68]
Sweden	3.6%	6.3%	0.3%	0.7%	1.2%	0.5%	[44]
Thailand	4.1%	6.6%	1.0%	0.8%	1.8%	1.3%	[68]
United Kingdom	1.2%	7.2%	0.9%	0.9%	1.9%	0.8%	[68]
United States	1.5%	2.7%	0.7%	0.4%	1.1%	0.5%	[68]

Notes. This table shows the average quarterly total return, rent growth, inflation, and short term interest standard deviation for every country included in our database. The number of available quarters is given in brackets.

Table 4.1 shows statistics on average total return for office properties, average inflation, and average short term interest rate by country. The total return for a country is calculated from the weighted average total return of the cities in our dataset, based on relative size of a market in square meters. Total return, inflation, and short term interest rate are used to determine expected and unexpected inflation as described in the methodology section. The table also provides standard deviations for the real estate total return, inflation rate, and interest rate (σ TR, σ Inflation, and σ ST. Interest Rate). The number of quarterly total return observations is shown in parentheses. The total return is relatively high in China and the Philippines and low in Japan. The office markets in Hong Kong and Indonesia have the most volatile total returns. Inflation is relatively high in Hong Kong, Indonesia, the Philippines and Central Europe, with high short term interest rates in Indonesia, Philippines, and Central Europe.

Figure 4.1 Ex-post real total return and real rent growth for Asia/Pacific

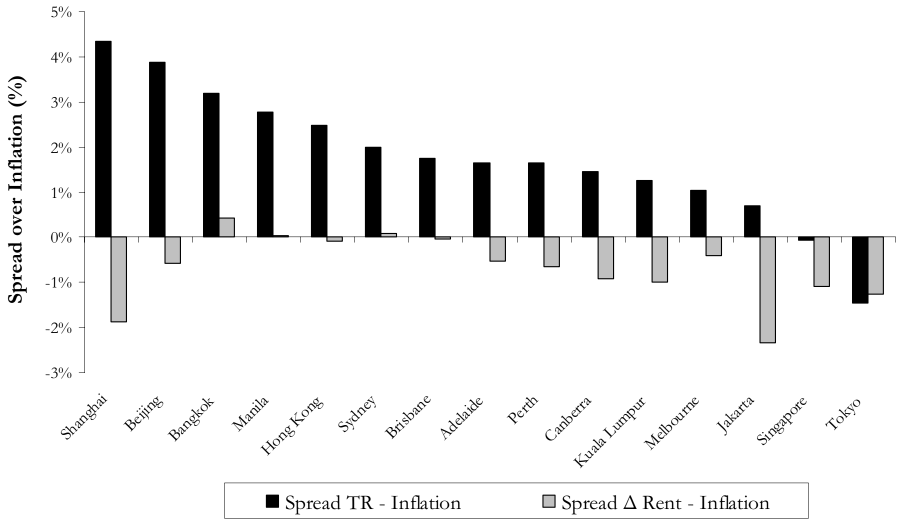


Figure 4.2 Ex-post real total return and real rent growth for Europe

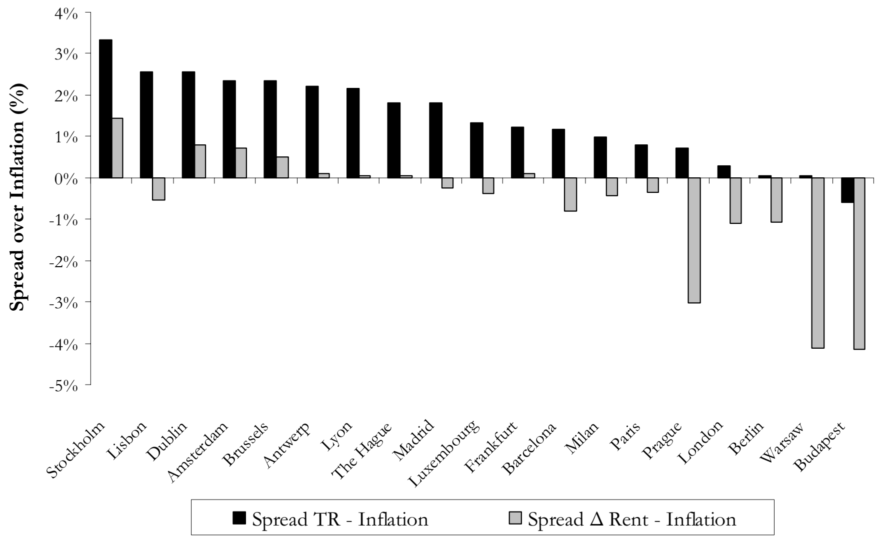
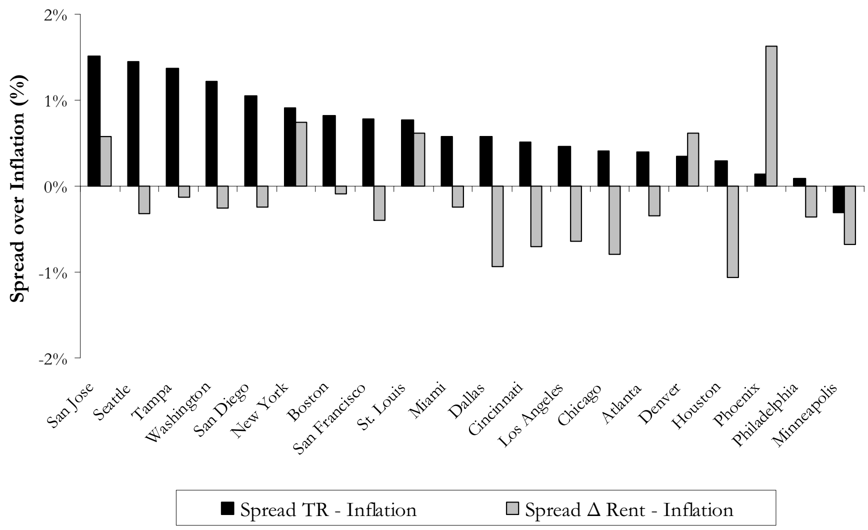


Figure 4.3 Ex-post real total return and real rent growth for the United States



Figures 4.1–4.3 show the difference between the quarterly total return, quarterly rent growth, and inflation for Asia/Pacific, Europe, and the U.S. The bars in the figures are ranked based on the largest spread of the total return over inflation. This analysis gives an indication of the ex-post comparison between total return and inflation. It also provides an insight into how well nominal rent growth has kept up with inflation. For Asia/Pacific we can see that all cities, except for Singapore and Tokyo, have a positive spread of the total return over inflation. However, rent growth has only been fully compensated for inflation in Bangkok, Manila, and Sydney. In the other Asia/Pacific cities, the rent growth is below ex-post inflation. Most European cities, with the exception of Budapest, have a positive real total return, but again as in Asia/Pacific, real rent growth has not occurred in all cities. Most notably are the three cities in Central Europe: Prague, Warsaw, and Budapest. In these cities, the office market rents have been declining as more high quality or class A office space became available as a result of new construction. For the U.S., only Minneapolis shows a negative difference for total return over ex-post inflation. The spread of rent growth over ex-post inflation gives a different picture. Five of the 20 cities have a positive spread, and Phoenix has a relatively high quarterly spread of 1.6%.

Descriptive analyses in appendices B-E show the quarterly change in rent, change in capital value, and total return versus the quarterly inflation (change in consumer price index in the quarter) over the time period included in our data set (see table 4.1 and appendix 4.A). We selected office markets in four countries, Australia, Hong Kong[29], the U.K.[29] and the U.S., to provide an initial view of countries in different regions of the world. The figures do not show consistent relationships for the four countries: the office market in Australia shows a positive relationship between change in inflation and rent, and a negative relationship between inflation and change in capital value and total return. For the Hong Kong office market change in rent, capital value, and total return seem to be very closely linked to inflation. However, the change in rent, capital value, total return, and inflation are very volatile, in part as a result of the Asian crisis. For the office market in the U.K., there is a slightly positive relationship between change in rent and inflation and a positive relationship between inflation and change in capital value and total return. The inflation rate has been relatively low in the U.K. and differences in variability between the rate of inflation and change in rent, change in capital value, and total return have also been low. For the U.S., there is a positive relationship between change in rent and inflation and a negative relationship between change in capital value and total return and inflation, similar to the office market in Australia.

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[29] Using a four quarters lag for the change in rent, change in capital value, and total return. See paragraph 4.4.4 for further information.

Table 4.2 gives an overview of rent-review indexation by country, average revision period, lease length, and right to renew. Indexed rent reviews are used in most European countries, while revalued rents are most used in Australia, Ireland and the U.K., flat rents in Asia, and graduated rent reviews in the U.S. Rent-review information in table 4.2 is collected from various industry reports. For Europe, we used European Property 2004 from Freeman Business Information, and the NAI Property Guide. Data for Asia/Pacific were obtained from JLL Corporate Occupiers Guide (Asia Pacific), Colliers Worldwide Leasing Guidelines, and the NAI Property Guide. The U.S. information was provided by ING Clarion.

For Australia, Asia, Europe, and the U.S. country-specific data for short term interest rate, and consumer price inflation (CPI) were obtained from Thomson Financial Datastream.

Table 4.2 Rent review and lease characteristics by country

	Rent Review	**Review Period in Years**	**Estimated Lease Length**	**Right to Renew**
Australia	Revaluated Rent	2	3–10	No
Belgium	Indexed Rent	1	9	No
China	Flat Rent	3	2–3	Yes
Czech Republic	Indexed Rent	1	5–10	No
France	Indexed Rent	1	9	Yes
Germany	Indexed Rent	1	5–10	No
Hong Kong	Flat Rent	3	2–3	No
Hungary	Indexed Rent	1	1–5	No
Indonesia	Flat Rent	3	3	Yes
Ireland	Revaluated Rent	5	15–20	Yes
Italy	Indexed Rent	1	9	Yes
Japan	Flat Rent	3	3–5	No
Luxembourg	Indexed Rent	1	3–9	Yes
Malaysia	Flat Rent	2	2–3	Yes
Netherlands	Indexed Rent	1	5–10	No
Philippines	Flat Rent	3	3	Yes
Poland	Indexed Rent	1	5–10	No
Portugal	Indexed Rent	1	>15	No
Singapore	Flat Rent	2	2–3	Yes
Spain	Indexed Rent	1	5–10	No
Sweden	Indexed Rent	1	3–10	Yes
Thailand	Flat Rent	3	3	No
United Kingdom	Revaluated Rent	5	15–20	Yes
United States	Graduated Rent	3–5	5	No

Notes. This table shows rent review type, review period, average estimated lease length in years, and whether the tenant has a right to renew the lease at the end of the lease period. Information for Asia/Pacific is obtained from Jones Lang LaSalle's publication Corporate Occupiers Guide (Asia/Pacific), NAI Property Guide summer 2004, and Colliers International Worldwide Leasing Guidelines. For Europe, the information was collected from Freeman's European Property 2004 and NAI Property Guide summer 2004. ING Clarion provided the information for the U.S.

4.4 Methodology

4.4.1 Test for inflation hedging

A frequently used method to test inflation hedge characteristics is based on the definition proposed by Fisher (1930) and the methodology formalized by Fama and Schwert (1977). It states that the expected nominal return on an asset is equal to the expected real return on an asset plus the expected rate of inflation. Formally,

$$E(\tilde{R}_{it} \mid \varphi_{t-1}) = E(\tilde{r}_{it} \mid \varphi_{t-1}) + E(\tilde{\Delta}_t \mid \varphi_{t-1}), \tag{4.1}$$

where the left hand side, $E(\tilde{R}_{it} \mid \varphi_{t-1})$, is the expected nominal return on asset *i* from *t-1* to *t*, and the right hand side the expected real return, $E(\tilde{r}_{it} \mid \phi_{t-1})$ on asset *i*, and expected inflation, $E(\tilde{\Delta}_{it} \mid \phi_{t-1})$, subject to all the information available at time (*t*-1). For our international direct real estate database, the expected nominal direct real estate return for a country *i* at time *t* is equal to the expected real return on real estate in country *i* at time *t* plus the expected inflation at time *t* in the country, based on the best possible assessment in the previous period at time (*t*-1).

Given that the market is efficient, we can assume that the set price of an asset is equal to the sum of the expected real return and correctly assessed inflation, whereby the real return and the expected inflation vary independently. In that case, the expected inflation can be measured by estimating:

$$\tilde{R}_{it} = \alpha_i + \beta_i \, E(\tilde{\Delta}_t \mid \varphi_{t-1}) + \tilde{\varepsilon}_{it}, \tag{4.2}$$

where α_i represents the real rate of return and β_i shows the relationship with the expected inflation rate. If this regression estimate for coefficient β_i is indistinguishable from 1.0, the expected nominal return has a one-on-one relation to expected inflation and expected inflation is unrelated to the expected real return. $\tilde{\varepsilon}_{it}$ should be serially uncorrelated, as the market is assumed to be efficient.

So far, we have only discussed expected inflation. However, we are also interested in the unexpected inflation component, which is equal to observed inflation (Δ_t) minus expected inflation $E(\tilde{\Delta}_{it} \mid \phi_{t-1})$. Incorporating this into equation (4.2) gives:

$$\tilde{R}_{it} = \alpha_i + \beta_i \, E(\tilde{\Delta}_t \mid \varphi_{t-1}) + \gamma_i \left[\Delta_t - E(\tilde{\Delta}_t \mid \varphi_{t-1}) \right] + \tilde{\eta}_{it}. \tag{4.3}$$

When the regression coefficient γ_i is indistinguishable from 1.0, this indicates that an asset is a hedge for unexpected inflation. If β_i = γ_i = 1.0, the asset is a hedge against both expected and unexpected inflation and the ex-post real return is uncorrelated with ex-post inflation.

Critical in testing equation (4.3) is to find a measure for the expected inflation. Current literature mostly uses one of the following three measures as proxy for expected inflation: (I) a lagged return on the short term government bond, (II) a method described in a paper by Fama and Gibbons (1982)[30], and (III) an ARIMA (0,1,1)[31] model for the real rate of return. The first proxy assumes that the expected real interest rate on government bonds is constant and that the market for government bond is efficient. Fama and Gibbons (1982) correct for the non constant real interest rate by applying a moving average process.

To test the effectiveness of each of the three proxies we use the following model:

$$\Delta_t = \alpha + \beta \; E(\tilde{\Delta}_t) + \tilde{\varepsilon}_{it} , \tag{4.4}$$

where (Δ_t) is the observed inflation for a country in quarter *t* and $E(\tilde{\Delta}_t)$ is one of the three proxies. The proxy should have a coefficient that is statistically indistinguishable from 1.0.

4.4.2 Inflation hedge capabilities during different market conditions

Hartzell and Webb (1993) demonstrate that the inflation hedge potential of real estate also depends on market fundamentals. As a measure of market fundamentals they use vacancy rate on a MSA level. Since our analysis is on a country level, we calculated a weighted average vacancy rate based on the relative size of the downtown office market. We will test inflation hedge characteristics during both low and high vacancy rate periods and analyze the impact of changing market conditions. This is achieved by adding vacancy rate as a third component to equation (4.3) in addition to expected and unexpected inflation.

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30 The Fama and Gibbons (1982) method , applied by Liu et al. (1997), give the expected inflation as:

$$E(\tilde{\Delta}) = STY_{t-1} - (1/4)\sum_{s=t-1}^{t-4}\left(STY_{s-1} - log\left(\frac{CPI_s}{CPI_{s-1}}\right)\right),$$

where STY_{t-1} is the nominal short term yield at time *t*-1 and $\tilde{\Delta}$ is the inflation rate.

31 The estimated inflation is calculated by using a ARIMA (0,1,1) model to forecast the real rate of return. The expected inflation is equal to the lagged short term interest rate minus the forecast real rate of return (see Liu et al., 1997).

4.4.3 Rent contract characteristics and potential as inflation hedge

To analyze whether the inflation hedge capability is influenced by rent review type and/or the length of the lease contract, we apply an unbalanced panel data approach because this allows us to combine cross-section and time-series dimensions for the country level return data on a quarterly basis, thereby obtaining the parameters more efficiently than by means of a pure time-series or cross-section (additional benefits of panel data are described in Baltagi, 2005). The two separate analyses will be: pooled regression equations for the four rent review types and pooled regression equations for the three lease-length groups. We propose a one-way fixed effect model, where the specification is only dependent on the cross section. In order to achieve this we have to adjust equation (4.3) to:

$$R_{it} = \beta E(\widetilde{\Delta}_{it}) + \gamma \left[\Delta_{it} - E(\widetilde{\Delta}_{it}) \right] + \mu_i + \upsilon_{it}, \tag{4.5}$$

where R_{it} denotes a particular change in rent, change in capital value or total return of the office market in country *i* in period *t*, $E(\widetilde{\Delta}_{it})$ is the expected inflation, $\left[\Delta_{it} - E(\widetilde{\Delta}_{it}) \right]$ denotes the unexpected inflation, μ_i is the office market or country-specific real rate of return, and υ_{it} denotes the remainder of the disturbance.

4.4.4 Lag of change in rent, change in capital value, and total return

In estimating the expected and unexpected inflation we apply a lag up to four quarters, as used in previous real estate research (see for example Gyourko and Linneman, 1988 and Miles and Mahoney, 1997), because it is assumed that real estate indicators do not adjust immediately. The lag varies by country, but is consistent for change in rent, change in capital value and total return within a country. We find no lag in Australia, China, the Philippines, and the U.S.; a lag of one quarter in Ireland, Luxembourg, and Singapore; a lag of two quarters for office markets in Japan, Poland, and Thailand; a lag of three quarters for office markets in Belgium, the Czech Republic, Germany, the Netherlands, Portugal, Spain, and Sweden; and a lag of four quarters in France, Hong Kong, Hungary, Indonesia, Italy, Malaysia, and the U.K.

4.5 Results

4.5.1 Test of expected inflation proxies

As discussed in the methodology section, we are planning to use three proxies for expected inflation: (I) a lagged return on the short term government bond, (II) a method described by Fama and Gibbons (1982), and (III) a ARIMA (0,1,1).

Table 4.3 presents the results of the test for the effectiveness of each of the three proxies. The best of the three proxies for expected inflation is in bold type. The results are in line with our expectations and what previous research has indicated. The expected inflation proxy using the ARIMA model is favoured in most countries, followed by the Fama Gibbons short term yield proxy. The beta coefficients for the lagged short term yield are between -0.10 and 1.56, the coefficients for Fama Gibbons STY proxy are between -1.91 and 1.06, and the ARIMA model proxies are between 0.04 and 0.79

Table 4.3 Predictors of quarterly inflation by country

Measure of $E(\widetilde{\Delta}_t)$	Lag of Short Term Yield			Fama-Gibbons STY			ARIMA (0,1,1)		
Country	α^a	β^a	R^2	α^a	β^a	R^2	α^a	β^a	R^2
Australia	0.44*	13.09	0.03	**0.44***	**15.67**	**0.04**	0.54*	15.45	0.02
Belgium	0.31*	16.55*	0.08	**0.33***	**17.93***	**0.08**	0.44*	15.37	0.01
China	0.45*	1.83*	0.09	0.45*	1.75*	0.09	**0.39***	**18.67***	**0.12**
Czech Republic	**0.42**	**67.99***	**0.09**	1.26*	35.91	0.02	0.78*	60.92*	0.19
France	**0.27***	**13.28***	**0.09**	0.30*	13.19*	0.07	0.37*	18.54	0.03
Germany	0.31	7.28	0.00	**0.20**	**19.99**	**0.01**	0.33*	11.69	0.00
Hong Kong	2.29*	156.25*	0.06	2.77*	-191.26*	0.21	**1.09**	**71.91***	**0.19**
Hungary	**-0.36**	**84.57***	**0.45**	0.28	106.49*	0.35	0.62	79.45*	0.39
Indonesia	-0.16	69.12*	0.39	**-0.40**	**103.46***	**0.48**	0.98*	63.76*	0.40
Ireland	0.90*	-10.31	0.04	0.89*	-12.11	0.06	**0.70***	**4.08**	**0.00**
Italy	0.32*	27.66*	0.46	0.38*	30.53*	0.42	**0.36***	**54.55***	**0.43**
Japan	-0.30	51.88*	0.15	**-0.35**	**62.29***	**0.11**	0.08	59.16*	0.11
Luxembourg	0.37*	13.29	0.04	0.40*	13.52	0.03	**0.46***	**14.75**	**0.01**
Malaysia	0.09	51.85*	0.21	**0.12**	**65.57***	**0.20**	0.41*	39.51*	0.09
Netherlands	0.47*	7.50	0.02	0.53*	5.14	0.01	**0.41***	**33.10***	**0.07**
Philippines	**-0.26**	**71.30***	**0.20**	0.43	67.04*	0.11	0.82*	54.03*	0.22
Poland	-0.27	57.93*	0.34	**-0.02**	**67.61***	**0.21**	1.00*	57.90*	0.40
Portugal	0.32	52.33	0.06	**0.48**	**54.11**	**0.06**	0.61*	18.71	0.01
Singapore	0.20	38.03	0.06	0.37*	-3.79	0.00	**0.15***	**52.12***	**0.25**
Spain	0.50*	25.51*	0.19	0.57*	28.20*	0.18	**0.64***	**38.99***	**0.12**
Sweden	0.14	13.53	0.00	0.18	9.83	0.01	**0.23**	**23.19**	**0.01**
Thailand	0.26	37.70*	0.36	0.31*	45.42*	0.38	**0.49***	**47.40***	**0.35**
United Kingdom	-0.08	52.15*	0.25	**-0.11**	**67.98***	**0.24**	0.42*	55.68*	0.20
United States	0.37*	32.42*	0.19	0.47*	33.74*	0.15	**0.41***	**43.98***	**0.16**

Notes. This table gives the results for testing the effectiveness of each of the three proxies for expected inflation. The following model is used: $\Delta_t = \alpha + \beta \; E(\widetilde{\Delta}_t) + \widetilde{\varepsilon}_{it}$,

where (Δ_t) is the observed inflation for a country in quarter *t* and $E(\widetilde{\Delta}_t)$ is one of the three proxies. The proxy should have a coefficient that is statistically indistinguishable from 1.0. The symbols * indicate that the measure is significantly different from zero at the 5% level using a two-sided test methodology. In bold type are the results for the best of the three proxies for expected inflation, measured by an alpha close to zero and a beta coefficient close to one.

[a] Values are x 100

4.5.2 Test of inflation hedge capability

Table 4.4 presents the results of the change in rent test for the coefficient of the expected (β) and unexpected inflation (γ), where a good inflation hedge would be a coefficient close to one. Most coefficients are positive and some are close to one, showing that change in real estate office rent moves with expected and unexpected inflation. There appears to be a good relationship between expected inflation and the change in rent for European offices in Belgium, France, Germany, Hungary, Ireland, the Netherlands, Poland, Spain (in Asia) Hong Kong, Japan, Malaysia, and Thailand and in the United States. However, some results for the coefficients are negative: the coefficients for China are negative five times out of six, which could lead to the conclusion that a change in real estate rents does not follow expected and unexpected inflation. Some countries have only a negative β for all three (Indonesia, Italy, Luxembourg) or for one or two of the proxies used (Australia, Sweden and the U.K.), where the office market change in rent could be less of an inflation hedge against expected inflation. The bold type indicates the best model for the expected and unexpected inflation hedge from table 4.3. Looking at the coefficient for unexpected inflation, we can conclude that real estate seems to be a better hedge against unexpected inflation, because more coefficients have a positive sign. Next to China, only Italy and Portugal have a negative coefficient for unexpected inflation.

Table 4.4 Inflation hedging ability of change in rent

	Lag of Short Term Yield		Fama-Gibbons STY		ARIMA (0,1,1)	
Country	β	γ	β	γ	β	γ
Australia	-1.82	1.15	**-2.40**	**1.22**	2.37	0.07
Belgium	0.93	0.61	**0.97**	**0.61**	2.86*	0.56
China	-25.96	-28.59	-25.16	-27.78	**2.27**	**-46.61***
Czech Republic	**-0.33**	**0.04**	0.59	-0.08	-0.32	0.26
France	**1.31**	**1.05**	1.35	1.05	4.12*	1.02
Germany	2.56*	1.16	**3.09***	**0.37**	3.45*	0.96
Hong Kong	4.36	0.43	2.79	0.83	**0.80**	**0.50**
Hungary	**0.23**	**0.42**	0.39	0.22	0.24	0.39
Indonesia	-0.49	0.47	**-0.38**	**0.20**	-0.48	0.59
Ireland	2.59	2.64*	2.76	2.69*	**2.96***	**2.63***
Italy	-1.68	0.55	-2.18	0.20	**-3.64***	**-0.68**
Japan	1.51	0.76	**1.62**	**0.81**	2.00	0.72
Luxembourg	-0.76	0.51	-0.96	0.49	**-0.70**	**0.18**
Malaysia	1.75	1.05	**2.64***	**0.82**	1.94	1.15
Netherlands	1.97*	1.90*	1.99*	1.90*	**1.38**	**2.06***
Philippines	**1.82***	**1.04**	1.32	1.27*	1.85*	0.71
Poland	0.53	0.50	**0.61**	**0.47**	0.38	0.75
Portugal	6.69*	-0.19	**7.97***	**-0.23**	1.43	0.51
Singapore	9.89*	4.75	6.68	5.46*	**9.50***	**1.67**
Spain	0.65	1.29	0.53	1.29	**0.99**	**0.69**
Sweden	4.38*	0.55	3.62	0.67	**-2.18**	**0.80**
Thailand	1.88	2.38	1.79	2.46	**1.96**	**1.71**
United Kingdom	-0.20	0.46	**-0.38**	**0.42**	0.41	-0.02
United States	1.76	1.38	2.03	1.27	**1.61**	**1.60**

Notes. The symbols * indicate that the measure is significantly different from zero at the 5% level using a two-sided test methodology. In bold type are the results for the best of the three proxies for expected inflation, measured by an alpha close to zero and a beta coefficient close to one.

Table 4.5 shows the results for the change in capital value test for expected and unexpected inflation. Most coefficients are positive and some are very close to one, demonstrating that in most countries office real estate appreciation is a good hedge against expected and unexpected inflation. An exception, alongside China, is the Czech Republic with mostly negative coefficients. Additionally, the change in capital value of office markets in the U.S. does not seem to be a good inflation hedge. We will discuss the negative coefficient for the office markets in the U.S. in the next paragraph, when we discuss the results of the inflation hedge capability of total return, which also shows negative coefficients. We can see that the change in capital value has more positive coefficients and therefore moves more closely in line with unexpected inflation.

Table 4.5 Inflation hedging ability of change in capital value

	Lag of Short Term Yield		Fama-Gibbons STY		ARIMA (0,1,1)	
Country	β	γ	β	γ	β	γ
Australia	-3.61*	0.75	**-4.30***	**0.81**	1.53	-0.69
Belgium	0.01	1.13	**-0.09**	**1.12**	0.57	0.69
China	-7.18	-8.48	-6.78	-8.09	**5.03**	**-14.09***
Czech Republic	**-0.34**	**-0.09**	0.45	-0.18	-0.31	0.02
France	**-1.38**	**0.15**	-1.43	0.05	0.64	-0.49
Germany	2.46	1.68	**3.33***	**0.59**	3.21	1.44
Hong Kong	1.22	0.94	3.03	1.17*	**1.00**	**0.93**
Hungary	**0.06**	**0.64**	-0.12	0.55	0.07	0.59
Indonesia	-0.65	1.02*	**-0.83**	**0.90**	-0.52	1.05*
Ireland	1.14	2.02	1.41	2.07	**2.12**	**2.43**
Italy	-1.08	2.29	-1.83	1.81	**-3.97**	**0.17**
Japan	1.05	1.28	**0.53**	**1.40**	2.10	0.99
Luxembourg	-1.11	0.69	-1.40	0.66	**-1.93**	**0.27**
Malaysia	1.16	0.83	**1.70***	**0.67**	1.90*	0.74
Netherlands	1.58	1.93	1.63	1.87	**-0.11**	**2.29***
Philippines	**1.94***	**0.63**	1.62	0.91	1.57*	0.49
Poland	0.56	0.97	**0.32**	**0.93**	0.54	1.09
Portugal	11.92*	2.82	**16.87***	**2.40**	4.46	3.80
Singapore	0.44	5.31*	-6.51	4.45*	**8.21***	**1.37**
Spain	0.66	1.58	0.50	1.57	**0.51**	**1.06**
Sweden	6.66*	0.74	6.04*	0.94	**-1.49**	**1.04**
Thailand	1.01	2.22	0.81	2.35	**1.00**	**1.26**
United Kingdom	0.84	2.89*	**0.29**	**2.76***	1.42	2.18*
United States	-0.65	-1.31	-0.20	-1.51	**-0.63**	**-1.09**

Notes. The symbols * indicate that the measure is significantly different from zero at the 5% level using a two-sided test methodology. In bold type are the results for the best of the three proxies for expected inflation, measured by an alpha close to zero and a beta coefficient close to one.

Table 4.6 shows the inflation hedge ability of total return on office real estate in the countries in our database. Most coefficients are positive and demonstrate that real estate is a good inflation hedge. The results are similar to the test for the inflation hedge ability of a change in capital value (see table 4.5) We can also conclude that property is a better hedge against unexpected inflation rather than expected inflation, as found by Barber and White (1995). The results also show that total return of office real estate in the U.S. is not as good an inflation hedge as one would expect. However, the results are consistent with previous findings of Hartzell and Webb (1993) who find negative coefficients for direct office returns. Furthermore, Hoesli et al. (1997) suggest that the relationship between change in capital value and total return and unexpected inflation might be negative in the short term. The same argument might apply since the NCREIF appreciation and total returns are very similar to the appreciation and total return IPD data used in the study by Hoesli et al. (1997).

Table 4.6 Inflation hedging ability of total return

	Lag of Short Term Yield		Fama-Gibbons STY		ARIMA (0,1,1)	
Country	β	γ	β	γ	β	γ
Australia	-3.51*	0.87	**-4.21***	**0.93**	1.61	-0.57
Belgium	-0.11	1.11	**-0.22**	**1.10**	0.29	0.64
China	-12.14	-15.40*	-11.19	-14.46	**8.05**	**-10.61**
Czech Republic	**-0.13**	**0.00**	0.54	-0.05	-0.11	0.07
France	**-1.58**	**0.07**	-1.64	-0.04	0.24	-0.61
Germany	2.38	1.68	**3.28***	**0.58**	3.10	1.44
Hong Kong	1.15	1.02*	3.09	1.24*	**1.02**	**1.02**
Hungary	**0.18**	**0.68**	0.01	0.61	0.19	0.63
Indonesia	-0.73	1.03*	**-0.91**	**0.90**	-0.60	1.08*
Ireland	1.11	1.94	1.40	2.00	**1.95**	**2.34**
Italy	-1.17	2.21	-1.92	1.72	**-4.10**	**0.17**
Japan	0.60	1.29	**-0.07**	**1.39**	1.58	0.96
Luxembourg	-1.15	0.70	-1.44	0.67	**-1.92**	**0.27**
Malaysia	1.22	0.93	**1.76***	**0.77**	1.98*	0.83
Netherlands	1.63	2.02	1.68	1.96	**-0.20**	**2.40***
Philippines	**2.17***	**0.89**	1.79*	1.14*	1.86*	0.82
Poland	0.72	1.03	**0.53**	**1.01**	0.68	1.17
Portugal	11.98*	2.79	**17.27***	**2.34**	3.95	3.83
Singapore	0.49	5.33*	-6.45	4.47*	**8.24***	**1.39**
Spain	0.80	1.56	0.66	1.56	**0.47**	**1.23**
Sweden	6.79*	0.76	6.14*	0.96	**-1.23**	**1.04**
Thailand	0.96	2.20	0.75	2.33	**0.95**	**1.22**
United Kingdom	0.64	2.90*	**0.03**	**2.76***	1.15	2.21*
United States	-1.05	-1.54	-0.59	-1.78*	**-1.10**	**-1.34**

Notes. The symbols * indicate that the measure is significantly different from zero at the 5% level using a two-sided test methodology. In bold type are the results for the best of the three proxies for expected inflation, measured by an alpha close to zero and a beta coefficient close to one.

Table 4.7 shows that the results, when we add the vacancy rate to the previously used equation (as described by Hartzell and Webb, 1993), confirm our earlier findings for β and γ. Furthermore, it shows the negative impact of a vacancy rate increase on the nominal return of office real estate markets. The few positive coefficients for β_{vac} are very close to zero and not significant. The others are negative and most of the time significantly different from zero. The impact of including the vacancy rate in the test of change in capital value and total return gives similar coefficients for vacancy rate.

From looking at the analysis in this paragraph, we can confirm that in most countries there is a positive relationship between change in rent, change in capital value and total return and expected and unexpected inflation. Furthermore, we can conclude that real estate seems to be a better hedge against unexpected inflation.

Table 4.7 Inflation hedge of change in rent including adjustment for market fundamentals

	Lag of Short Term Yield			Fama-Gibbons STY			ARIMA (0,1,1)		
Country	β	γ	β_{vac}	β	γ	β_{vac}	β	γ	β_{vac}
Australia	-0.62	1.44	-0.25*	**-1.11**	**1.50**	**-0.24***	2.48	0.78	-0.30*
Belgium	0.29	0.46	-0.55*	**0.29**	**0.46**	**-0.54***	1.67	0.41	-0.36
China	78.53*	85.08*	-0.82*	77.28*	83.91*	-0.82*	**26.66**	**-6.11**	**-0.37***
Czech Republic	**-0.42**	**-0.01**	**-0.04**	0.57	-0.11	-0.02	-1.10	0.11	-0.30
France	**1.49**	**0.47**	**-1.01***	1.61	0.49	-1.02*	2.41	0.84	-0.86*
Germany	0.64	1.19	-0.34	**3.69**	**0.36**	**0.12**	2.73	0.95	-0.10
Hong Kong	3.99	-0.52	-1.21*	8.07*	0.18	-1.78*	**-1.21**	**-0.11**	**-1.35***
Hungary	**0.18**	**0.43**	**-0.09**	0.34	0.22	-0.07	0.19	0.39	-0.09
Indonesia	-0.55	0.39	-0.35*	**-0.52**	**0.19**	**-0.36***	-0.55	0.52	-0.35*
Ireland	2.25	2.32*	-0.43*	2.38	2.36*	-0.43*	**2.65***	**2.32***	**-0.43***
Italy	-2.54	0.41	-2.45*	-3.20	0.09	-2.52*	**-4.44***	**-1.73**	**-1.65***
Japan	3.37*	0.67	-0.80*	**4.22***	**0.75**	**-0.81***	3.84*	0.82	-0.74*
Luxembourg	-0.96	0.63	-0.40	-1.24	0.61	-0.43	**-0.85**	**0.20**	**-0.21**
Malaysia	0.80	1.06	-0.12	**1.78**	**0.81**	**-0.09**	1.03	0.99	-0.11
Netherlands	1.57*	1.42	-0.25*	1.59*	1.42	-0.25*	**0.55**	**1.65***	**-0.27***
Philippines	**-1.84***	**-0.05**	**-0.40***	-1.77*	-0.16	-0.36*	-0.47	-0.20	-0.34*
Poland	1.03	0.75	0.17	**1.14**	**0.77**	**0.16**	0.65	0.87	0.09
Portugal	7.42*	-0.18	0.18	**8.52***	**-0.22**	**0.12**	1.30	0.40	0.23
Singapore	1.92	1.29	-0.80*	3.85	1.31	-0.83*	**3.53**	**0.57**	**-0.68***
Spain	4.87*	1.59	-1.28*	5.20*	1.71	-1.23*	**5.26***	**1.84**	**-0.84***
Sweden	5.77*	0.49	-0.46*	4.78*	0.66	-0.46*	**1.85**	**0.58**	**-0.39***
Thailand	0.57	1.35	-0.47*	0.47	1.38	-0.47*	**0.26**	**1.33**	**0.51***
United Kingdom	-0.07	0.11	-0.68*	**-0.06**	**0.07**	**-0.68***	-0.16	0.13	-0.69*
United States	2.39	2.65	-0.40	2.28	2.71	-0.41	**2.61**	**2.41**	**-0.39**

Notes. The symbols * indicate that the measure is significantly different from zero at the 5% level using a two-sided test methodology. In bold type are the results for the best of the three proxies for expected inflation, measured by an alpha close to zero and a beta coefficient close to one.

4.5.3 Test for rent contract characteristics

To test the inflation hedge capability of different rent review groups, we perform a separate panel data[32] regression on each of the four defined rent groups. We performed the test on change in rent, change in capital value, and total return.

[32] Panel data methodology is applied to identify the coefficients for three groups: flat rent, revaluated rent, and indexed rent. The expected and unexpected inflation coefficients for the graduated rent group on country level inflation are the result of applying equation (4). Panel data regression cannot be applied since there is only one cross-section variable in the revaluated rent group, which is the U.S. office return information.

Table 4.8 Inflation hedge by rent review groups

Rent Review Group	Lag of Short Term Yield β	Lag of Short Term Yield γ	Fama-Gibbons STY β	Fama-Gibbons STY γ	ARIMA (0,1,1) β	ARIMA (0,1,1) γ
			Change in Rent			
Flat Rent	0.03	0.53*	0.16	0.41*	0.11	0.57*
Graduated Rent	1.76	1.38	2.03	1.27	1.61	1.60
Revaluated Rent	0.29	0.97	0.26	0.88	1.06	0.71
Indexed Rent	0.26	0.51*	0.35	0.39*	0.22	0.55*
All Groups	0.11	0.55*	0.22	0.43*	0.17	0.56*
			Change in Capital Value			
Flat Rent	-0.26	0.96*	-0.28	0.78*	0.05	0.95*
Graduated Rent	-0.65	-1.31[b]	-0.20	-1.51[b]	-0.63	-1.09[b]
Revaluated Rent	0.75	2.20*	0.72	2.02*	1.63	1.96*
Indexed Rent	0.09	0.82*	0.05	0.63*	0.12	0.78*
All Groups	-0.12	0.96*	-0.15	0.77*	0.11	0.93*
			Total Return			
Flat Rent	-0.24	0.99*	-0.23	0.79*	0.02	1.02*
Graduated Rent	-1.05	-1.54[b]	-0.59	-1.78*[b]	-1.10	-1.34[b]
Revaluated Rent	0.65	2.13*	0.63	1.94*	1.45	1.92*
Indexed Rent	0.20	0.88*	0.15	0.71*	0.22	0.84*
All Groups	-0.08	0.99*	-0.09	0.80*	0.10	0.99*

Notes. Estimated coefficients for the expected and unexpected inflation using country change in rent, change in capital value, and total return. The symbols * indicate that the measure is significantly different from zero at the 5% level using a two-sided test methodology, [b] indicates that the estimated coefficient is significantly different for the 'All Groups' coefficients.

Table 4.8 shows the results for the test of inflation hedge by rent review groups. All coefficients for the change in rent are positive, demonstrating that the change in rent moves with expected and unexpected inflation. However, the flat rent review and the indexed rent review have lower coefficients. It would be expected for the flat rent contract since the lease rental agreement is fixed at a constant rent level throughout the term of the lease. The flat rent contract is mostly applied in Asia with very short lease contracts of two to three years. The short lease contract provides the opportunity to adjust the rents with a lag of two to three years when inflation starts to increase. It is surprising that the indexed rent contract does not have a higher coefficient with expected and unexpected inflation, because indexed rents are periodically adjusted according to regularly reported indices (in most cases the CPI). This would mean that the indexation of a rent contract does not fully compensate the landlord for expected and unexpected inflation, but rather for inflation in the previous period. The graduated rent system seems to provide the best inflation hedge for both expected and unexpected inflation. This simple type of rent review provides the opportunity to include step-ups in the rent. The fact that the rent review period for the graduated rent contract is between three and five years may have a positive impact. The unexpected inflation coefficient γ of the rent contract with revaluated rents (Australia, Ireland, and the U.K.) is close to the graduated rent contracts. With revaluated rent contracts the amount of increase per period is not fixed or linked to an index in advance. A real estate appraiser will adjust the rent to market level or only increase it if the market goes up (in the case of upward-only revisions in the rent contract). The coefficients of the 'All Groups' are obtained from a cross-section and time series regression over the all country dataset. The coefficients for the 'All Groups' confirm that change in rent moves more closely in line with unexpected than expected inflation.

The coefficients for revaluated rent with change in capital value and total return are close to one for expected inflation. The coefficient with unexpected inflation for the revaluated rent contract is even higher, which might be the result of a coefficient close to one for the change in rent. Both flat rent and indexed rent contracts have a coefficient close to one for unexpected inflation. The coefficients for unexpected inflation might be better as a result of the change in rent for these contract types, which show a similar trend. Only the graduated rent contract is not a good hedge against unexpected inflation. This means that the growth in value of the rent contract (see change in rent in table 4.8) is not translated into an increase in the value of the property at the same rate. The inflation hedge capability of the other rent contracts is significantly different from the 'All Groups'. Overall, change in capital value and total return appear to be a good inflation hedge against unexpected inflation. There seem to be differences in the inflation hedge capability of different rent contracts, where the change in rent on a graduated rent contract is a better hedge against inflation and the change in capital value and total return on the flat and indexed rent are a better hedge against unexpected inflation, because the coefficients are very close to one.

Table 4.9 shows the results for the expected and unexpected inflation hedge. All coefficients for the change in rent are positive. But it seems that the longer the contract length, the better the hedge against inflation. This is clearer when we look at the change in capital value and total return. The longer the lease contract, the better the inflation hedge, especially for expected inflation.

Table 4.9 Inflation hedge by lease length

	Lag of Short Term Yield		Fama-Gibbons STY		ARIMA (0,1,1)	
Lease Length	β	γ	β	γ	β	γ
			Change in Rent			
1–3 years	0.01	0.53*	0.14	0.40	0.10	0.57*
3–5 years	0.34	0.53	0.45	0.40	0.35	0.50
5 + years	0.31	0.68*	0.36	0.58*	0.41	0.61
All Groups	0.11	0.55*	0.22	0.43*	0.17	0.56*
			Change in Capital Value			
1–3 years	-0.27	0.96*	-0.29	0.77*	0.04	0.95*
3–5 years	0.12	0.61	0.15	0.44	0.14	0.54
5 + years	0.29	1.30*	0.23	1.10*	0.51	1.16*
All Groups	-0.12	0.96*	-0.15	0.77*	0.11	0.93*
			Total Return			
1–3 years	-0.25	0.98*	-0.24	0.78*	0.01	1.02*
3–5 years	0.17	0.66*	0.19	0.50	0.21	0.57
5 + years	0.35	1.33*	0.29	1.14*	0.55	1.21*
All Groups	-0.08	0.99*	-0.09	0.80*	0.10	0.99*

Notes. Estimated coefficients for the expected and unexpected inflation using country returns. The symbols * indicate that the measure is significant different from zero at the 5% level using a two-sided test methodology, [b] indicates that the estimated coefficient is significant different for the 'all groups' coefficients.

4.6 Conclusions

This chapter examines the hedge potential of direct office real estate returns for expected and unexpected inflation. To analyze this, we created a dataset consisting of 54 office markets in 24 countries. In our study, we find that direct office real estate changes in rent, changes in capital value, and total return in most countries have a positive relationship with expected and unexpected inflation. We also find that office real estate seems to be a better hedge against unexpected inflation than against expected inflation. This also holds when we correct for market fundamentals.

Our tests of the influence of rent contract characteristics on the inflation hedge potential show that there are differences between rent review groups where change in rent for contracts with graduated rent increases move with expected and unexpected inflation. Changes in capital value and total return for rent contracts with revaluated rent increases and indexed rent contracts move with expected and unexpected inflation. Rent contracts with flat rents seem to move with unexpected inflation, adjusting to the market rent at the end of the contract. However, the differences are not significantly different, only the unexpected inflation from the graduated rent contract moves significantly differently from the average for change in capital value and total return. Furthermore, the lease length seems to have a positive influence on the hedge capability, because the coefficients of the longer lease contracts are more positive. Overall, we can conclude that direct office real estate is a good inflation hedge in many of the tested countries and that it is a better hedge against unexpected inflation.

Appendix 4.A Return characteristics by city

		Total Return	σ Total Return	Δ Rent	σ Δ Rent	Δ Capital Value	σ Δ Capital Value	
Asia/Pacific								
China	Beijing	4.3%	4.1%	- 0.2%	10.4%	- 0.1%	3.6%	[52]
China	Hong Kong	3.5%	12.1%	0.8%	10.7%	1.9%	12.1%	[68]
China	Shanghai	4.7%	5.6%	- 1.5%	8.1%	0.1%	4.1%	[49]
Indonesia	Jakarta	3.4%	12.1%	0.3%	11.7%	0.8%	11.8%	[68]
Japan	Tokyo	- 1.3%	4.1%	- 1.1%	3.4%	- 2.1%	4.1%	[68]
Malaysia	Kuala Lumpur	1.9%	2.0%	- 0.3%	2.9%	- 0.2%	2.0%	[52]
Philippines	Manila	4.6%	5.6%	1.6%	6.1%	1.9%	5.3%	[68]
Singapore	Singapore	0.3%	6.0%	- 0.7%	7.8%	- 0.8%	6.0%	[59]
Thailand	Bangkok	4.1%	6.6%	1.4%	6.6%	1.6%	6.4%	[68]
Australia	Adelaide	2.3%	5.1%	0.1%	4.2%	- 0.1%	5.0%	[55]
Australia	Brisbane	2.3%	5.5%	0.6%	5.1%	0.4%	5.4%	[55]
Australia	Canberra	2.1%	4.1%	- 0.3%	3.2%	- 0.3%	4.0%	[55]
Australia	Melbourne	1.6%	5.1%	0.2%	5.1%	0.0%	5.2%	[55]
Australia	Perth	2.2%	5.8%	- 0.1%	4.5%	0.0%	5.7%	[55]
Australia	Sydney	2.6%	4.7%	0.7%	3.5%	0.7%	4.7%	[55]
Europe								
Belgium	Antwerp	2.7%	3.3%	0.6%	3.0%	0.7%	3.2%	[62]
Belgium	Brussels	2.8%	4.2%	0.9%	3.0%	1.1%	4.2%	[68]
Czech republic	Prague	2.4%	4.7%	- 1.4%	3.3%	- 0.2%	4.7%	[50]
France	Lyon	2.6%	4.2%	0.5%	3.8%	0.4%	4.2%	[56]
France	Paris	1.3%	4.9%	0.1%	4.0%	- 0.4%	4.8%	[58]
Germany	Berlin	0.4%	6.5%	- 0.7%	5.5%	- 0.9%	6.4%	[57]
Germany	Frankfurt	1.6%	5.3%	0.5%	4.4%	0.4%	5.3%	[68]
Hungary	Budapest	2.7%	4.2%	- 0.9%	2.7%	0.1%	4.1%	[50]
Ireland	Dublin	3.3%	7.1%	1.5%	5.2%	1.8%	7.0%	[62]
Italy	Milan	1.8%	5.5%	0.4%	4.4%	0.4%	5.5%	[56]
Luxembourg	Luxembourg	1.9%	5.1%	0.1%	4.2%	0.1%	5.0%	[56]
Netherlands	Amsterdam	3.0%	4.6%	1.4%	3.8%	1.5%	4.5%	[68]
Netherlands	The Hague	2.4%	3.0%	0.7%	1.7%	0.8%	3.0%	[68]
Poland	Warsaw	1.8%	4.7%	- 2.4%	4.1%	- 0.9%	4.6%	[35]
Portugal	Lisbon	3.3%	9.2%	0.2%	5.1%	1.3%	9.0%	[28]
Spain	Barcelona	2.1%	6.8%	0.1%	5.1%	0.5%	6.8%	[60]
Spain	Madrid	2.8%	8.8%	0.5%	6.9%	1.0%	8.6%	[68]
Sweden	Stockholm	3.6%	6.3%	1.7%	5.3%	2.1%	6.2%	[44]
United Kingdom	London	1.2%	7.2%	- 0.3%	4.7%	- 0.3%	6.6%	[68]

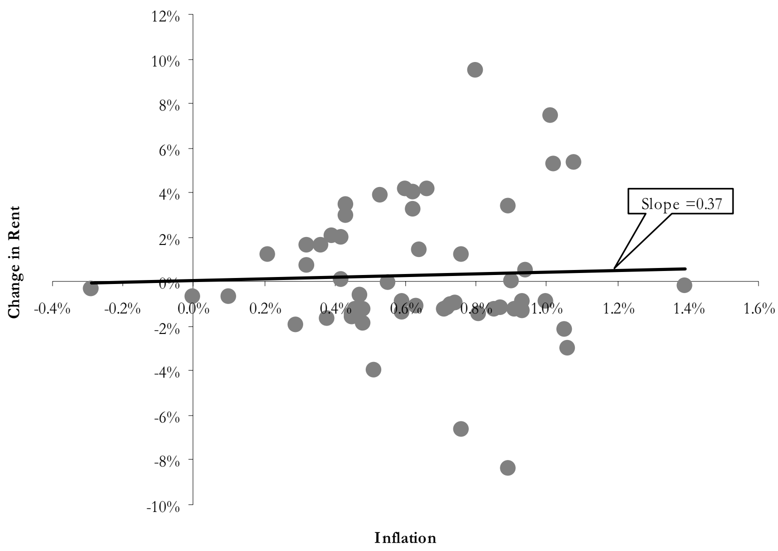
Notes. This table shows the average quarterly total return, rent growth, change in capital value, as well as the standard deviation for every city/MSA included in our database. The number of available quarters is given in brackets.

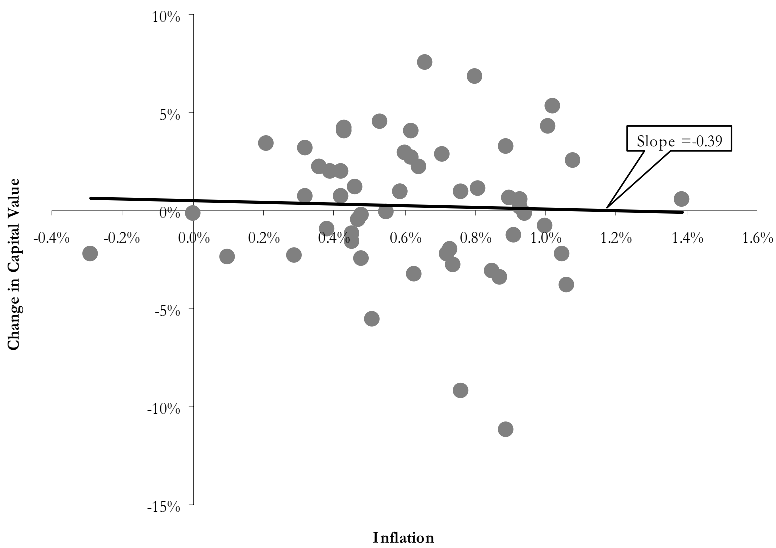
Appendix 4.A Return characteristics by city (Cont'd)

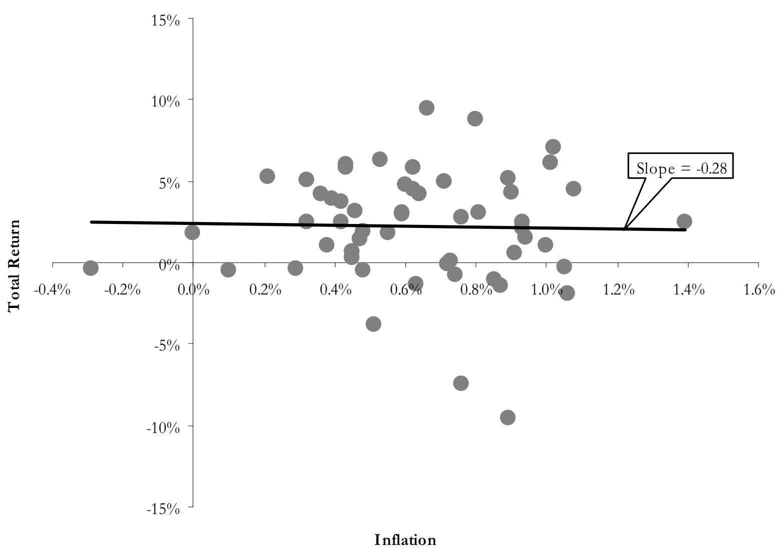
		Total Return	σ Total Return	Δ Rent	σ Δ Rent	Δ Capital Value	σ Δ Capital Value	
United States								
United States	Atlanta	1.1%	2.9%	0.4%	6.2%	- 0.8%	2.6%	[68]
United States	Boston	1.6%	4.3%	0.7%	10.2%	- 0.5%	4.0%	[68]
United States	Chicago	1.2%	3.2%	0.0%	3.7%	- 0.7%	3.1%	[68]
United States	Cincinnati	1.3%	2.2%	0.0%	2.5%	- 0.9%	2.2%	[66]
United States	Dallas	1.3%	3.1%	- 0.2%	3.8%	- 0.7%	3.0%	[68]
United States	Denver	1.1%	3.3%	1.4%	22.3%	- 0.7%	3.1%	[68]
United States	Houston	1.0%	3.4%	- 0.1%	7.4%	- 0.7%	3.2%	[68]
United States	Los Angeles	1.2%	3.2%	0.1%	5.9%	- 0.6%	3.1%	[68]
United States	Miami	1.3%	3.7%	0.5%	5.9%	- 0.6%	3.6%	[68]
United States	Minneapolis	0.4%	3.2%	0.1%	5.5%	- 1.8%	3.0%	[68]
United States	New York	1.7%	3.5%	1.6%	19.0%	- 0.3%	3.5%	[68]
United States	Philadelphia	0.8%	3.8%	0.3%	3.1%	- 1.1%	3.6%	[68]
United States	Phoenix	0.9%	4.4%	1.3%	10.4%	- 1.1%	4.2%	[68]
United States	San Diego	1.8%	4.2%	0.6%	5.1%	- 0.3%	4.1%	[68]
United States	San Francisco	1.5%	4.1%	0.3%	10.3%	- 0.2%	4.0%	[68]
United States	San Jose	2.2%	5.9%	1.2%	15.7%	0.1%	5.9%	[58]
United States	Seattle	2.1%	4.1%	0.4%	7.0%	0.2%	3.8%	[59]
United States	St. Louis	1.5%	3.4%	1.5%	21.3%	- 0.7%	3.3%	[68]
United States	Tampa	2.0%	1.6%	0.5%	6.1%	- 0.1%	1.5%	[36]
United States	Washington	2.0%	2.0%	0.6%	4.5%	- 0.1%	1.9%	[68]

Notes. This table shows the average quarterly total return, rent growth, change in capital value, as well as the standard deviation for every city/MSA included in our database. The number of available quarters is given in brackets.

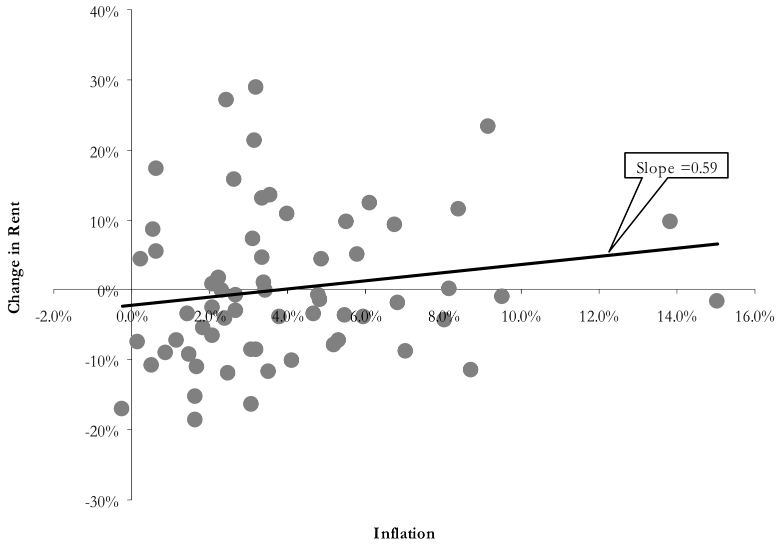
Appendix 4.B Real estate return indicators vs. inflation for Australia

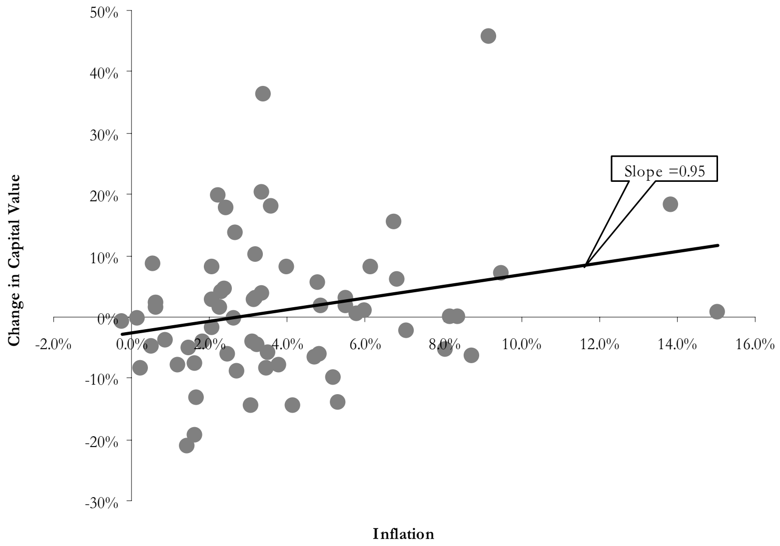


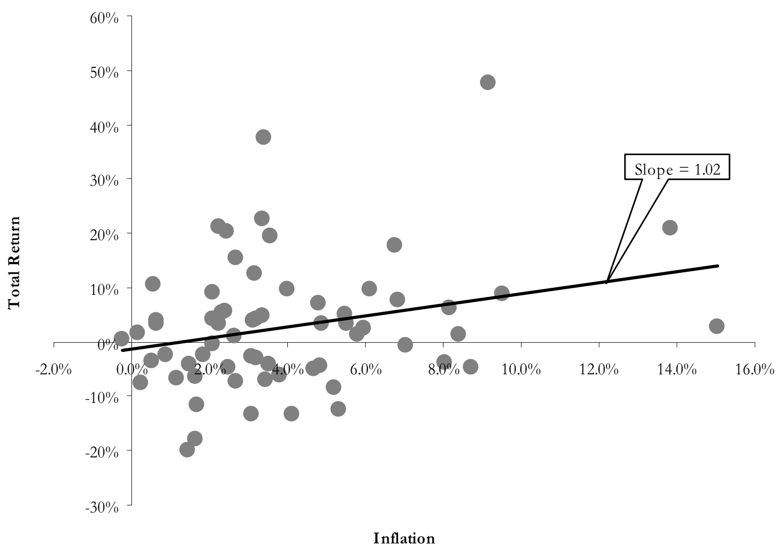




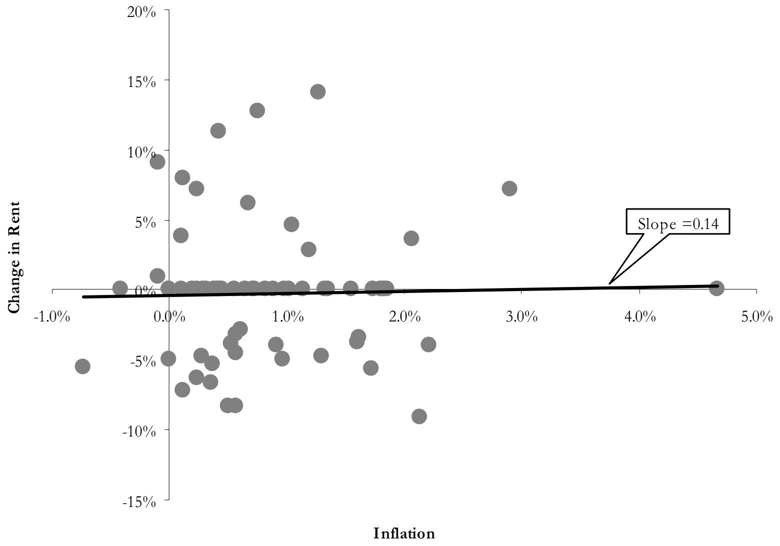
Appendix 4.C Real estate return indicators vs. inflation for Hong Kong

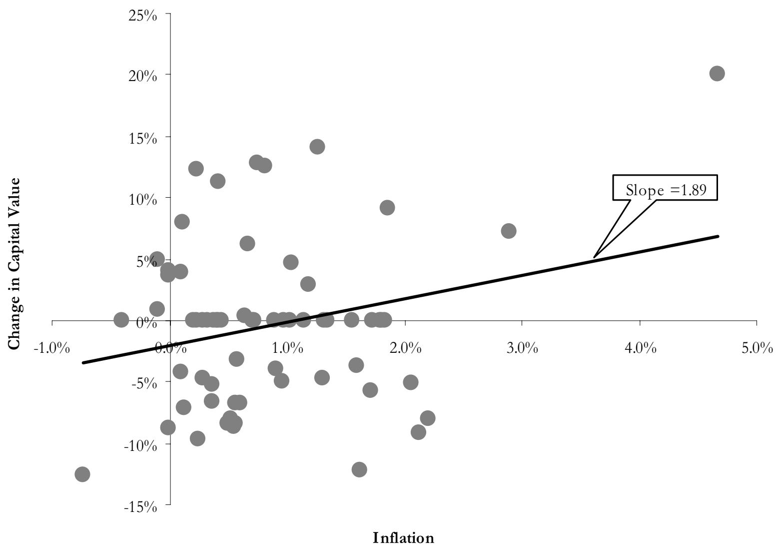


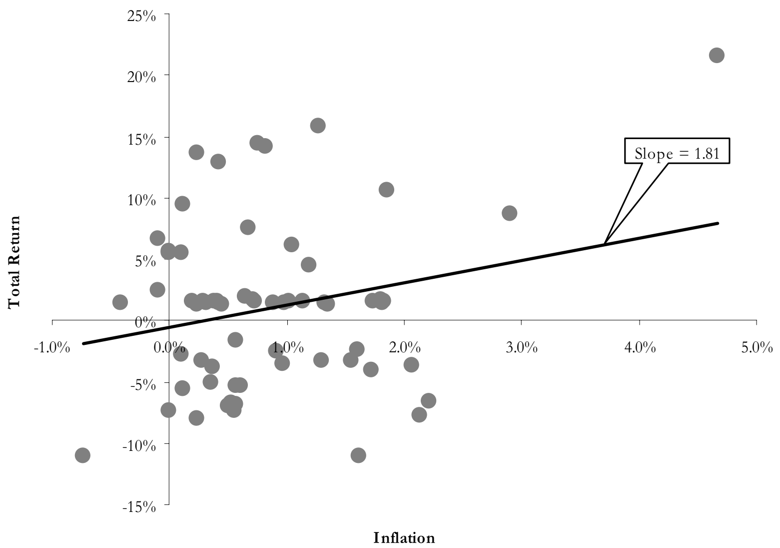




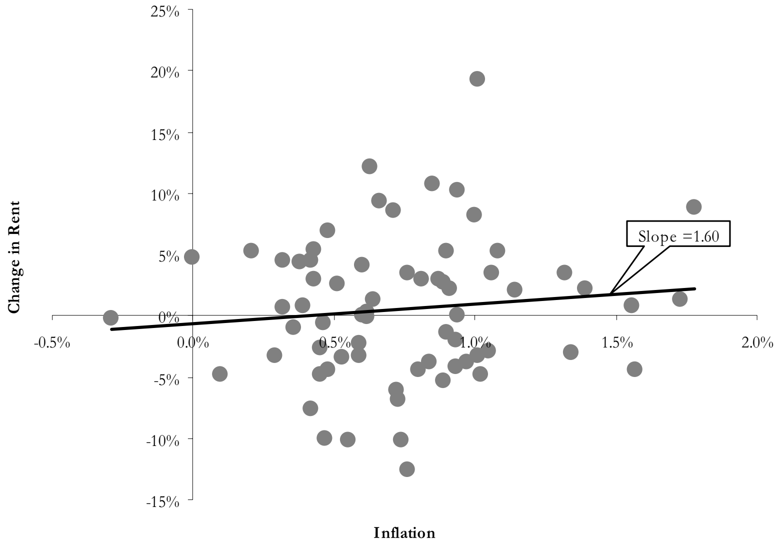
Appendix 4.D Real estate return indicators vs. inflation for the U.K.

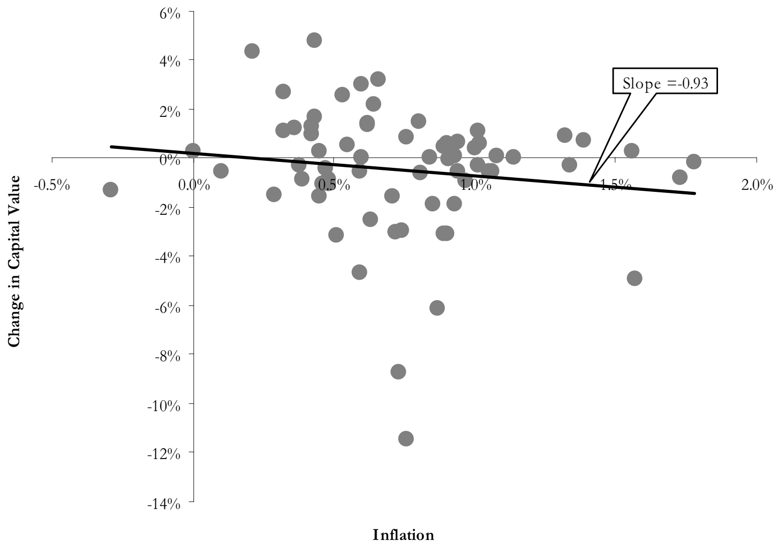


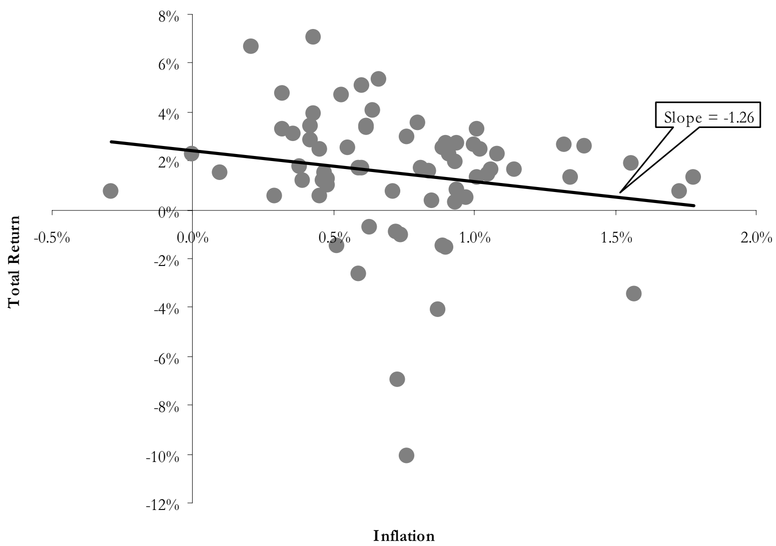




Appendix 4.E Real estate return indicators vs. inflation for the U.S.







Chapter 5

INTERNATIONAL DIVERSIFICATION STRATEGIES FOR DIRECT REAL ESTATE

5.1 Introduction

Traditionally, investment managers in direct real estate have focused on a single geographical region. To achieve diversification, they have invested across different property types, in assets with different characteristics, or by selecting assets in targeted areas within that region. Achieving diversification through international investment—common in other asset classes—has not been considered as attractive for direct real estate because real estate markets are less transparent and there are higher risks and costs involved. This could be a disadvantage for the international real estate investor versus the domestic investor. A study by Eichholtz et al. (2001) finds that international companies underperform domestic companies and that the underperformance is not the result of transaction costs, leverage or currency. Size appears to be the only factor that improves the performance of international companies.

The size of a real estate investment company relative to its home market also seems to be an important reason why we have seen international expansion by institutional investors over the past few years. The international expansion is mainly driven by the relatively small size of their home market and the shortage of investment products. For example ING Real Estate started its international expansion in 1998 because of the relatively small size of the home market. It transformed its business from a mainly local Dutch real estate company with Euro 6 billion of assets under management (AuM) to one of the largest property investors with more than Euro 50 billion AuM in 14 countries. To achieve this expansion together with good investment performance requires a strong focus on high quality and consistent information data to create a global direct real estate investment strategy. Information about performance, market rents, and capital value has recently become available through international expansion of Investment Property Databank (IPD) and Jones Lang LaSalle (JLL). With this newly collected information, it is possible to demonstrate whether the additional risk of international investment is offset by higher returns and to determine which investment strategy—portfolio diversification by region or property type—is more effective in reducing the volatility of real estate returns.

For most asset classes, where the information has been available for some time, the question of investing internationally has been addressed extensively. For equities, Solnik (1974) looks at the advantages of international investment by measuring the reduction in variability of the total portfolio as a result of including foreign securities. He concludes that there is a large risk reduction for US and foreign investors who invest internationally. This risk reduction is achieved with relatively few investments. Since then there have been several studies on the diversification benefits of international investment. For the purpose of this chapter we focus on a group of studies that decompose international equity data to identify the effect that is most important for international stock returns. Heston and Rouwenhorst (1995) develop a model to measure country and industry effects, providing a quantitative framework for analyzing portfolio selection. They find that country effects are greater than industry effects, which implies that diversification by country reduces risk more. A paper by Griffin and Karolyi (1998) extends the Heston and Rouwenhorst model by including a weighting for the relative market value of the equity market for a country or industry. They confirm the original results and also reveal the differences in the proportion of variation that is captured by country and industry. A paper by Van Dijk and Keijzer (2004) decomposes the importance of region, industry sector, size, and value/growth allocation for global equity portfolios. They find that the combination of region and industry sector is more important than style tilts towards value/growth and size. In addition they show that, over their sample period of January 1987 through March 2002, the relative importance of region and industry-sector changes. In the first half of the sample period regional allocation is the more important, while in the second half this is industry-sector allocation.

For this study, we would like to focus on diversification effects within a real estate strategy. A literature review on investing in international listed real estate by Worzala and Sirmans (2003) shows the benefits of international diversification using real estate equities. Giliberto (1990) was among the first to analyze international diversification for a portfolio consisting only of listed real estate companies. Eichholtz (1997) examines international diversification by looking at investing in different regions versus different property types. This is a similar analysis to the one we make in this chapter, where we focus on direct real estate investments.

Eichholtz concludes that regional diversification is more beneficial than property type diversification. This is also the conclusion of Eichholtz et al. (1995), who use the Jennrich test to measure the stability of correlations and find that the benefits from international investment versus property type diversification differ by region. Another study by Eichholtz (1996) finds that correlation between national real estate returns are significantly lower than similar correlations for stocks and bonds. This implies that international diversification reduces risk in a real estate portfolio more than it does in common stock and bond portfolios. In addition, Eichholtz (1993) examines continental factors by using a principal component analysis. The findings show that countries within continents move together. The implication is that investors cannot realize optimal diversification by investing in one continent alone and need to diversify across multiple regions for optimal international diversification. Eichholtz et al. (1998) re-examine continental factors and find that real estate returns in Europe depend positively and significantly on returns in other European countries. They further conclude that European and North American investors can achieve diversification benefits specifically by investing in Asia Pacific real estate. Ling and Naranjo (2002) find evidence of a world-wide systematic factor influencing listed real estate returns. However, country-specific factors are more significant in many countries, demonstrating the advantages of international investment in real estate stocks. A recent paper by Hamelink and Hoesli (2004) disentangles the effects of country, property type, size, and value/growth factors on listed real estate securities, based on the model applied in Heston and Rouwenhorst (1995). In their study the identification of 'pure' factors is very important. Returns on country (or property type) factors are adjusted to the difference in the property type (or country), size and value/growth composition of the country markets. The study concludes that country factors are more important than property type, size and value/growth factors.

One of the earlier papers looking at international diversification for non-listed or direct real estate is from Sweeney (1988 and 1989). Sweeney (1988) looks at rental value growth rate for 16 countries from 1970 to 1986. This study finds support for international diversification and concludes that an investor would have achieved a superior return if a global investment strategy had been implemented. The benefit achieved from international diversification depends on the home country of the investor. Sweeney (1989) adds the modern portfolio theory to the previous study and finds that a minimum risk portfolio allocates investments to 7 out of 11 countries. The conclusions remain the same as Sweeney (1988), that diversification benefits can be achieved by investing internationally. Gordon (1991) looks at mean returns, standard deviations and correlations for all asset classes. In his study he analyses real estate data from 1970–1990 for the US (combination of EAI survey and NCREIF index) and for the UK (combination of JLL property index and IPD index) and finds gains from international diversification. An overview of studies about diversification benefits of international direct real estate investment is discussed in a literature review by Sirmans and Worzala (2003). Looking at the literature on international investment within a real estate asset class portfolio, they conclude that most of the studies advocate the inclusion of international real estate in a mean-variance analysis. Furthermore, they conclude that both property type and regional diversification is important, but regional diversification appears to be more important. However, most studies are based on mean-variance analysis using the modern portfolio theory of 1959. As most real estate data are appraisal based and therefore do not reflect the true volatility, applying the MPT theory has some disadvantages, especially when comparing real estate to other asset classes. Goetzmann and Wachter (2001) use a cluster analysis and bootstrapping technique alongside the MPT model to demonstrate the potential benefits of international diversification. Case et al. (1999) find support for increasing globalization of property markets, with cross-border correlations depending in part on the exposure to fluctuations in the global economy. However, the analysis of international diversification also suggests that portfolio volatility is reduced by cross-border property investment.

In this chapter, we examine the potential for diversification in the international direct real estate market. Since real estate returns are believed to be strongly influenced by geographical and property type effects, it is key to be able to disentangle those effects from one another. In particular, differences between regional returns may simply reflect differences in the property type allocation in the regions, which clearly makes it difficult to disassociate the two effects. For international real estate investors, it is crucial to identify which factor offers the highest diversification benefits and return potential. We apply a multi-factor approach to estimate 'pure' regional and property type factors. The diversification benefits are tested using a unique database of 200 city/MSA and property type combinations from the first quarter of 1988 through the last quarter of 2003. Through a restricted cross-sectional regression analysis, we separate the effects that property type and region have on the variance (and therefore the diversification) of international real estate investment and determine that the impact of different geographical regions is much more substantial than that of different property types. Therefore, we will show that by investing in different geographical areas, a real estate investor is able to increase diversification benefits compared with investing solely across property types.

The 'pure' factor approach developed in this chapter could have important implications for portfolio management. Active portfolio manager will have to decide according to which factor they want to make a bet. If regions with a positive return are selected, then they have to make sure that this strategy is neutral with respect to property type. For instance, if it is decided to overweight the U.K. and this is done based on the allocation to property type of IPD total return property index[33], it should be recognized that the residential property type is not represented in the IPD index and therefore the U.K. bet also results in a bet being made against residential. The 'pure' factor for the region will show the outperformance with a neutral allocation with respect to property type.

This chapter is organized as follows. In section 5.2 we describe the data and provide summary statistics for total returns for the regions and property types; section 5.3 provides the methodology. Section 5.4 discusses the results and interprets the findings. Section 5.5 gives the conclusions for this chapter.

5.2 Data

In this chapter, we analyze total return data for five regions to compare international real estate markets (see appendix 5.A and table 5.1). The data sources are selected to create a dataset that has a sufficiently long history. The cross-sectional analysis is only possible if every region is represented by at least one city, in other words the shortest time-series meeting this condition becomes the limiting factor. As a result the database starts in the first quarter of 1988 because that is when we have at least one data-point for every region. Furthermore, the dataset should contain enough cities/MSAs to provide a good representation of the performance of real estate in a particular region. For Asia and Continental Europe, the source is market information from Jones Lang LaSalle (JLL). Data for Australia are provided by the Property Council of Australia (PCA) investment performance index, the return data for the U.K. are extracted from the monthly database of Investment Property Databank (IPD), and for the U.S. we use the total return series from the National Council of Real Estate Investment Fiduciaries (NCREIF) index. The data have been selected on the basis of quality and availability.

Table 5.1 Number of cities/MSAs by region and property type

	Property Type				
	Industrial	Office	Residential	Retail	Total
Asia	0	9	8	8	25
Australia	3	5	0	4	12
Continental Europe	21	21	0	21	63
United Kingdom	6	7	0	7	20
United States	20	20	20	20	80
	50	62	28	60	200

Notes. This table shows number of cities/MSAs represented by region and property type.

[33] This strategy could be achieved by taking a derivatives contract on the U.K. IPD total return index

For the 30 cities in Asia and Continental Europe, the JLL[34] total return index is based on rents, yields, and capital values (or price). The city selection is based on data availability and institutional activity in a real estate market. The data are proxies of average effective rents and yields for institutional quality real estate in a specific market. For the office sector, the market information focuses on class A office space in the Central Business District (CBD). Residential property is represented by high-rise buildings in the inner city area of the best quality for the renters market. Retail space is represented by shopping center space and high-street retail in the main shopping locations of the cities. Industrial real estate is logistic warehouse space in the immediate area around the city. Based on rent (D_{it}) per quarter per square meter, yield, and price (P_{it}) per square meter we created a total return series (R_{it}) on a quarterly basis from the first quarter of 1988 through the last quarter of 2003, where the total return is the sum of capital appreciation and the net rent generated by the property.

For Australia, we used total return series provided by the Property Council Investment Performance Index in Australia. As of December 2003, the PCA index included 470 properties with a total market value of 43.2 billion Australian dollars. The index comprises three property types: industrial (4.6%), office (44.5%), and retail (50.9%). The PCA index breaks the data down into sub-categories. In our database we included CBD office total returns for 5 cities, industrial total returns for Sydney, Melbourne, and Brisbane. For retail, Sydney represents the performance of retail in metropolitan New South Wales, Melbourne retail performance in metropolitan Victoria, Brisbane in metropolitan Queensland, and Perth in metropolitan Western Australia.

For the U.K., IPD published an annual and monthly index from the first quarter of 1988 through the last quarter of 2003. To make the time series consistent with other regions, the quarterly total returns are calculated from the monthly IPD index for the cities. The monthly index at year-end 2003 covered about 16% of the annual index, with a slightly different composition. The annual index comprises 15.7% industrial, 29.7% office, 51.6% retail, and 3.0% other. Our dataset has a higher allocation to office (50.1%) and a lower allocation to industrial (14.8%) and retail (35.1%) as a result of city selection and use of the monthly index.

For the U.S., the data selection is compiled from the appraisal-based direct real estate index from NCREIF. As of year-end 2003, the NCREIF index included 4,060 properties with a total market value of 132.4 billion USD. The NCREIF index breaks down into five property types: apartments (19.21% of the index),

[34] The JLL data series are used in various international direct real estate diversification studies, for example Newell and Webb (1996), Quan and Titman (1997 and 1999), Stevenson (1998), Addae-Dapaah and Young (1998) Chua (1999).

hotels (1.66%), industrial (19.50%), office (38.96%), and retail (20.67%). NCREIF provides return data if there are four or more property investments in an MSA, which results in 49 MSAs for industrial real estate, 47 MSAs for office, 49 MSAs for residential, and 36 MSAs for retail. This gives the index a wide geographical spread. However, for a global analysis we would need comparable cities on an international scale. We therefore select only the top 20 MSAs by market value for the four main property types: industrial, office, residential, and retail. By selecting the top 20 markets we cover 81.2% of the industrial market value, 84.4% of the office market value, 74.9% of residential, and 88.2% of the retail market value in the NCREIF index.

Table 5.2 shows the key statistics of the total returns in local currency by region and by property type. The region returns are calculated on a quarterly basis from the city/MSA data as shown in appendix 5.A. The total number of observations is 9933, with the majority of the observations in the U.S. and Continental Europe. The average return and risk is highest for Asia. The average return for all regions (9.3%) is higher than the average return for the U.S. and Australia. Moreover, the risk for all regions combined (2.9%) is lower than the risk for any individual region. This already indicates potential for diversification. If we look at the key property type statistics we can see that the office property type has the lowest return, but also the highest risk. Residential real estate has the highest average return and slightly higher risk than the average of all property types. Retail property has a higher return than the mean of all property types, but a lower risk (2.8% vs. 2.9%).

Table 5.2 Summary statistics for equally weighted total returns in local currency

Region	Number of observations	Mean	Standard Deviation	Minimum	Maximum
Asia	1094	14.5%	8.8%	-7.4%	21.5%
Australia	691	8.9%	3.7%	-1.6%	6.7%
Continental Europe	2669	11.9%	5.0%	-3.8%	9.5%
United Kingdom	1113	10.8%	5.4%	-2.4%	11.1%
United States	4366	7.3%	3.2%	-4.4%	5.2%
All regions	9933	9.3%	2.9%	-1.6%	5.1%
Property type	**Number of observations**	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**
Industrial	2499	9.7%	3.1%	-1.6%	4.7%
Office	3389	8.0%	4.1%	-2.7%	5.9%
Residential	1288	10.6%	3.0%	-1.2%	10.0%
Retail	2757	9.6%	2.8%	-0.7%	5.7%
All property types	9933	9.3%	2.9%	-1.6%	5.1%

Notes. The table contains the number of observations, average annual equally weighted mean in local currency, and standard deviations of the annualized return variables in our study. The minimum and maximum observations are the minimum and maximum average value for a region or property type in a quarter. The statistics were obtained after pooling all observations over the whole time-series. The period ranges from 1Q1988 to 4Q2003.

Table 5.3 gives the correlation coefficients by region and property type. Asia has very low correlation coefficients with the other regions and even negative correlation with the U.S. This makes investing in real estate in Asia good for diversification purposes. Australia has relatively high correlation coefficients with the other regions, similar to the correlation coefficients of the U.K. Continental Europe has a low correlation with Asia. The U.S. property market has low correlation coefficients with Asia and the U.K. In addition, table 5.3 also shows that the property types industrial, office, and retail have relatively high correlation coefficients compared to the correlation coefficients by regions. Residential real estate has lower correlation coefficients with the other property types and is therefore potentially a better diversification candidate. It is also clear from this table that there is a lot of interaction between region and property type. The correlation coefficients between region and property type close to zero are the result of the lack of data for a property type in a region.

Appendix 5.C gives the weight for each region or property type for every quarter between 1Q1988 through 4Q2003. The weight for each region/property type depends on the number of cities and the market value (size of the real estate market times the price per square meter in US dollars). The weights change gradually through time as cities are added to the database and market values change; the number of cities included in the database appears to be large enough to avoid large fluctuations from adding cities. The region weights are most impacted by the increase in weight of Europe over the time period, as a result of including Central European cities in the database. The increasing number of European cities in the database is also the main reason for the decrease in relative weight of the U.S.

Table 5.3 Correlations by region and property type

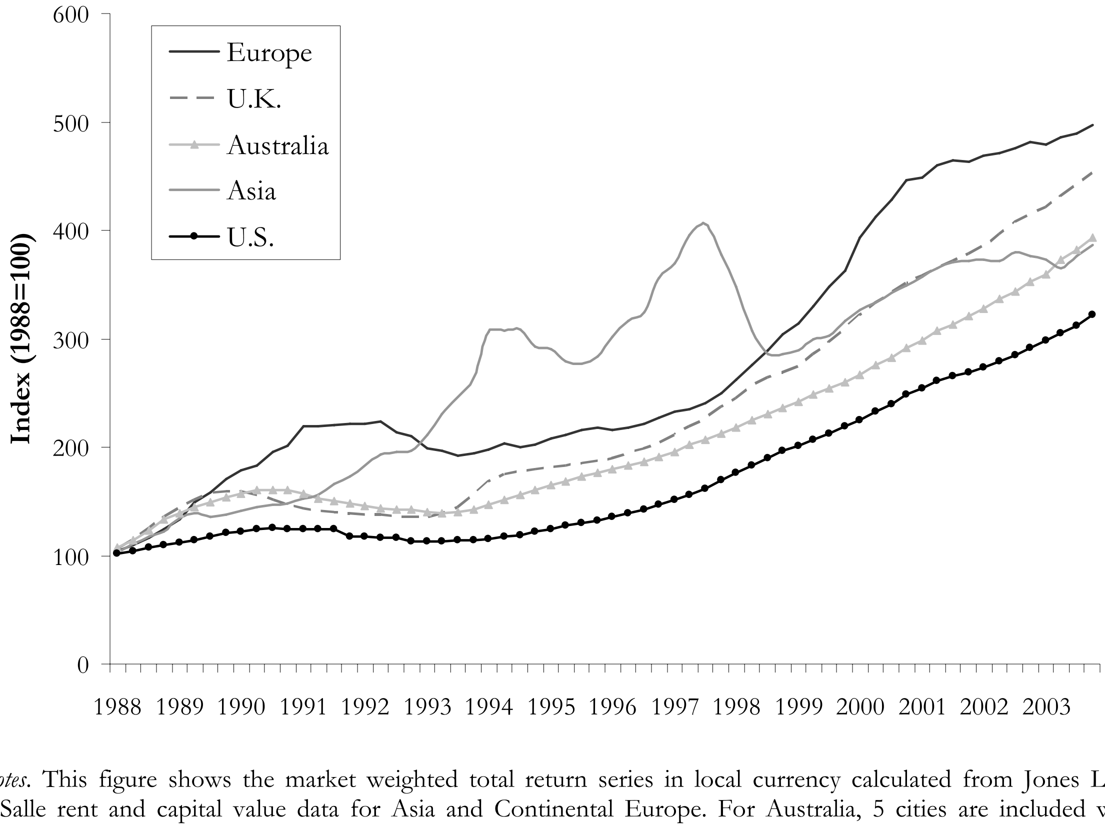
	Asia	Australia	Europe	U.K.	U.S.	Industrial	Office	Residential	Retail
Asia	1.00								
Australia	0.36***	1.00							
Continental Europe	0.13	0.64***	1.00						
United Kingdom	0.53***	0.65***	0.40***	1.00					
United States	-0.16	0.55***	0.42***	0.24*	1.00				
Industrial	0.02	0.71***	0.76***	0.42***	0.83***	1.00			
Office	0.38***	0.79***	0.76***	0.66***	0.70***	0.87***	1.00		
Residential	0.64***	0.18	-0.06	0.32***	0.24*	0.16	0.34***	1.00	
Retail	0.43***	0.77***	0.64***	0.61***	0.52***	0.61***	0.70***	0.32***	1.00

Notes. This table contains correlations of the quarterly equally weighted total returns in local currency between 1Q1988–4Q2003. The symbols *, **, *** indicate that a correlation is significant from zero at the 10%, 5%, 1% levels, respectively.

Figures 5.1 and 5.2 show the relative performance of the market weighted total return in local currency for the regions and property types, respectively. Up to the third quarter of 1997, Asia has the highest performance relative to the other regions. After the Asian crisis, its performance drops to below that of Australia.

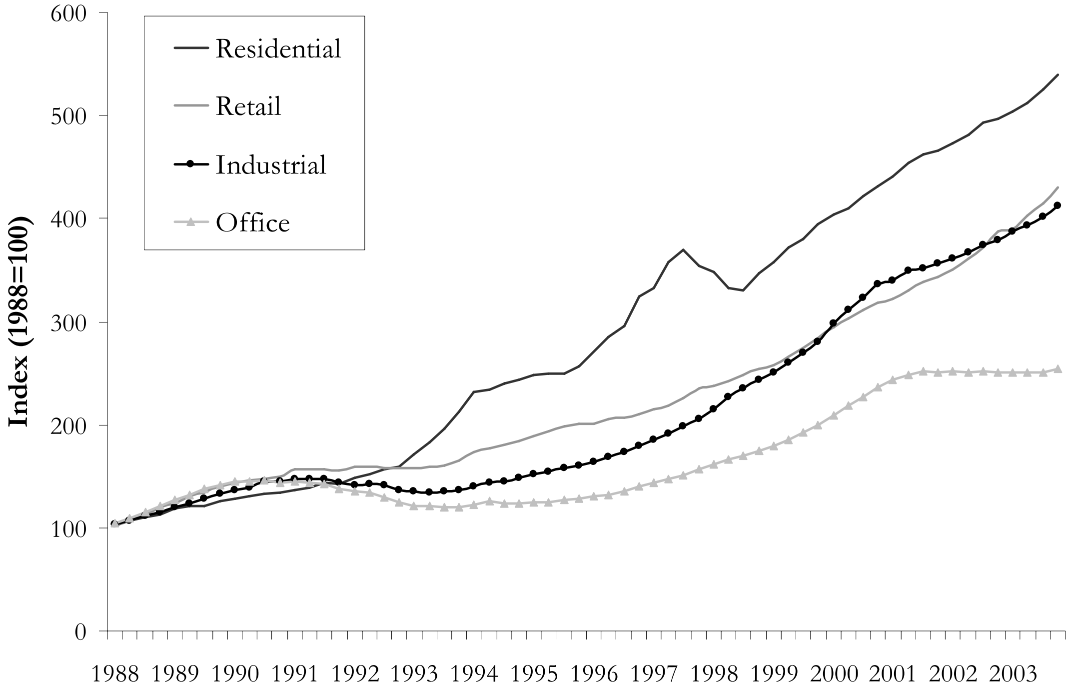
All results presented so far are in local currency. However, currency risk can have an impact on the diversification potential of international real estate investment (see Liu and Mei, 1998). In order to measure the influence of currency risk, we have calculated the total return for each quarter between 1Q1988–4Q2003, to include the change in local currency versus the US dollar. All returns are converted into U.S. dollars using exchange rates taken from Thomson Financial Datastream. Appendix 5.D shows that the total returns for the regions move closer together after converting to US dollars. In particular, the performance of the Australian, U.K., and U.S property market are very close to one another until the beginning of 1994. Europe outperforms the other regions over the time period from 1Q1988 to 4Q2003, followed by the U.K. The performance of Asian real estate is the most impacted by the conversion to US dollars.

Figure 5.1 The market weighted total return index in local currency by region



Notes. This figure shows the market weighted total return series in local currency calculated from Jones Lang LaSalle rent and capital value data for Asia and Continental Europe. For Australia, 5 cities are included with market weighted total return series calculated by PCA. The U.K. consists of IPD total return data for 7 cities. A composite of NCREIF total return for the 20 selected markets by property type is used to calculate the return for the United States. The average total return in local currency for the region is the market weighted average total return by city/MSAs and available property type. 1988 is our base year. The values of the indices are set equal to 100 in the base year.

Figure 5.2 The market weighted total return index in local currency by property type



Notes. This figure shows the market weighted total return series in local currency calculated from Jones Lang LaSalle rent and capital value data for Asia and Continental Europe. For Australia, 5 cities are included with market weighted total return series calculated by PCA. The U.K. consists of IPD total return data for 7 cities. A composite of NCREIF total return for the 20 selected markets by property type is used to calculate the return for the United States. The average total return in local currency for industrial, office, residential, and retail is the market weighted average total return by city/MSA and available property type. 1988 is our base year. The values of the indices are set equal to 100 in the base year.

5.3 Methodology

Our objective is to determine which investment strategy—portfolio diversification by region or by property type—is more effective in reducing the volatility of a direct real estate portfolio. The model should therefore decompose the city/MSA direct real estate return into a geographic or property type effect.

To isolate the regional effect from property type factors it is crucial not only to separate the two influences on the return but also eliminate the interaction between them. The goal is not reached when region indices are used as a proxy for region factors, and property type indices for property type factors. If the allocation of property type differs across regions, than the region indices contain a property type effect and the property type indices contain a regional effect. That is why we apply a multi-factor approach to city or MSA direct real estate returns. Region and property type effects can be more easily separated by using individual city or MSA returns rather than indices and by simultaneously estimating 'pure' factor returns through a regression technique. With this methodology, the region effect of for example Asia can be interpreted as the outperformance of a property type diversified Asian portfolio relative to the global portfolio. By 'property type diversified', we mean that the Asian portfolio has the same property type composition as the global return index. This is to compensate for the lack of industrial real estate data in our database for Asia (see Appendix 5.A). Similarly, for example, the residential effect is the outperformance of a geographically diversified residential portfolio relative to the global return index, this is to compensate for the lack of residential data in Australia, Europe, and the U.K.

This type of model is proposed for the global equity market in a paper by Heston and Rouwenhorst (1995) and later re-examined by Griffin and Karolyi (1998). The model is based on the assumption that the return on an individual asset depends on a common factor (the market movement) and loading factors. In their paper, this approach assumes that equity returns are a function of market movements and industry and country effects. If we replace the industry effect by property type effect we can assume that: the direct real estate return for a city or MSA i is the result of market movements, plus property type effects, and region effects.[35] Therefore, every return i should belong to a property type j and a region k.

$$R_{it} = \alpha_t + \beta_{jt} + \gamma_{kt} + e_{it} \ , \tag{5.1}$$

where α is the common factor, β_j is the property type effect for property type j, γ_k is the region effect for region k and e_i is a city or MSA specific component of the return period t.

For each quarter we estimate α, β, and γ by running a cross-section regression of the total returns of 74 cities or MSAs in our data set on a set of property types and region dummies:

$$\mathrm{R}_i = \alpha + \beta_1 P_{i1} + \ldots + \beta_4 P_{i4} + \gamma_1 G_{i1} + \ldots + \gamma_5 G_{i5} + e_i \ , \tag{5.2}$$

where $P_{ij} = 1$ if a city or MSA i belongs to property type j (otherwise zero), and $G_{ik} = 1$ if a city or MSA belongs to geographic region k (otherwise zero). Running the cross-sectional analysis will result in a time-series for each of the estimated parameters for property type and region.

However, applying this model creates an identification problem because every return belongs to both a property type and a region. To solve this we could eliminate one property type dummy and one region dummy. The eliminated dummies would then become the benchmark. To avoid this interpretation problem of an arbitrary benchmark, we can impose the constraint that, for a value weighted

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[35] Property type effect and region effect are tested for listed property by Hamelink and Hoesli (2004)

portfolio, the sum of the property type value weighted coefficients equals zero and the sum of the region value weighted coefficients equals zero, as proposed by Kennedy (1986).

$$\sum_{j=1}^{4} w_j \beta_j = 0 \ , \tag{5.3a}$$

$$\sum_{k=1}^{5} v_k \gamma_k = 0 \ , \tag{5.3b}$$

where w_j and v_k are value weighted (see appendix 5.C) by property type j and region k in the total aggregate portfolio. The least-square estimate of α is the return on the value-weighted total aggregate portfolio. With these constrains, a portfolio replicating a global index has zero exposure to the two factors. By construction, the common factor equals the global real estate index return.[36]

For every quarter we calculate the weighted least square (WLS) using equation (5.2) subject to restriction (5.3a) and (5.3b). This will result in time-series of the intercepts and coefficients by property type and geographic region. Coefficient $\hat{\beta}$ estimates the 'pure' property type effect and coefficient $\hat{\gamma}$ measures the 'pure' region effect. The variation of the time-series indicates the better diversification strategy to reduce risk.

5.4 Results

5.4.1 Property type and region effect

Table 5.4 shows the annualized mean and standard deviation in local currency by region and property type. The common factor is equal to the global index or equal to the average of all regions in table 5.2. The mean for the individual regions indicates over or underperformance relative to the common factor or global index given a property type diversified portfolio for the 'pure' region effects and a regionally diversified portfolio for the 'pure' property type effects. For example, Asia has outperformed the common factor or market by 510 basis points during the selected period, given a diversified portfolio with the same property type allocation (see appendix 5.C) as the global portfolio. Since the common effect is the global total return performance, all regions except the U.S. outperform. Asia,

[36] Griffin and Karolyi (1998) for further information.

Australia, Europe and the U.K. show a positive 'pure' effect, demonstrating that these regions, with the same allocation to property type as the global allocation, outperform the global total return. Residential real estate has the highest outperformance, followed by industrial, and retail, given the same regional allocation as the global portfolio. Only office real estate underperforms. By carrying out this analysis, we separate the region effect from the property type effect and eliminate their interaction.

The results in table 5.4 also show that the average absolute value for the regional effect is higher than the average absolute value for the property type effect, demonstrating that the average returns over this time period for the property type stay closer together than the average returns between regions. It appears that average regional effect volatility is more than twice the property type volatility. This shows that returns for regions are more volatile than returns for property types. It is clear that Asia has the highest variance and therefore has a big influence on portfolio diversification. However, excluding Asia from the average absolute value will lead to the same conclusion, because the average volatility of the remaining regions is still higher than the average volatility of the property types. The higher average absolute volatility of the region effects makes it a more important determinant of the variation in international returns.

Table 5.4 'Pure' effects in local currency

	Mean 'pure' effect	Standard deviation
Common Factor	9.3%	2.9%
Asia	5.1%	8.1%
Australia	0.3%	2.1%
Continental Europe	3.0%	3.3%
United Kingdom	2.0%	4.2%
United States	-2.3%	2.3%
Average Absolute Value	2.6%	4.0%
Industrial	1.1%	0.9%
Office	-1.9%	1.4%
Residential	2.2%	2.4%
Retail	0.4%	1.6%
Average Absolute Value	1.4%	1.6%

Notes. The table contains the results for the mean and variance by region and property type in local currency. Mean 'pure' effect and standard deviation are annualized.

Table 5.5 'Pure' effects in US dollars

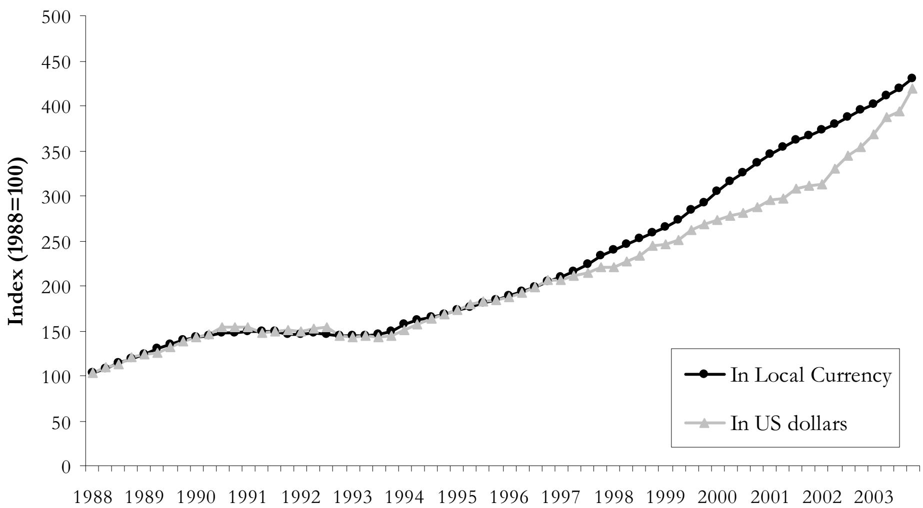
	Mean 'pure' effect	Standard deviation
Common Factor	9.1%	4.5%
Asia	2.1%	9.3%
Australia	1.1%	7.9%
Continental Europe	3.3%	6.7%
United Kingdom	2.2%	6.8%
United States	-2.2%	4.2%
Average Absolute Value	2.2%	7.0%
Industrial	1.1%	0.9%
Office	-1.9%	1.4%
Residential	2.1%	2.3%
Retail	0.4%	1.6%
Average Absolute Value	1.4%	1.6%

Notes. The table contains the results for the mean and variance by region and property type in US dollars. Mean 'pure' effect and standard deviation are annualized.

Figure 5.3 shows the index of the common factor or global index for the total return in local currency and US dollars. The currency effect over the whole period is very small, with the exception of the period after the Asian crisis, when the global total return index in US dollars is below the global total return index in local currency.

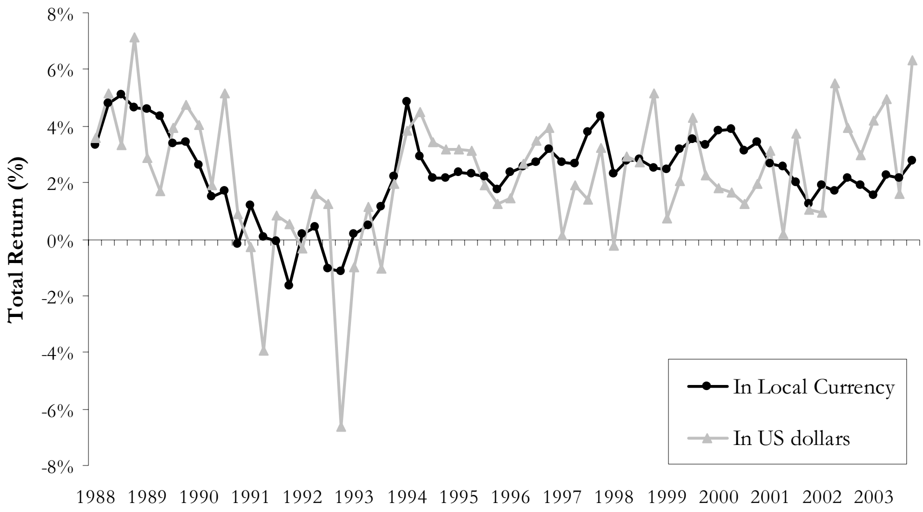
Table 5.5 gives the results for the common factor, the mean 'pure' effect, and standard deviation in US dollars by region and property type. Converting the returns into US dollars reduces the outperformance of Asia and increases the outperformance of Australia, Continental Europe, and the U.K., relative to the global portfolio. Figure 5.3 shows the global total return index in local currency and after converting into US dollars. Converting to US dollars also increases the volatility of the common factor or global total return, as shown in figure 5.4. The increase in volatility of the global total return leads to an increase in volatility of the 'pure' effects, because the 'pure' effect is a relative measure to the global portfolio. The analysis of the returns in US dollars results in the same conclusion as the local currency analysis. International diversification has a larger influence on the overall variation of the portfolio than property type diversification.

Figure 5.3 Global total return index in local currency and US dollars



Notes. This figure shows the index of the common factor or global total return index, both in local currency and US dollars. The values of the indices are set equal to 100 in the base year.

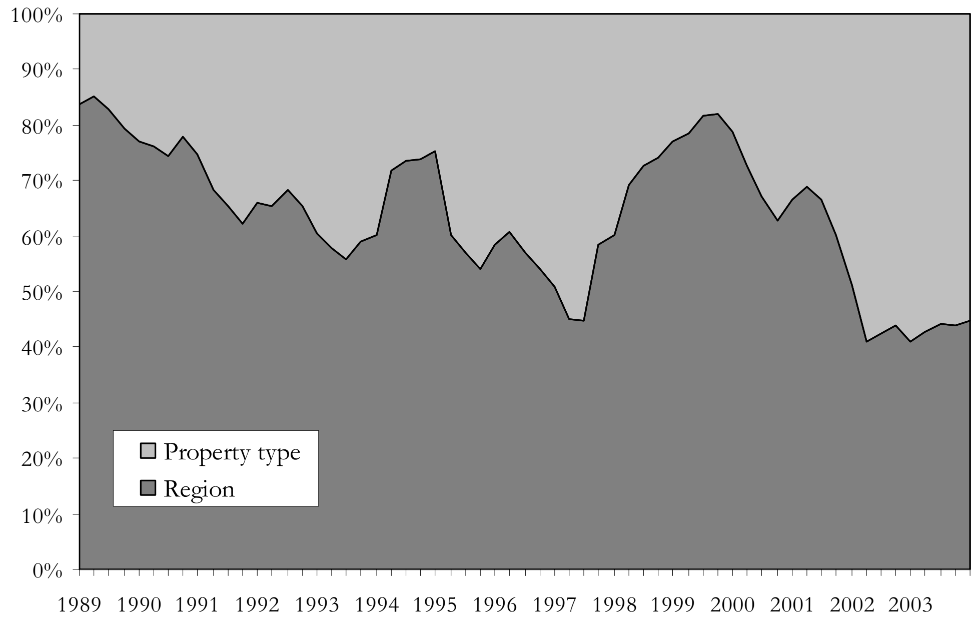
Figure 5.4 Quarterly global total return in local currency and US dollars



Notes. This figure shows the quarterly common factor or global total return, both in local currency and US dollars.

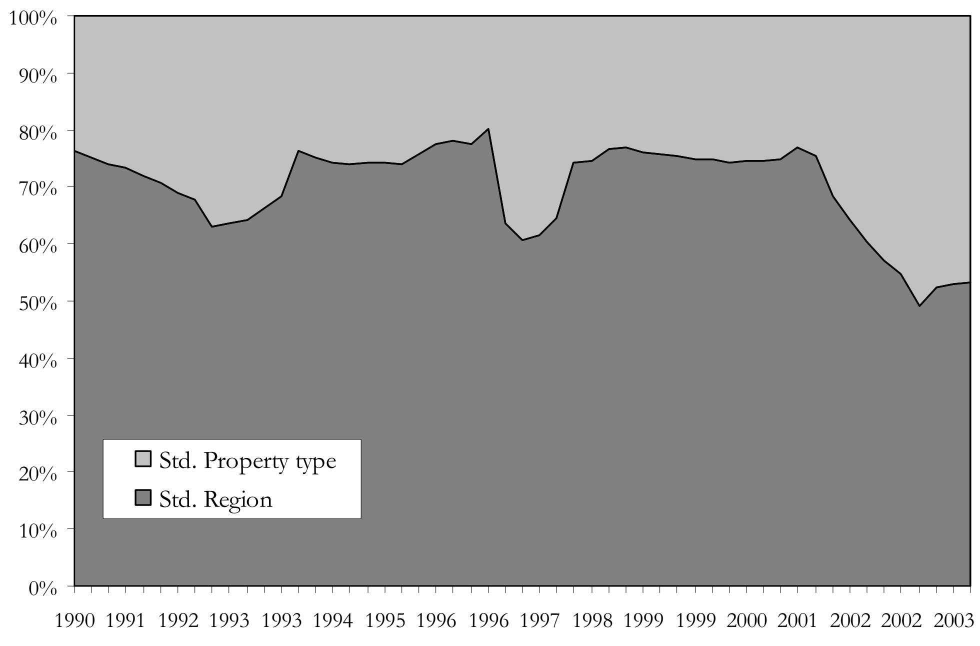
To analyze whether the importance of the pure effect for the regions changes over time, we calculate the moving average absolute return by property type and region relative to the sum of the absolute returns. Figure 5.5 shows that the region has the most influence on the return. However, the influence of the property type is higher in the last 2 years, when expressing the returns in local currency. Figure 5.6 analyzes the average standard deviation of the region versus the average standard deviation of the property type. We conclude that the average region standard deviation is higher than the property type standard deviation, for every time period. However, similarly to the absolute average return analysis, the average standard deviation for the property type effect becomes relatively more important in the most recent years, when expressed in local currency. Van Dijk and Keijzer (2004) find similar results for the equity markets. Over the period January 1987 through March 2002, they show that there is a shift in the relative importance from region to industry-sector effect. In the first half of the sample period, region allocation is most important. However, over the second half of the sample period the region allocation becomes less important, while the industry-sector allocation becomes the most important.

Figure 5.5 Moving average absolute return



Notes. This figure shows the moving average 4 quarter absolute returns for the property types and region effect in local currency as a percentage of the sum of the absolute returns.

Figure 5.6 Moving average standard deviation



Notes. This figure shows the moving average 12 quarter standard deviation for the property types and region effect in local currency as a percentage of the sum of the standard deviations.

Table 5.6 Correlations between the common factor and mean 'pure' effects in local currency

	Common Factor	Asia	Australia	Europe	U.K.	U.S.	Industrial	Office	Residential
Asia	0.106	1							
Australia	-0.075	0.131	1						
Cont. Europe	0.177	-0.183	0.041	1					
U.K.	0.082	0.399***	0.275*	-0.112	1				
U.S.	-0.168	-0.758***	-0.250*	-0.354***	-0.544***	1			
Industrial	0.105	0.239*	0.178	0.153	-0.023	-0.228*	1		
Office	0.618***	-0.253**	-0.297*	0.149	-0.159	0.250**	0.108	1	
Residential	-0.629***	0.100	-0.079	-0.182	0.158	-0.127	-0.258**	-0.565***	1
Retail	-0.406***	0.124	0.218	-0.095	0.081	-0.111	-0.445***	-0.810***	0.184

Notes. This table contains correlations of the common factor, pure effect by region, and pure effect by property type in local currency between 1Q1988–4Q2003. The symbols *, **, *** indicate that a correlation is significant from zero at the 10%, 5%, 1% levels, respectively.

Table 5.7 Correlations between the common factor and mean 'pure' effects in US dollars

	Common Factor	Asia	Australia	Europe	U.K.	U.S.	Industrial	Office	Residential
Asia	-0.209*	1							
Australia	0.227*	0.230*	1						
Cont. Europe	0.566***	-0.382***	-0.250**	1					
U.K.	0.500***	-0.118	0.060	0.203	1				
U.S.	-0.698***	-0.192	-0.270**	-0.659***	-0.514***	1			
Industrial	-0.069	0.224*	0.115	-0.066	-0.085	0.014	1		
Office	0.312**	-0.311**	-0.209*	-0.021	0.139	0.236*	0.081	1	
Residential	-0.463***	0.166	-0.047	-0.086	-0.090	-0.017	-0.242*	-0.549***	1
Retail	-0.123	0.163	0.117	0.096	-0.100	-0.209*	-0.442***	-0.809***	0.181

Notes. This table contains correlations of the common factor, pure effect by region, and pure effect by property type in US dollars between 1Q1988–4Q2003. The symbols *, **, *** indicate that a correlation is significant from zero at the 10%, 5%, 1% levels, respectively.

Table 5.6 and 5.7 give the correlations between the common factor, the pure region effect, and the pure property type effect, in both local currency and US dollars. As expected, the correlation coefficients between the regions and property type are very low and mostly not significant. This demonstrates the disentanglement of the region effect versus the property type effect when compared to the correlation coefficients of the region and property type indices (see table 5.3). The correlation coefficients between the outperformance of regional effects and outperformance of property type effects are, as stated above, generally not significantly different from zero (with the exception of office and Asia, Australia, and the U.S. in local currency, and office and Asia in US dollars). Looking at the correlations between the pure region effects, the U.S. is significantly negatively different from the other regions, except for Continental Europe when expressed in local currency. After converting the total returns into US dollars, Continental Europe becomes significantly negatively different from the other regions (with the exception of the U.K.). Overall, we conclude from tables 5.6 and 5.7 that from a region perspective there are diversification benefits to be achieved because the correlation coefficients between the regions are not close to one. In the case of Continental Europe and the U.S. the correlation coefficients are in most cases negative. This would indicate that adding a region to an investment portfolio will reduce the risk more than the outperformance. Converting total returns in local currency to US dollars has less of an influence on the correlations between the pure effects of the property types. Industrial and office are both significantly negatively different from retail and residential (industrial and residential in US dollars are significantly different at a 10 percent level). This indicates that there is good diversification potential from adding industrial or office to a portfolio of residential or retail real estate.

5.4.2 Stability of correlation and variance of the pure effects

In the previous section, we saw that the mean and standard deviations change through time, which results in a changing diversification potential of region versus property type. Since the stability of the mean and standard deviation is absolutely crucial to the diversification potential and to determine what the influence of the Asian crisis was on our results we test the stability of the correlation matrix using a Jennrich (1970) Chi-square test. This will determine the stability of the correlations and variance by dividing the time series of the pure effects into four equal sub-periods. The test was developed to investigate the equality of two correlation or covariance matrices. The correlation matrices R_1 and R_2 are compared with n_1 and n_2 number of observations. To compute X^2, let $\overline{\mathrm{R}} = (r_{ij}), S = (\delta_{ij} + \bar{r}_{ij}\bar{r}^{ij}), c = n_1 n_2 / (n_1 + n_2)$ and $Z = c^{1/2}\,\overline{\mathrm{R}}^{-1}(\mathrm{R}_1 - \mathrm{R}_2)$. Then

$$X^2 = \frac{1}{2} tr(Z^2) - dg'(Z) S^{-1} dg(Z), \tag{5.4}$$

the Jennrich X^2 for covariance, the first term in equation (5.4) is a standard asymptotic X^2 statistic for testing the equality of two covariance matrices. The second term is a correction for correlations and is therefore not used when applying the equation to a covariance matrix. The covariance matrix test has $p(p + 1)/2$ degrees of freedom.

Table 5.8 Stability of the correlation by region and property type pure effects

	Currency	Period I	Period II	Correlation Jennrich Chi-Square
Region	Local	1Q1988–4Q1991	1Q1992–4Q1995	19.01**
		1Q1992–4Q1995	1Q1996–4Q1999	19.11**
		1Q1996–4Q1999	1Q2000–4Q2003	22.68**
		1Q1988–4Q1991	1Q1996–4Q1999	31.01***
		1Q1992–4Q1995	1Q2000–4Q2003	21.00**
		1Q1988–4Q1991	1Q2000–4Q2003	26.32***
Region	US dollars	1Q1988–4Q1991	1Q1992–4Q1995	23.60***
		1Q1992–4Q1995	1Q1996–4Q1999	41.98***
		1Q1996–4Q1999	1Q2000–4Q2003	52.26***
		1Q1988–4Q1991	1Q1996–4Q1999	46.60***
		1Q1992–4Q1995	1Q2000–4Q2003	24.50***
		1Q1988–4Q1991	1Q2000–4Q2003	30.27***
Property Type	Local	1Q1988–4Q1991	1Q1992–4Q1995	2.94
		1Q1992–4Q1995	1Q1996–4Q1999	4.89
		1Q1996–4Q1999	1Q2000–4Q2003	5.28
		1Q1988–4Q1991	1Q1996–4Q1999	5.89
		1Q1992–4Q1995	1Q2000–4Q2003	8.61
		1Q1988–4Q1991	1Q2000–4Q2003	4.83
Property Type	US dollars	1Q1988–4Q1991	1Q1992–4Q1995	7.01
		1Q1992–4Q1995	1Q1996–4Q1999	8.48
		1Q1996–4Q1999	1Q2000–4Q2003	12.36*
		1Q1988–4Q1991	1Q1996–4Q1999	11.82*
		1Q1992–4Q1995	1Q2000–4Q2003	15.69**
		1Q1988–4Q1991	1Q2000–4Q2003	7.62

Notes. The table contains the results of the Jennrich X^2 test for the stability of the correlation matrix by region and property type for four equal periods between 1Q1988 and 4Q2003. The symbols *, **, *** indicate that the result is significant from zero at the 10%, 5%, 1% levels, respectively.

The first test looks at the stability of the correlation matrix by region and property type. To test the stability we divide the data series into four equal sub-periods of four years and calculate the correlation matrices for the regions and property types for six possible period combinations between 1Q1988 and 4Q2003, for the 'pure' effects both in local currency and US dollars. Table 5.8 shows that the null hypothesis of stability can be rejected with at least a 5% confidence level for the region correlation matrices. The stability for the regions in local currency for adjacent periods and the period (1Q1992–4Q1995 compared to 1Q2000–4Q2003) can be rejected at a 5% confidence level. The other non-adjacent periods can be rejected at a 1% confidence level. This suggests that the correlation matrices between regions shift abruptly from time period to time period. This is also the case for the regional correlation matrices in US dollars, where all the correlation matrices compared are unstable. In contrast, the property type correlation matrices in local currency seem to be stable for all time periods. When the pure effects are expressed in US dollars, the null hypothesis cannot be rejected either for the first two adjacent periods or when the first period is compared to the last time period. The other three time period comparisons can be rejected at least at a 5% confidence level. This might be the result of the currency fluctuations before and after the Asian crisis. To determine whether the instability is the result of the Asian crisis and whether it effects only the correlation matrix of the region, we apply a similar analysis to Chakrabarti and Roll (2002). As part of their analysis of the impact of the Asian crisis on the diversification potential of Asian and European stock markets, they perform a Jennrich test on pre- and post-crisis (before and after July 1997) correlations. Table 5.9 shows that the correlation matrices before and after the Asian crisis are different for the region effect at a 1% confidence level. The null hypothesis for the property type effects can only be rejected at a 10% confidence level for the correlation matrices in local currency.

Table 5.9 Stability of the correlation before and after the Asian crisis

	Currency	Correlation Jennrich Chi-Square
Region	Local	41.20***
	US dollars	33.04***
Property Type	Local	11.85*
	US dollars	9.05

Notes. The table contains the results of the Jennrich X^2 test for the stability of the correlation matrix by region and property type before (1Q1988–2Q1997) and after (3Q1997–3Q2003) the Asian crisis. The symbols *, **, *** indicate that the result is significant from zero at the 10%, 5%, 1% levels, respectively.

Table 5.10 Stability of the variances

	a to b	b to c	c to d	a to c	b to d	a to d
Common Factor	1.44	9.36***	1.67	12.00***	5.51**	9.11***
Asia	0.51	0.04	12.78***	0.83	12.47***	11.19***
Australia	2.09	1.98	1.84	6.41**	0.00	2.24
Continental Europe	0.29	0.21	6.45**	0.01	5.02**	6.66***
United Kingdom	0.59	11.80***	1.66	13.02***	8.80***	10.68***
United States	0.27	3.65*	4.63**	2.21	10.44***	9.19***
Industrial	0.20	0.06	0.03	0.47	0.00	0.26
Office	0.11	0.10	0.01	0.00	0.15	0.00
Residential	0.31	4.62**	1.03	6.33**	7.74***	9.26***
Retail	0.65	0.00	0.62	0.59	0.68	0.00

Notes. The table contains the results of the Jennrich X^2 test for the stability of the variances by region and property type in local currency, where period a=1Q1988–4Q1991, period b=1Q1992–4Q1995, period c=1Q1996–4Q1999, period d=1Q2000–4Q2003. The symbols *, **, *** indicate that the result is significant from zero at the 10%, 5%, 1% levels, respectively.

Table 5.10 shows the results for the Jennrich test on the variance for each of the regions and property types. This will determine the stability of the individual 'pure' effects through time. The majority of the region variances are stable in the short term (adjacent time periods), but get more unstable in the longer term, with the exception of Australia. The property type variances seem to be stable for all time periods, apart from residential property which is only stable for two of the adjacent time periods.

5.4.3 Disentangling the performance of the region

The results of the models can be used to explain the performance of a region. The individual return by region on an equally weighted market of region *k* is the sum of three components: the common factor, the weighted average of the property type effect, and the region effect.

$$R_k^{ew} \quad = \underbrace{\hat{\alpha}}_{\text{Common effect}} + \underbrace{\sum_{j=1}^{4} x_{k,j}\hat{\beta}_j P_{k,j}}_{\text{Property type effect}} + \underbrace{\hat{\gamma}_k}_{\text{Region effect}}, \qquad (5.5)$$

where $x_{k,j}$ is the weight of the property type in region *k* compared to the aggregate of the property type for all regions. All regions have the same common factor ($\hat{\alpha}$); the difference between the performance of the regions is therefore the result of two effects: the property type effect and the region effect. The first factor is an adjustment for property types that are under-represented or not represented in the performance of a region. This under representation is the result of data, but also indicates the relative (in)activity of institutional investors in a certain property type. The attribution of the property type selection to the return performance is given in the second part of equation (5.5). For example, there is very little consistent data available for institutional residential real estate investment in Australia, Continental Europe, and the U.K. (this does not mean that this market is not important to institutional investors, but that they rely on local information for specific markets). As a result, there are no available observations in our database for residential real estate in Australia, Continental Europe, and the U.K. Therefore, property returns, in these regions, do not reflect the performance of residential real estate and can be interpreted as a negative bet against residential real estate. The second driver of return is the regional effect, represented by the last term in equation (5.5). It measures the performance of cities/MSA in a region relative to cities/MSAs in other regions. It controls for the fact that a region is relatively over or under represented by a property type.

Table 5.11 Component analysis for regional return in local currency

	Common effect	Property type effect	Region effect	Equally-weighted regional performance
Asia	9.3%	0.1%	5.1%	14.5%
Australia	9.3%	-0.6%	0.3%	9.0%
Continental Europe	9.3%	-0.4%	3.0%	11.9%
United Kingdom	9.3%	-0.5%	2.0%	10.8%
United States	9.3%	0.4%	-2.3%	7.4%

Notes. The table contains the results for the common effect, property type effect, and region effect by region. All effects are annualized.

Table 5.12 Component analysis for regional return in US dollars

	Common effect	Property type effect	Region effect	Equally-weighted regional performance
Asia	9.1%	0.0%	2.1%	11.2%
Australia	9.1%	-0.6%	1.1%	9.6%
Continental Europe	9.1%	-0.4%	3.3%	12.0%
United Kingdom	9.1%	-0.5%	2.2%	10.8%
United States	9.1%	0.4%	-2.2%	7.3%

Notes. The table contains the results for the common effect, property type effect, and region effect by region. All effects are annualized.

Tables 5.11 and 5.12 show the sum of the equally weighted performance of the regions in local currency and US dollars. Australia, Continental Europe, and the U.K. are negatively impacted because there is no residential data in the performance. For Australia, the property type effect is also negative because there is an under-allocation in the industrial sector, which has an outperforming property type effect.

5.4.4 Disentangling the performance of the property type

To disentangle the performance for the individual property type on an equally weighted basis, we have to correct for the different weightings of property types within regions. The individual return by property type on an equally weighted market within property type *j* is the sum of three components: the common factor, the property type effect, and the weighted average region effect.

$$R_j^{ew} = \underbrace{\hat{\alpha}}_{\text{Common effect}} + \underbrace{\hat{\beta}_j}_{\text{Property type effect}} + \underbrace{\sum_{k=1}^{5} \phi_{j,k} \hat{\gamma}_k G_{j,k}}_{\text{Region effect}}, \tag{5.6}$$

where $\phi_{j,k}$ is the weight of the property type within a region compared to the aggregate of the property type for all regions. All property types have the same common effect. The property type effect is the pure property effect given in table 5.4 and 5.5. The region effect shows whether a region is under- or overweighted for a certain property type and the impact on the overall return for a property type.

Table 5.13 Component analysis for property type return in local currency

	Common effect	Property type effect	Region effect	Equally-weighted property type performance
Industrial	9.3%	1.1%	-0.6%	9.8%
Office	9.3%	-1.9%	0.7%	8.1%
Residential	9.3%	2.2%	-0.8%	10.7%
Retail	9.3%	0.4%	-0.1%	9.6%

Notes. The table contains the results for the common effect, property type effect, region effect by property type. All effects are annualized.

Table 5.14 Component analysis for property type return in US dollars

	Common effect	Property type effect	Region effect	Equally-weighted property type performance
Industrial	9.1%	1.1%	-0.1%	10.1%
Office	9.1%	-1.9%	0.5%	7.7%
Residential	9.1%	2.1%	-1.7%	9.5%
Retail	9.1%	0.4%	0.1%	9.6%

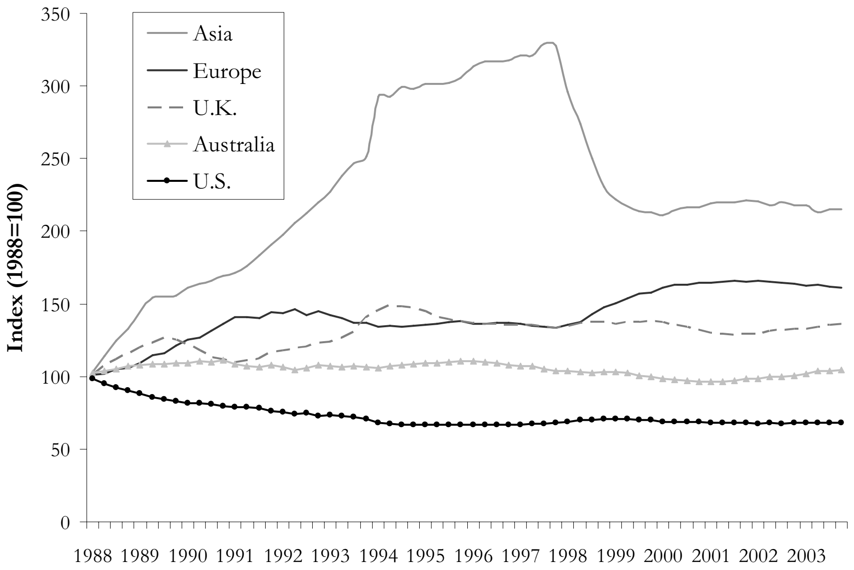
Notes. The table contains the results for the common effect, property type effect, region effect by property type. All effects are annualized.

Tables 5.13 and 5.14 show the results for the equally weighted property type performance. The underweight of industrial in Asia has impacted the overall return for industrial in a negative way, because Asia was an outperforming region. The overweight of office in Asia was a positive bet and has a positive influence on the return. The underweight for residential in Continental Europe and the U.K. has a negative impact on the overall performance for residential, because Continental Europe and the U.K. have an above average performance. Retail seems to be more balanced with returns across all regions. Looking at the differences in performance between local currency and US dollars, we can see that the region effect for industrial and office becomes smaller. This is the result of a lower return for Asia when converting from local currency to US dollars. The performance of residential becomes more negative as the underweight is in regions (Continental Europe and the U.K.) with additional currency gains between 1983–2003.

5.4.5 Cumulative effects

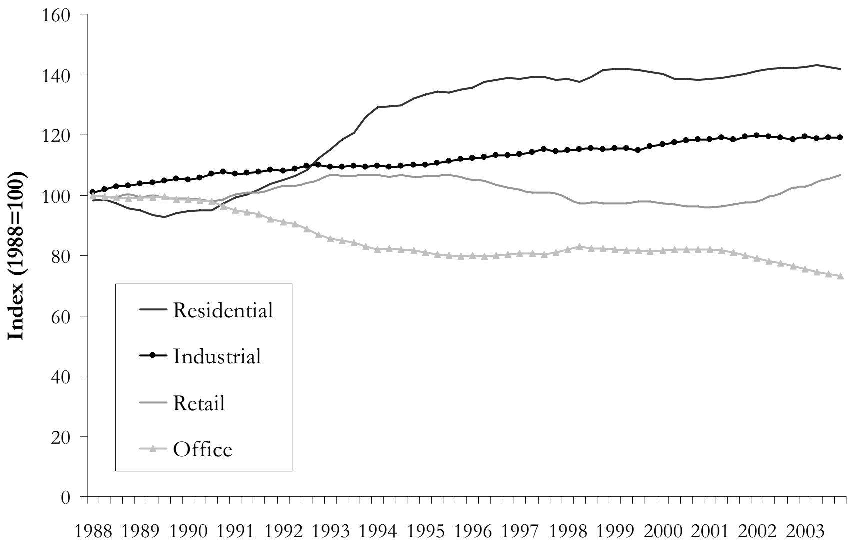
Figures 5.7 and 5.8 show the cumulative return of the 'pure' effect by region and property type. An index value of more than 100 in 4Q2003 indicates that outperformance was achieved between 1Q1988–4Q2003 for the region with the same property type allocation as the global index. Similarly for the property type cumulative return indices, a value higher than 100 in 4Q2003 indicates outperformance. This represents the property type outperformance given a geographically diversified portfolio equal to the global portfolio. The differences across regions have a bigger impact on the return than the differences between property types, as the cumulative returns deviate much more between regions than between property types. The influence of the Asian crisis becomes apparent from figures 5.7 and 5.9, especially if the returns are converted into US dollars.

Figure 5.7 Index of cumulative returns on the pure effect for the regions



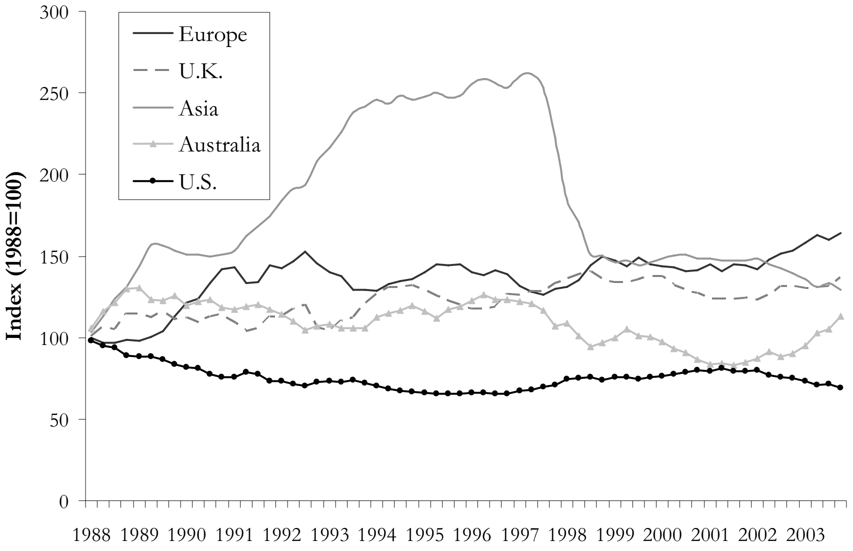
Notes. This figure shows the index of cumulative returns on the pure effect for the regions in local currency. The values of the indices are set equal to 100 in the base year.

Figure 5.8 Index of cumulative returns on the pure effect for the property types



Notes. This Figure shows the index of cumulative returns on the pure effect for the property types in local currency. The values of the indices are set equal to 100 in the base year.

Figure 5.9 Index of cumulative returns on the pure effect for the regions in US dollars



Notes. This figure shows the index of cumulative returns on the pure effect for the regions in US dollars. The values of the indices are set equal to 100 in the base year.

5.5 Conclusions

This chapter examines whether investing across regions or property types can lead to higher diversification gains. To analyze this, we created a unique data set for direct real estate covering 25 countries in 5 regions for 4 different property types. Our study confirms the previous findings of Hamelink and Hoesli (2004) for listed real estate securities. They found that geographic factors still have the biggest influence on the volatility of international real estate security returns. The average variance of the regional effects is higher than that of the property type effects and therefore the regional effects have a bigger influence on the variation of the total portfolio. Because of the stronger influence on the total risk of the portfolio, investing in assets across regions will result in the highest diversification benefits. However, the regional effects are less stable through time, compared with the variance and correlation of the property type effects. Also the property type effect seems to become a more important factor for the return, especially when the return is expressed in local currency. This is similar to findings in the equity markets for this period, where the region allocation becomes less important and the industry-sector allocation becomes more important. With respect to the 'pure' factor for the region we conclude that over the time period 1Q1988–4Q2003 Asia, Australia, Continental Europe, and the U.K. outperform based on the same property type allocation as the global index. For the property type 'pure' factor we conclude that during the selected time period industrial, residential, and retail outperform given the regional allocation of the global index. The regional outperformance in particular depends on the selected time period and the impact of the Asian crisis.

Appendix 5.A Average total return analysis by city and property type

Region/Country	City/MSA	Industrial			Office			Residential			Retail		
		Total Return	σ Total Return		Total Return	σ Total Return		Total Return	σ Total Return		Total Return	σ Total Return	
Asia													
China	Beijing				22.1%	20.1%	[48]	18.0%	17.9%	[56]	-1.2%	14.9%	[32]
	Shanghai				13.3%	19.9%	[41]	19.8%	19.9%	[40]	15.4%	17.0%	[40]
	Hong Kong				9.9%	19.9%	[64]	17.6%	19.6%	[64]	1.6%	13.9%	[24]
Indonesia	Jakarta				24.3%	27.3%	[64]	25.1%	27.2%	[28]	21.6%	29.4%	[44]
Japan	Tokyo				-6.8%	7.7%	[64]						
Malaysia	Kuala Lumpur				7.1%	4.1%	[48]	11.7%	7.1%	[48]	4.0%	11.6%	[24]
Philippines	Manila				3.3%	5.7%	[31]	0.4%	7.9%	[32]	4.5%	5.7%	[24]
Singapore	Singapore				1.0%	12.8%	[49]	10.2%	10.2%	[60]	1.6%	13.5%	[49]
Thailand	Bangkok				6.2%	10.4%	[40]	6.5%	5.5%	[44]	8.2%	13.7%	[36]
Australia													
Australia	Brisbane	12.3%	2.9%	[40]	6.5%	3.6%	[64]				10.7%	2.4%	[40]
	Canberra				8.0%	5.2%	[64]						
	Melbourne	12.1%	2.4%	[35]	5.2%	6.1%	[64]				11.0%	3.4%	[64]
	Perth				5.3%	7.3%	[64]				13.0%	4.0%	[64]
	Sydney	10.5%	4.6%	[64]	5.9%	6.8%	[64]				12.0%	3.3%	[64]
Continental Europe													
Belgium	Antwerp	12.1%	9.6%	[58]	10.7%	6.5%	[58]				11.2%	8.0%	[64]
	Brussels	11.5%	10.5%	[58]	10.4%	8.2%	[64]				11.7%	8.3%	[64]
Czech Republic	Prague	15.0%	6.5%	[28]	8.4%	9.4%	[46]				22.5%	12.9%	[16]
Denmark	Copenhagen	12.3%	6.6%	[12]	9.6%	3.7%	[16]				6.6%	8.1%	[16]
Finland	Helsinki	12.1%	9.7%	[16]	7.3%	7.4%	[16]				7.2%	6.8%	[16]
France	Lyon	16.0%	8.8%	[36]	10.3%	8.8%	[52]				30.7%	15.5%	[38]
	Paris	8.7%	10.5%	[58]	3.9%	10.0%	[54]				20.2%	13.1%	[38]
Germany	Berlin	5.6%	10.1%	[29]	2.0%	13.4%	[53]				7.2%	9.5%	[64]
	Frankfurt	7.5%	7.0%	[43]	7.5%	10.6%	[64]				7.3%	10.0%	[64]
	Munich	9.3%	6.7%	[16]	7.2%	9.6%	[64]				8.1%	10.5%	[64]
Hungary	Budapest	11.1%	8.9%	[26]	9.9%	8.5%	[46]				15.9%	6.5%	[8]
Ireland	Dublin	14.1%	10.2%	[56]	11.7%	12.0%	[57]				19.0%	12.4%	[16]
Italy	Milan	14.5%	10.6%	[36]	7.5%	11.4%	[52]				14.1%	9.2%	[32]
Luxembourg	Luxembourg	13.9%	7.2%	[50]	6.9%	8.5%	[52]				11.7%	6.9%	[16]
Netherlands	Amsterdam	13.5%	9.6%	[58]	11.8%	9.5%	[64]				13.0%	7.5%	[64]
	The Hague	10.7%	10.0%	[58]	9.6%	6.1%	[64]				9.8%	8.1%	[58]
Norway	Oslo	12.6%	10.3%	[13]	4.8%	17.5%	[16]				6.4%	6.2%	[16]
Poland	Warsaw	13.5%	13.4%	[31]	7.3%	9.5%	[31]				19.5%	10.6%	[16]
Spain	Barcelona	15.0%	14.3%	[58]	8.3%	14.0%	[56]				14.8%	16.2%	[57]
	Madrid	12.4%	10.1%	[58]	10.7%	18.1%	[64]				17.6%	14.9%	[64]
Sweden	Stockholm	12.8%	14.5%	[36]	14.8%	13.1%	[40]				-0.7%	8.9%	[15]

Notes. This appendix shows the average annual total return in local currency and standard deviation for every city/MSA included in our database. If there is a value, it means that there is a time-series available, no value means no time-series included in the database. The number of available quarters is given in brackets.

Appendix 5.A Average total return analysis by city and property type (Cont'd)

Region/Country	City/MSA	Industrial			Office			Residential			Retail		
		Total Return	σ Total Return		Total Return	σ Total Return		Total Return	σ Total Return		Total Return	σ Total Return	
United Kingdom													
United Kingdom	Birmingham	10.2%	4.3%	[30]	10.4%	5.6%	[64]				12.1%	4.6%	[41]
	Bristol	12.4%	6.2%	[64]	11.4%	8.6%	[64]				9.5%	4.8%	[64]
	Edinburgh				10.0%	9.7%	[64]				9.6%	6.0%	[64]
	Leeds	14.7%	8.5%	[64]	11.1%	7.1%	[64]				11.9%	5.6%	[44]
	London	12.4%	5.5%	[64]	7.9%	6.6%	[64]				9.7%	4.4%	[64]
	Manchester	10.8%	3.3%	[37]	13.6%	7.7%	[64]				11.8%	5.1%	[44]
	Reading	7.9%	4.5%	[41]	6.3%	6.0%	[64]				11.2%	4.9%	[44]
United States													
United States	Atlanta	6.5%	4.1%	[64]	4.2%	5.7%	[64]	7.7%	4.5%	[64]	8.1%	3.7%	[64]
	Austin							8.0%	3.3%	[35]			
	Baltimore	9.7%	3.5%	[64]							5.7%	4.7%	[56]
	Boston	8.3%	6.0%	[64]	5.9%	8.6%	[64]	11.8%	5.7%	[53]	9.9%	3.6%	[38]
	Chicago	7.7%	3.3%	[64]	4.6%	6.5%	[64]	11.3%	3.2%	[35]	7.3%	3.5%	[64]
	Dallas	6.1%	3.9%	[64]	5.3%	6.2%	[64]	6.6%	4.2%	[64]	6.3%	4.7%	[64]
	Denver				4.2%	6.7%	[64]	13.0%	3.7%	[46]	6.0%	5.2%	[64]
	Fort Lauderdale							8.0%	3.3%	[59]			
	Houston				4.1%	6.8%	[64]	6.9%	5.0%	[64]	4.5%	8.1%	[64]
	Indianapolis	6.7%	3.1%	[53]									
	Las Vegas							7.6%	2.8%	[59]			
	Los Angeles	8.7%	5.0%	[64]	4.3%	6.4%	[64]	13.3%	4.4%	[23]	9.7%	5.8%	[64]
	Memphis	7.1%	4.5%	[64]									
	Miami				10.5%	4.1%	[33]				5.5%	3.8%	[21]
	Middlesex	6.2%	4.5%	[52]	8.7%	2.3%	[20]						
	Minneapolis	7.3%	4.1%	[64]	1.4%	6.3%	[64]				9.0%	2.7%	[33]
	New Haven				9.0%	16.5%	[54]						
	New York				6.4%	7.1%	[64]	8.0%	3.6%	[15]			
	Oakland	8.4%	6.0%	[64]	6.9%	6.8%	[64]				7.6%	3.6%	[64]
	Orange County	8.6%	5.5%	[64]	6.8%	8.9%	[64]				6.4%	5.3%	[59]
	Orlando	7.4%	6.4%	[64]				7.6%	3.7%	[58]			
	Philadelphia							11.0%	7.5%	[60]	7.5%	5.3%	[44]
	Phoenix	6.3%	5.6%	[64]	8.8%	4.3%	[29]	9.0%	3.7%	[61]	8.4%	7.0%	[64]
	Portland	12.4%	3.5%	[34]									
	Riverside	8.7%	5.1%	[63]				17.0%	3.6%	[20]			
	San Antonio										11.3%	5.2%	[15]
	San Diego	8.5%	4.9%	[64]	6.4%	8.3%	[64]	15.0%	3.4%	[19]	6.8%	5.6%	[64]
	San Francisco				5.7%	8.2%	[64]	5.0%	1.5%	[6]	8.4%	5.4%	[54]
	San Jose	9.6%	8.8%	[64]	8.6%	11.9%	[55]				8.6%	6.5%	[64]
	Seattle	8.9%	3.2%	[64]	8.1%	8.1%	[56]	9.5%	4.8%	[61]	9.4%	3.7%	[57]
	Washington	8.0%	5.4%	[64]	7.1%	3.6%	[64]	10.1%	3.7%	[64]	7.1%	5.2%	[64]
	West Palm Beach							8.7%	3.3%	[50]			

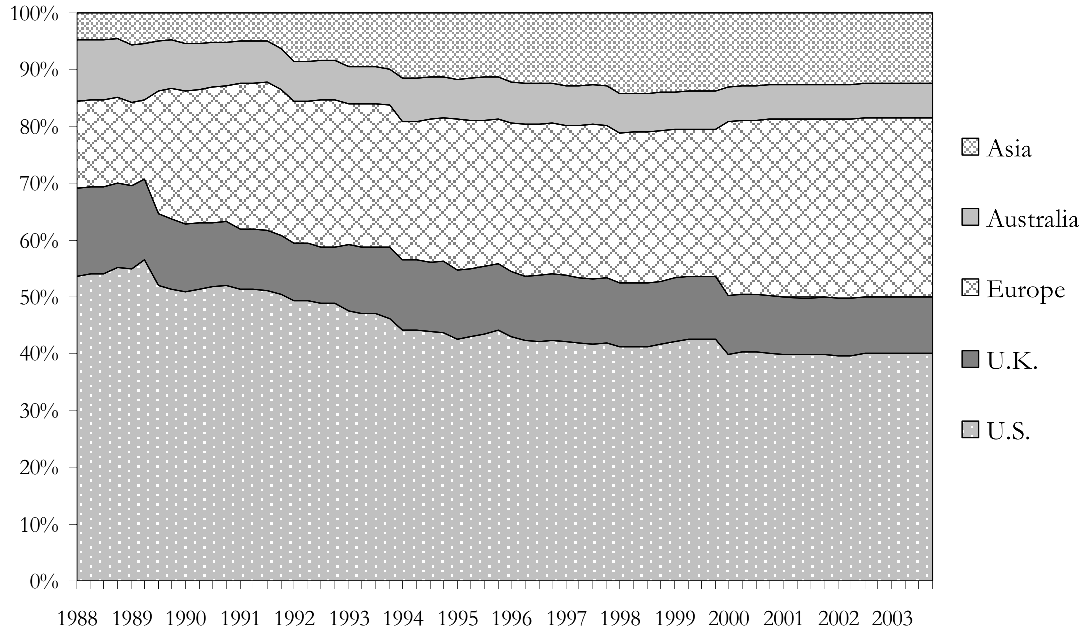
Notes. This appendix shows the average annual total return in local currency and standard deviation for every city/MSA included in our database. If there is a value, it means that there is a time-series available, no value means no time-series included in the database. The number of available quarters is given in brackets.

Appendix 5.B Average total return analysis by country and property type

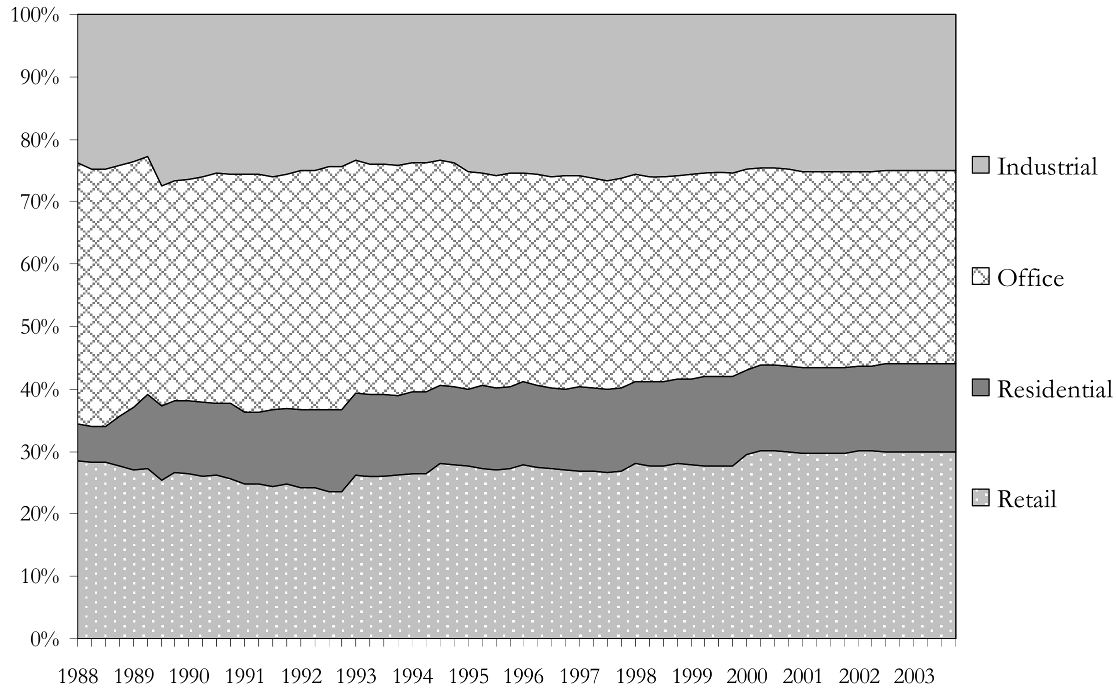
Country	Industrial			Office			Residential			Retail		
	Total Return	σ Total Return		Total Return	σ Total Return		Total Return	σ Total Return		Total Return	σ Total Return	
Australia	11.4%	3.7%	[139]	6.2%	5.9%	[320]				11.8%	3.4%	[232]
Belgium	11.8%	10.0%	[116]	10.5%	7.4%	[122]				11.5%	8.1%	[128]
China				18.1%	20.0%	[89]	18.7%	18.7%	[96]	8.0%	16.5%	[72]
Czech Republic	15.0%	6.5%	[28]	8.4%	9.4%	[46]				22.5%	12.9%	[16]
Denmark	12.3%	6.6%	[12]	9.6%	3.7%	[16]				6.6%	8.1%	[16]
Finland	12.1%	9.7%	[16]	7.3%	7.4%	[16]				7.2%	6.8%	[16]
France	11.5%	10.0%	[94]	7.0%	9.5%	[106]				25.4%	14.5%	[76]
Germany	7.2%	8.0%	[88]	5.8%	11.2%	[181]				7.5%	10.0%	[192]
Hong Kong				9.9%	19.9%	[64]	17.6%	19.6%	[64]	1.6%	13.9%	[24]
Hungary	11.1%	8.9%	[26]	9.9%	8.5%	[46]				15.9%	6.5%	[8]
Indonesia				24.3%	27.3%	[64]	25.1%	27.2%	[28]	21.6%	29.4%	[44]
Ireland	14.1%	10.2%	[56]	11.7%	12.0%	[57]				19.0%	12.4%	[16]
Italy	14.5%	10.6%	[36]	7.5%	11.4%	[52]				14.1%	9.2%	[32]
Japan				-6.8%	7.7%	[64]						
Luxembourg	13.9%	7.2%	[50]	6.9%	8.5%	[52]				11.7%	6.9%	[16]
Malaysia				7.1%	4.1%	[48]	11.7%	7.1%	[48]	4.0%	11.6%	[24]
Netherlands	12.1%	9.8%	[116]	10.7%	8.0%	[128]				11.5%	7.8%	[122]
Norway	12.6%	10.3%	[13]	4.8%	17.5%	[16]				6.4%	6.2%	[16]
Philippines				3.3%	5.7%	[31]	0.4%	7.9%	[32]	4.5%	5.7%	[24]
Poland	13.5%	13.4%	[31]	7.3%	9.5%	[31]				19.5%	10.6%	[16]
Singapore				1.0%	12.8%	[49]	10.2%	10.2%	[60]	1.6%	13.5%	[49]
Spain	13.7%	12.3%	[116]	9.6%	16.3%	[120]				16.3%	15.5%	[121]
Sweden	12.8%	14.5%	[36]	14.8%	13.1%	[40]				-0.7%	8.9%	[15]
Thailand				6.2%	10.4%	[40]	6.5%	5.5%	[44]	8.2%	13.7%	[36]
United Kingdom	11.9%	6.1%	[300]	10.1%	7.5%	[448]				10.6%	5.1%	[365]
United States	8.0%	5.0%	[1226]	6.0%	7.9%	[1143]	9.4%	4.4%	[916]	7.5%	5.2%	[1081]

Notes. This appendix shows the average annual total return in local currency and standard deviation for every country, calculated as the average of the total returns for the cities/MSAs included in our database. If there is a value, it means that there is a time-series available, no value means no time-series included in the database. The number of available quarters is given in brackets

Appendix 5.C Relative weight of regions and property type

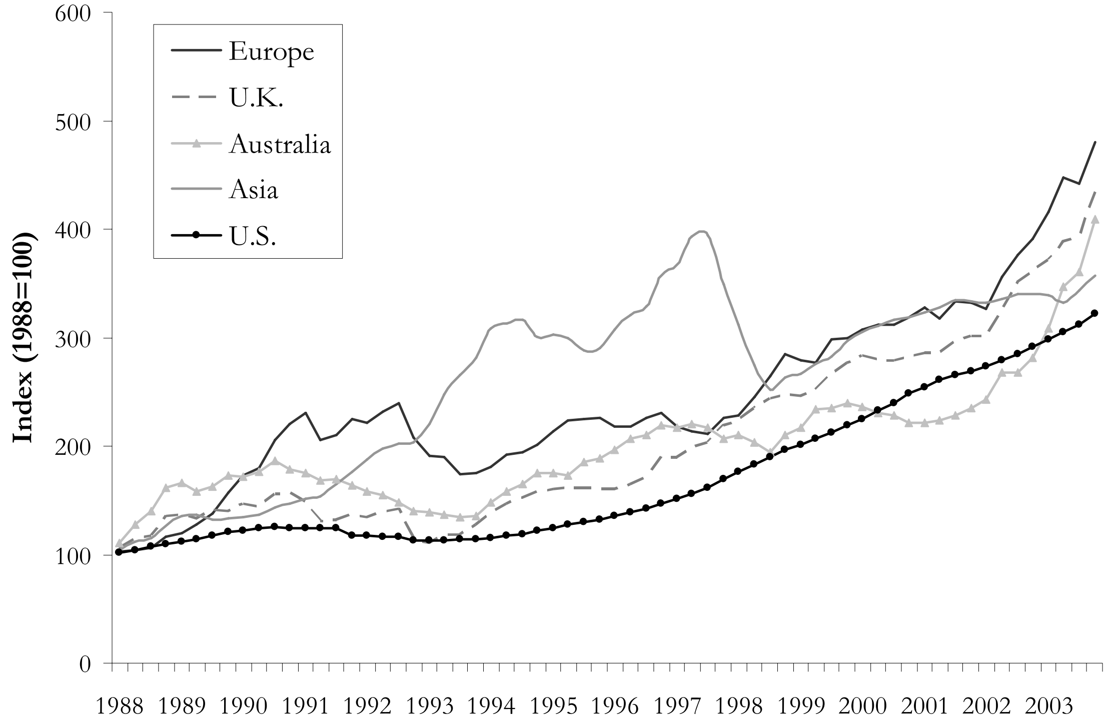


Notes. This figure shows the relative weight of regions in the dataset between 1Q1988–4Q2003. The weight depends on the number of cities and the market value in US dollars.



Notes. This figure shows the relative weight of property types in the dataset between 1Q1988–4Q2003. The weight depends on the number of cities and the market value in US dollars.

Appendix 5.D The market weighted total return index in U.S. dollars



Notes. This figures shows the market weighted total return series in US dollars calculated from Jones Lang LaSalle rent and capital value data for Asia and Continental Europe. For Australia, 5 cities are included with market weighted total return series calculated by PCA. The U.K. consists of IPD total return data for 7 cities. A composite of NCREIF total return for the 20 selected markets by property type is used to calculate the return for the United States. The average total return in US dollars for the region is the market weighted average total return by city/MSA and available property type. 1988 is our base year. The values of the indices are set equal to 100 in the base year.

Chapter 6

OVERALL CONCLUDING REMARKS

6.1 Conclusions

The global real estate market is a substantial part of the investable universe for institutional investors. High performance of real estate relative to bonds and equities over recent years has resulted in rapid inflows of money into real estate looking for opportunities. With limits to the size of domestic markets, investors started looking at other markets, creating rapid growth of international or cross border investment in commercial real estate. This increase in investment includes direct foreign investment in direct property markets, and indirect investment in non-listed and listed investment vehicles such as property shares and funds-of-funds.

Cross-border investment in commercial real estate is motivated by different reasons. Besides the limited investment size of a single market, one of the most important, if not the most important reason, is to enhance returns and achieve a superior performance relative to investing in domestic real estate alone. Another important reason is that investing in international real estate will provide risk diversification opportunities. There are, as shown in this dissertation, diversification gains to be achieved by including international real estate in an investment portfolio. The low correlation between returns in different regions around the world offers a very good opportunity to reduce the systematic risk of an individual country or region, and thereby enhance the risk-adjusted return.

The theoretical advantages of investing internationally must be set against the difficulties in creating and executing a global direct real estate investment strategy. The first difficulty is finding good quality information to compare drivers and returns for different real estate markets around the world with each other to make an international investment allocation possible. As a result of increasing interest in international investment into real estate, information providers began collecting data for various markets around the world. This newly available information makes it possible to test different hypotheses for international real estate markets, where previously it was only possible for a few, relatively transparent, markets. With these new data, we have analyzed the central theme in this dissertation: performance and performance drivers in global property markets. We have discussed this by looking at the determinants, risk premium, inflation hedge, and diversification of international direct real estate investment, all necessary to create a global investment strategy.

In Chapter 2, we looked at the global determinants of office returns and found that change in GDP/GMP and change in inflation positively affect changes in real estate prices. Real estate prices are negatively influenced by changes in unemployment and vacancy rates. Only change in the stock variable seems to have no significant effect on real estate prices. Rents are positively affected by changes in GDP/GMP in a univariate context. Determinants that have a negative influence on change in rent level are change in stock, vacancy rate and unemployment. Change in inflation seems to have no direct influence on rents. Vacancy rate change and change in unemployment have the most influence on change in the value of office buildings. The change in the value of an office building is, however, strongly related to change in value in the previous period. Rent changes are also strongly related to rent changes in previous quarters. Overall we can conclude from this chapter that change in vacancy rate and change in unemployment rate are the most important indicators to include in a long term return analysis on a multinational level.

Chapter 3 determines ex-post and ex-ante real estate risk premiums for 60 major office districts around the world. Asia/Pacific, Beijing and Shanghai have a relatively high risk premium. Tokyo, Jakarta, and Singapore are at the lower end of the risk premium range. In Europe, the Central European cities of Prague and Budapest appear to have a higher risk premium. Estimated risk premiums for cities in the U.S. show relatively small differences. Looking at regional differences, we can conclude that Europe has the lowest risk premium, followed by Australia. The relatively high risk premium for the U.S. is mainly the result of a declining yield on the long term government bond in the U.S. On a global level, we find a risk premium of 3.8% for Gordon's growth and two-stage growth model for the equally weighted aggregation. The stock weighted aggregation has an average value of 2.7% and 2.8% for the two models. The periodic growth model shows slightly lower risk premiums of 3.3% and 2.4% for the equally and stock weighted models. We find convergence between risk premiums across continents both over time and in cross-sectional variance. However, this is happening slowly, thereby making differences in risk premiums very important in making a global direct real estate investment allocation. We find that increased volatility of real estate yields and rents leads to an increase in the real estate risk premium. Volatility of interest rates and the global equity market are negatively related to real estate risk premiums.

Chapter 4 examines the hedge potential of direct office real estate returns for expected and unexpected inflation. We find that direct office real estate change in rent, change in capital value and total return in most countries have a positive relationship with expected and unexpected inflation. The results also indicate that direct office real estate is a better hedge against unexpected inflation than against expected inflation. This also holds when we correct for market fundamentals. Our test on the influence of rent contract characteristics on the inflation hedge potential shows that there are differences between rent review groups, where changes in rent, for rent contracts with graduated rent increases, move with expected and unexpected inflation. Change in capital value and total return for rent contracts with revaluated rent increases and indexed rent contract move with expected and unexpected inflation. Rent contracts with flat rents seem to move with unexpected inflation, adjusting to the market rent at the end of the contract. However, the differences are not significant, except that the unexpected inflation in the graduated rent contract moves significantly differently from the average for change in capital value and total return. Furthermore, the lease length seems to have a positive influence on the hedge capability, because the coefficients of the longer lease contracts are more positive. Overall, we can conclude that direct office real estate is a good inflation hedge in many of the tested countries and that it is a better hedge against unexpected inflation. Another very important conclusion from this chapter is that change in rent keeps up with inflation in almost all countries. This supports our assumption in Chapter 3, that the growth rate in the growth models is equal to inflation.

The results in Chapter 5 indicate that regional effects have a stronger influence on the variation of an international portfolio. This implies that investing in multiple regions will lead to the largest risk reduction, where Asia has the highest diversification potential. However, the property type effects are more stable through time and are becoming more important in the more recent years, especially when the returns are expressed in local currency. With respect to the 'pure' factor for the region, we conclude that over the time period 1Q1988–4Q2003 Asia, Australia, Continental Europe, and the U.K. outperform based on the same property type allocation as the global index. For the property type 'pure' factor we conclude that during the selected time period industrial, residential, and retail outperform given the regional allocation of the global index. The regional outperformance in particular depends on the selected time period and the impact of the Asian crisis.

6.2 Practical implications

The practical implications of the research in this dissertation are mainly applicable to analyzing international real estate opportunities at a global level and can be used as input for the asset allocation process of a direct real estate investor. To start the international investment process, there is an obvious need for a reliable and truly international dataset for the direct real estate investment industry as it continues toward market globalization. One of the many changes taking place in the real estate investment industry is an increasing need for local research in a global context. Another change is the first truly global mandates for direct real estate investment. This dissertation analyzes the data necessary for an international investment strategy.

Furthermore, the chapters in this dissertation relate to several steps of a global investment strategy for direct real estate.

Figure 6.1 Portfolio construction process

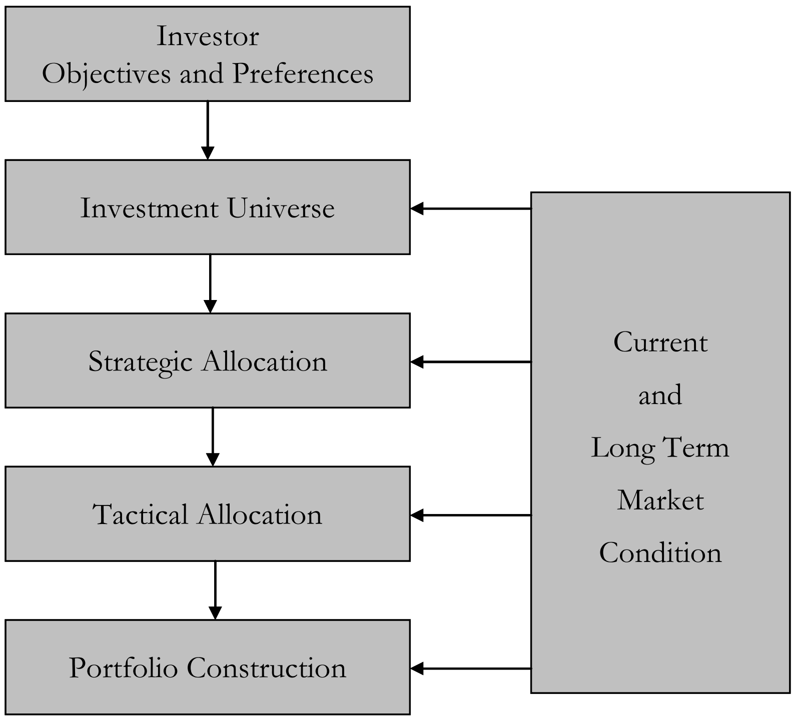


Figure 6.1 shows the portfolio construction process of a global investment strategy as described by De Wit (2006). In order to show the link with the various chapters in this dissertation we first would like to review the steps that the investor needs to consider in formulating the strategy.

- *Investor objectives and preferences*. Identifying the appropriate strategic decision is crucial in meeting long-term investment performance goals. Portfolio strategy results from a set of decisions on how best to achieve the goals set out by the investor. The main principle of strategic asset allocation is to achieve the benefits of diversification and the advantages that derive from the dissimilarity in returns across different geographic areas and property types. The primary goal of a strategic allocation is to generate the highest possible return by reducing portfolio volatility.

- *Investment universe*. The size of the institutional-grade investment universe identifies where institutional real estate exists and where the investor can invest based on the preferences in step one. There is no definitive and universally accepted size of the global real estate market. Generally, the investment universe can be broken down into a geographical allocation and a property type allocation.
- *Strategic allocation*. Analysis of long-term economic, demographic and real estate trends to determine the expectations that shape a strategic allocation. This is done by analyzing economic growth of a country or region. This helps to estimate the long-term potential rate and pattern of expansion. Economic growth when viewed alongside demographic patterns can determine potential demand for real estate. In addition, real estate market relationships are analyzed. The degree of correlation between regional returns will determine the diversification potential, where the lower the correlation levels, the greater the diversification benefits for a global investor.
- *Tactical allocation*. The tactical allocation starts with an analysis of current market expectations. These expectations are used to make 'tactical' tilts in a portfolio. Tactical tilts aim to add incremental returns without significantly altering the risk profile. The goal of a tactical allocation is to take advantage of cyclical changes in the real estate environment in order to generate additional incremental returns.
- *Portfolio construction*. The final step in the portfolio construction process is implementing the allocations based on selection criteria and product availability.

Strategy development starts with a clear understanding of the *investor's objectives and preferences* and is tailored to meet client investment targets. If the aim of the investor were to protect the real purchasing power of the investment, Chapter 4 demonstrates that office real estate is a good inflation hedge in many countries and that it is a better hedge against unexpected inflation than expected inflation. The next step is to determine the institutional-grade *investment universe*, where information from Chapter 5 can help to determine the investment universe and property type allocation. The relative weights of the different regions and property types in the database can be used as neutral positions, which can be adjusted according to the geographical and property type preferences of the investors. For the *strategic allocation*, information from Chapter 2 can be used to understand the economic, financial, and real estate drivers across the world that will impact the real estate returns. More specifically, the second chapter looks at the drivers for direct real estate returns and demonstrates that employment and vacancy rate are the most important drivers for returns. In creating an investment strategy analysis of the drivers is crucial as is making a forward projection of these drivers. This implies that focusing on understanding and forecasting employment and vacancy rates for various countries and markets will enhance the confidence of the investment decision. The risk premium is also very important for long term return expectations in the strategic allocation model. An estimate of the premium is also vital in order to project future investment returns, calculate the cost of capital, value real estate, appraise investment projects, and determine a fair rate of return. All these applications need an estimate of the ex-ante risk premium, whereas the only risk premium we can measure is the ex-post risk premium. For an investment strategy it is crucial to estimate the ex-ante return in order to determine whether an investment will fit into the fund or investment profile and return objectives. Furthermore, for an international investment strategy, understanding the risk premium will facilitate looking at returns on a relative basis, making returns for different countries more comparable and thereby identifying opportunities.

Information presented in Chapter 4 can be of additional value in the portfolio construction process. For example, the results demonstrate that contract characteristics have less influence on the inflation hedge capability of a real estate asset. This information should make the investor more aware of the influence of changing real estate market fundamentals on the inflation hedge capability of the real estate asset, especially for shorter lease contracts. Furthermore, since our findings support the view that office real estate is a good inflation hedge and since rent seems to be the best hedge against inflation, the rent component can be used to create inflation-linked products.

Chapter 5 in particular contains much information that can be used during the portfolio construction process. In this chapter we create benchmarks for assessing the risk and return from international diversification by constructing a five-region, 16-year global index for direct real estate. We find that investors in most regions would have been better off investing across regions rather than restricting their portfolio to domestic investment alone. International diversification reduces risk because different regions are less than perfectly correlated. The research in Chapter 5 also indicates that international real estate investment has better diversification benefits than investing in different property types, which suggests that there is an increasing need for international investment and therefore international capital flow between regions. A very interesting result in this chapter is also the 'pure' returns, which disentangle the indices returns into a 'pure' region and 'pure' property type return. The 'pure' region returns only include the return of the region and make it possible for the first time to compare the performance of different regions to one another, adjusted for the difference in property type allocation.

6.3 Future research

As described in Brown and Matysiak (2000), there has been increasing interest in recent years in studies of international property investment. A number of studies have been undertaken to investigate the effect of constructing international property portfolios. The rationale for doing this is not only to gain some international property exposure and increase the return but also to achieve more effective reduction in risk. Research in this area has followed on from similar research in the equity market. In this dissertation, we have selected four topics that are currently unresolved due to availably and quality of data restraints. However, these topics are part of a long list of topics that deal with the challenges of creating an international investment strategy for direct real estate. Solnik (1996) describes five major challenges when creating an international investment strategy:

- *Familiarity* An investor may not know or fully understand the trading practices or actors involved in an overseas market and may have difficulty in obtaining and assessing information on market opportunities and market performance
- *Regulations* There may be restrictions or prohibitions on foreign ownership, constraints on the repatriation of capital and profits and a restrictive regulatory framework
- *Market efficiency* Smaller markets may exhibit liquidity problems, there may be pricing inefficiencies or manipulation and obstacles to capital flows. These may not be reflected into return data.
- *Risk perception* Investment may be discouraged by concerns over political and currency stability—particularly in the light of uncertainties concerning performance, correlation structures and hence the gains possible for diversification.
- *Cost structures* International property may generate higher costs in terms of information gathering and monitoring, management fees and currency transmission costs. These costs are compounded by difficulties regarding transaction costs that may not be fully reflected in the available performance statistics.

These five challenges have been hindering large-scale international investment in direct real estate. However, we have seen a change in recent years.[37]

With respect to the *familiarity*, we try to use newly available information to gain better insights into the differences between markets in order to asses performance

[37] as shown in figure 1.2 and 1.3

and find opportunities. However, using the direct real estate data in a global perspective resulted in a number of challenges. Current time series are relatively short, but as time passes more data will become available, making it possible to test assumptions and perform additional tests on the topics discussed in this dissertation. Also as the direct real estate data series become longer and available in a higher frequency, issues of timing and allocation can be studied further. This will permit enhancement of knowledge about tactical investment in direct real estate.

Regulations appear to be becoming more favorable to international investors, especially between the countries in the European Union, making international investment more attractive. It would be interesting to look at institutional and regulatory differences between countries and the impact on direct real estate returns. Related to this would be an assessment of the impact of regulatory restrictions on foreign property ownership, and changes in these restrictions, on direct real estate returns. Furthermore, the impact of international capital flows on real estate returns has not yet been well documented, because of the lack of longer time series for international capital flow data. However, in the future this might be an interesting topic, since it could have a substantial influence on direct real estate returns.

Market efficiency may improve as more money is allocated to real estate and as the industry becomes more professional. However, larger investment size may also lead to a focus on larger markets and create a strategy that excludes smaller markets. Low market capitalization in relation to fund size may restrict market access. The total value of investment-quality property in smaller cities or an emerging market may be too small relative to the target allocation. It would be interesting if this focus on larger markets also leads to a better performance and whether smaller markets may be attractive in a global portfolio to reduce the risk as they are not integrated into the global financial system.

Risk perception can be better analyzed with longer time series. Further study can be done on timing, in combination with changing diversification benefits. Timing is also very important for the influence of currency fluctuation on the return of a direct real estate portfolio. Studying the impact of currency fluctuations would make it possible to determine an optimal currency hedge strategy for an international direct real estate portfolio. Avoiding political instability is a particular form of risk avoidance. Such considerations have an effect on investment strategies and influence the portfolio construction. More research into political risk and its influence on the required return might be possible. It could further enhance insights into the components for the risk premium for a country or market. With respect to diversification, it is assumed that the correlations change through time. As office markets in the major cities around the world are driven largely by international financial services, demand and economic activity in these cities is likely to be increasingly coordinated, the international correlation between these markets may go up and the potential for diversification benefits decrease. Furthermore, the idea of convergence of financial services has generated a changing relationship in response to rapid transitions of shocks to in the global equity markets. This could demonstrate that seemingly diversified portfolios will prove to be undiversified in the future because assets will move uniformly rather than independently in response to a shock.

With respect to *cost structures* Ball et al. (1998) show that these difficulties are largely related to information costs and apply to all investment in commercial property. This is even enhanced by property's specific characteristics and the institutional structure of the market. Some of them may be overcome through joint ventures with local partners. Additional research could be done on the success and performance of international joint venture partnerships and whether these international joint ventures outperform and expand faster than local companies due to better access to international capital markets.

Understanding these topics will add to a existing body of literature and will help investment managers in creating an international direct real estate strategy.

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NEDERLANDSE SAMENVATTING / DUTCH SUMMARY

Eigendom van international vastgoed door ondernemingen is niet nieuw. Het vond al plaats in de zestiende eeuw toen Nederlandse organisaties handelsposten stichtten op strategisch belangrijke plaatsen. Een van de belangrijkste handelsposten van de West-Indische Compagnie (WIC) was New Amsterdam, het latere New York. Dit is ook de stad waar ik het grootste deel van dit proefschrift heb geschreven.

Hoofdstuk 1 geeft aan dat vastgoed een belangrijke beleggingscategorie is naast aandelen en obligaties. Momenteel wordt de totale omvang van de institutionele vastgoedmarkt door DTZ research (2006) geschat op US$ 8 triljard (US$ 3.1 triljard in Europa, US$1.6 triljard in Azië en Australië en US$ 3.3 triljard in de Verenigde Staten), dit is ongeveer 30% van de totale marktkapitalisatie van de aandelenmarkt. Het grootste deel van de investeringen in vastgoed wordt echter in eigen land belegd en maar een beperkt deel wordt internationaal belegd. Internationaal eigendom van vastgoed is vanuit een beleggingsperspectief minder populair omdat: sommige overheden restricties stellen op het bezit van vastgoed door buitenlandse bedrijven, de kosten van informatie hoger zijn dan voor beleggen in het eigen land en er zijn taal, cultuur en wettelijke verschillen die internationaal beleggen in vastgoed gecompliceerd maken. Tegenover deze nadelen staan ook voordelen, waarbij de belangrijkste rendement en risicospreiding zijn. Beleggen in buitenlands vastgoed kan meer rendement opleveren. Verder levert het beleggen in het buitenland risico spreiding op omdat de vastgoedmarkten in diverse landen niet synchroon met elkaar bewegen.

Als gevolg van het onderkennen van deze voordelen heeft de afgelopen jaren een toename plaatsgevonden van het internationale beleggen in vastgoed. Deze trend wordt verder versterkt door betere informatie, een algemene toename van het belegd vermogen in vastgoed en toegenomen globalisering van bedrijven.

Het doel van dit proefschrift is het rendement van direct internationaal vastgoed te analyseren en te verklaren op basis van de bepalende factoren voor het rendement en risico van vastgoed. Deze analyses zijn pas recentelijk mogelijk door nieuwe databronnen te combineren met econometrische methoden die tot nu toe weinig in vastgoedonderzoek zijn toegepast. De gekozen data en methoden maken het mogelijk om een eerste aanzet te geven tot het verkrijgen van inzicht in fundamentele vragen voor het beleggen in internationaal vastgoed.

In hoofdstuk 2 wordt een analyse gepresenteerd van bepalende factoren van vastgoed rendement. De meeste onderzoeken tot nu toe richtten zich op de analyse van een land of een vastgoed type (industrieel, kantoren, winkels en woningen). Daarbij wordt in de literatuur een onderscheid gemaakt tussen de studies waarbij de huren worden verklaard vanuit een vraag en aanbod model en waarbij de huurverschillen worden verklaard op basis van een gewijzigde economische situatie als gevolg van veranderingen in de wetgeving of andere marktinefficienties. In dit hoofdstuk bekijken we de effecten van economische groei en vastgoed variabelen op verandering in de huurprijzen, waardegroei, als ook het totaal rendement. Daarvoor onderzoeken we de invloed van een verandering in de voorraad kantoorgebouwen door nieuwbouw op de rendementen van vastgoed. We kijken verder naar de invloed van verandering in economische groei, werkloosheid, en inflatie op huurprijzen, waardegroei, en het totaal rendement. Tevens analyseren we de invloed van een verandering in het rendement in de vorige periode op het rendement in de daaropvolgende periode.

We kunnen concluderen dat een stijging van de voorraad kantoren en een stijging van de leegstand een significant negatief effect hebben op de huurprijs, waardoor deze zal dalen. Dit geldt ook voor een stijging van de werkloosheid. Verandering in de leegstand heeft een significante invloed op de waardegroei en het totaal rendement op vastgoed. Economische groei heeft een positief effect op het totaal rendement. Een stijging van het inflatieniveau heeft ook een stijging van het totaal rendement tot gevolg. Verder onderzoek naar de relatie tussen inflatie en vastgoed rendement wordt beschreven in hoofdstuk 4. De huurgroei en waardestijging vertonen persistentie door de tijd wat kan duiden op een vertraging in de prijsverandering. Op basis van hoofdstuk 2 kunnen we concluderen dat, de internationale analyse van de verandering in leegstand en werkloosheid de belangrijkste factoren zijn voor het lange termijn rendement van vastgoed.

In hoofdstuk 3 onderzoeken we de determinanten van de risicopremie voor direct vastgoed. Deze is gedefinieerd als de compensatie voor het risico boven het risicovrije alternatief. De risicopremie op vastgoed bepaalt het rendement en is daardoor een van de belangrijkste factoren bij het bepalen van een investeringsstrategie. Over de hoogte van de risicopremie voor vastgoed bestaat echter nog veel onduidelijkheid, vooral als het gaat om de verschillen door de tijd en tussen continenten. Hoofdstuk 3 maakt een analyse van de risicopremies van de 60 belangrijkste kantorendistricten in Australië, Azië, Europa en de Verenigde Staten, waarbij zowel de ex-ante als ex-post risicopremie wordt geschat en geanalyseerd. De ex-ante risico premie wordt geschat door middel van drie modellen voor de waardering van vastgoed: "Gordon's growth" model, het "two-stage growth" model, en het "periodic growth" model. Verder onderzoeken we ook of de risicopremies veranderen door de tijd en of er convergentie plaatsvindt tussen de risicopremies van de diverse continenten. Voor de veranderingen in geschatte risicopremies onderzoeken we de relatie met de volatiliteit van zowel vastgoed rendementen, aandelen, obligaties en economische indicatoren.

De resultaten laten zien dat de risicopremies voor de kantoorgebieden in de geselecteerde steden verschillen. Voor Australië en Azië vinden we dat Beijing en

Sjanghai een hoge risicopremie hebben en Tokio, Jakarta, en Singapore een lage risicopremie. In Europa hebben vooral de vastgoedmarkten in Centraal Europa hogere risicopremies. De resultaten voor de Verenigde Staten laten zien dat de risicopremies tussen de kantoorgebieden in de diverse steden relatief geen grote verschillen met elkaar vertonen. De gemiddelde risicopremie voor het investeren in de kantoorvastgoedmarkt in de Verenigde Staten ligt hoger dan de ex-ante risicopremie in andere continenten. Dit wordt onder andere veroorzaakt door de lage inflatie in de periode tussen het eerste kwartaal van 1988 en het vierde kwartaal van 2004, maar ook door de dalende langetermijnrente (risicovrije voet) in diezelfde periode. De gemiddeld geschatte risicopremie voor kantoor vastgoed op basis van alle steden in de database is 3,8% voor zowel "Gordon's growth" model als het "two-stage growth" model. Wegen we de steden op basis van de omvang van de hoeveelheid kantoorruimte dan worden de risicopremies 2,7% en 2,8%, respectievelijk. De geschatte risicopremie op basis van het "periodic growth" model is lager, met 3,3% voor het ongewogen en 2,4% voor het gewogen gemiddelde. De lagere waarde van de gewogen gemiddelde risicopremie ten opzichte van de ongewogen gemiddelde risicopremie kan erop duiden dat kantoor vastgoed in grotere steden een lagere risicopremie heeft. Verder vertonen de wereldwijde ex-post en ex-ante risicopremies gemeten over de gehele periode een vergelijkbare trend, maar de ex-post risicopremie is meer volatiel. De data geeft empirisch bewijs dat er convergentie plaatsvindt tussen de geschatte risicopremies van de continenten. Dit gebeurt echter langzaam waardoor de verschillen tussen continenten toch nog erg belangrijk blijven bij het bepalen van een wereldwijde direct vastgoed allocatie. Op basis van het onderzoek naar de invloed van risicofactoren op de risicopremie kunnen we concluderen dat een toename in de volatiliteit van de huren en vastgoed yields beide de risicopremie laten stijgen. Veranderingen in de volatiliteit van de wereldwijde aandelenindex en de obligatie markt hebben een tegengesteld effect op de risicopremie van vastgoed.

In hoofdstuk 4 onderzoeken we de inflatie hedge potentie van vastgoed. In de praktijk wordt vastgoed als een hedge tegen inflatie gezien omdat veel huurcontracten jaarlijks worden aangepast aan de hand van de hoogte van inflatie in het afgelopen jaar. Wij toetsen deze visie empirisch. De gedachte is dat de inkomsten uit verhuurd vastgoed worden gecorrigeerd voor inflatie. De waarde van het vastgoed zal hierdoor ook stijgen met het inflatiepercentage, als daarbij wordt verondersteld dat de waarde van het vastgoed een verdisconteerde waarde is van de onderliggende huurinkomsten. Echter, huurcontracten voor de verhuur van kantoorpanden verschillen wereldwijd. In Azië hebben contracten over het algemeen geen link met inflatie en zijn de huurcontracten korter. Tijdens deze huurperiode staat de huur vast. Andere contracten hebben een gedeeltelijke compensatie voor inflatie. Geltner en Miller (2001) onderscheiden vier methoden van huurcompensatie: "flat rent" waarbij geen huurcompensatie plaatsvindt en de inflatie hedge het gevolg kan zijn van veranderingen in de markthuur; "graduated rent" waarbij het bedrag of percentage van huurverhoging en het tijdstip van de verhoging vooraf wordt vastgesteld bij het opmaken van het huurcontract; "revaluated rent" waarbij een taxateur de toename van de huur bepaalt op van te voren afgesproken tijdstippen (bijvoorbeeld jaarlijks) tijdens de looptijd van het huurcontract; "indexed rent" waarbij de huurverhoging zal plaatsvinden op basis van een index, de inflatie (consumenten prijs index) is een van de meest gebruikte indexen. De onderzoeksvraag in dit hoofdstuk is of de verschillen tussen de vier methoden van huurcompensatie ook gevolgen hebben op de inflatie hedge potentie van het vastgoed rendement. We analyseren de vier methoden door te kijken naar het verband tussen de huurverandering, waardeverandering, en totaal rendement enerzijds en de verwachte en onverwachte inflatie anderzijds. Verder onderzoeken we ook of de lengte van de huurcontracten invloed heeft op het hedge potentieel van kantoorvastgoed.

De resultaten laten zien dat kantoorvastgoed in de meeste landen een positieve relatie heeft met zowel verwachte als onverwachte inflatie. Deze relatie houdt ook stand bij veranderende omstandigheden op de vastgoed verhuurmarkt (gemeten door verandering in leegstand). We hebben de relatie tussen huurverhogingsmethode en inflatie hedge potentieel getest. Hieruit blijkt dat contracten met "graduated rent" bewegen met zowel verwachte als onverwachte inflatie. Voor waardegroei en totaal rendement zijn contracten met "revaluated rent" en "indexed rent" het meeste gerelateerd met zowel verwachte als onverwachte inflatie. Er is geen significant verschil tussen coëfficiënten van de vier huurcontracten en de coëfficiënt van alle huurcontracten samen; met uitzondering van de relatie tussen "graduated rent" en waardegroei en totaal rendement met onverwachte inflatie. Langere huurcontracten lijken een toename van inflatie hedge potentie tot gevolg te hebben. Verder kunnen we uit dit hoofdstuk concluderen dat direct kantoorvastgoed in het grootste gedeelte van de onderzochte landen een betere hedge is tegen onverwachte inflatie dan verwachte inflatie.

In hoofdstuk 5 analyseren we de opbouw van het rendement op internationaal direct vastgoed en onderzoeken we welk deel van het rendement is toe te wijzen aan geografische selectie (Australië, Azië, Continentaal Europa, het Verenigd Koninkrijk, en de Verenigde Staten) en welk deel afhankelijk is van het vastgoed type (industrieel, kantoren, winkels en woningen). Uit literatuur over beursgenoteerde vastgoedaandelen blijken deze twee factoren belangrijk te zijn voor de diversificatie van het risico en daarom ook van groot belang bij het bepalen van een internationale vastgoed strategie. Wij willen onderzoeken welk van deze twee factoren (geografische spreiding of vastgoed type selectie) het belangrijkste is voor de bepaling van het rendement en de volatiliteit van het rendement op vastgoed. Verder bekijken we of deze relatie constant is door de tijd en of er een verandering plaatsvindt in het belang van de twee factoren over de periode van het onderzoek.

Hiervoor gebruiken we een cross-sectie analyse methode, die een "pure effect" laat zien en bepaalt welk deel van het rendement afkomstig is van regio selectie en welk van vastgoed type selectie. We bekijken zowel de rendementen behaald in locale valuta alsook de rendementen omgerekend in US dollars en gewogen voor omvang van het vastgoed in steden alsook ongewogen. De datareeks loopt over de periode van het eerste kwartaal in 1988 tot en met het vierde kwartaal in 2003.

De resultaten laten zien dat regionale selectie een grotere invloed heeft op de volatiliteit van het rendement op direct vastgoed dan vastgoed type selectie. Echter het vastgoed type effect is stabieler door de tijd en wordt vooral in de meer recentere jaren belangrijker. Deze resultaten zijn consistent met de gevonden resultaten voor beursgenoteerde vastgoedaandelen (zie Hamelink en Hoesli, 2004) en vertonen sterke overeenkomsten met de resultaten van soortgelijke studies naar aandelen, waar de regio selectie minder belangrijk wordt en de industrie selectie belangrijker wordt (zie Van Dijk en Keijzer, 2004). De "pure effect" analyse laat zien dat Azië, Australië, Continentaal Europa, en het Verenigd Koninkrijk over de tijdsperiode van het eerste kwartaal in 1988 tot en met het vierde kwartaal in 2003 beter presteren dan het gemiddelde wereldwijde rendement. Voor dezelfde periode geldt dat industrieel, woningen en winkels beter presteren dan het gemiddelde wereldwijde rendement.

CURRICULUM VITAE

Ivo de Wit was born on August 17th 1970 in Sittard, the Netherlands. He graduated in 1997 from Maastricht University, where he studied Business Economics at the Faculty of Economics and Business Administration. After having worked at Maastricht University for both the Finance and Accounting Department for one year he was appointed as Product Developer at ING Real Estate International in The Hague. In this post, he worked on market research for real estate investment and development projects in Portugal, Spain, and the U.K. Furthermore, he was involved in creating a global direct real estate asset allocation model used to draw up global investment strategies. Working on this model motivated him to start writing his Ph.D. dissertation about global direct real estate investment. In 2001 he transferred to New York where he became a Vice President and Head of U.S. Strategy for the ING Clarion Investment Research Group. His main responsibilities included creating direct real estate investment strategies and forecasting U.S. real estate market returns. From March 2006, Ivo de Wit has been a Senior Business Analyst at ING Real Estate Investment Management, focusing on new business opportunities, strategy, and the coordination of global initiatives.

Ivo de Wit is geboren op 17 Augustus 1970, te Sittard. In 1997 studeerde hij af in de richting bedrijfeconomie aan de Faculteit der Economische Wetenschappen en Bedrijfskunde van de Universiteit Maastricht. Na een jaar te hebben gewerkt aan de Universiteit Maastricht voor zowel de sectie Financiering als Accounting, startte hij in de functie van Product Ontwikkelaar bij ING Real Estate International in Den Haag. Daar werkte hij aan markt onderzoeken voor vastgoed investerings- en ontwikkelingsprojecten in Portugal, Spanje en het Verenigd Koninkrijk. Daarbij was hij betrokken bij het opzetten van een wereldwijd direct vastgoed asset allocatie model voor internationale investeringsstrategieën. Het werken aan dit model motiveerde hem om te starten aan het schrijven van zijn proefschrift over wereldwijd direct vastgoed beleggen. In 2001 verhuisde hij naar New York waar hij Vice President en Head of U.S. Strategy voor ING Clarion's research groep werd. Zijn belangrijkste verantwoordelijkheden waren het creëren van direct vastgoed beleggingsstrategieën en het voorspellen van rendementen voor direct vastgoed in de V.S. Sinds Maart 2006 is Ivo de Wit Senior Business Analyst voor ING Real Estate Investment Management met als focus het vinden van nieuwe business opportunities, strategie, en het coördineren van initiatieven wereldwijd.