Real Estate Portfolio Construction in the context of the Multi-Asset Portfolio

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Abstract

Several studies have analyzed the role of real estate in a multi asset portfolio, but little work has been done on how to formulate real estate strategies within the context of a multi asset portfolio. An unconstrained real estate strategy needs to take into account the impact of leverage as well as the impact of management fees. This paper explores how two different types of real estate assets, globally dependent office properties and locally dependent retail, residential and industrial can best be utilized over six investor domiciles, given different levels of leverage. The results from the analysis indicates that leverage does have an impact on how real estate contributes to the overall portfolio efficiency, and that different types of real estate can be used for different objectives. It can also be concluded that real estate strategies composed of real estate with locally dependent tenant demand are generally preferable for diversification purposes over real estate with globally dependent demand, although not for all investor domiciles.

Key words; Asset Allocation, Real Estate, Real Estate portfolio construction

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1. Introduction

Institutional investors have over the past decade increased their allocation to alternative investments, including real estate. This increased interest in alternative investments stems from a recognition that alternative investments can contribute to the efficiency of the overall portfolio through diversification, liability matching, inflation hedging and increased returns stemming from investing in inefficient and illiquid asset classes.

For real estate, this has resulted in a revived interest for the asset class at a time when the market has become more accessible and the universe expanded as more and more international markets have become accessible.

Academic studies have supported this development by pointing to both the potential contributions of real estate to the multi-asset portfolio as well as increasing the understanding of the characteristics of the real estate markets and of understanding the data available for the markets. Several earlier papers have established that real estate, including international real estate, is an asset class with potentially powerful diversification characteristics.

The institutional framework, in particular the real estate industry, has also developed by increasing the accessibility and understanding of real estate markets. These institutional innovations include increased data availability, international service providers and new entry points.

This confluence of developments has resulted in an investment environment where investors have the ability to tailor their real estate exposure to specific needs, such as liability matching, asset diversification, liquidity, return objectives etc. Few studies have however investigated what parts of the real estate universe best compliments the
overall portfolio. Also, to the best of the knowledge of the author, little work has been done on the impacts of leverage with regards to the role of real estate in the multi asset portfolio. Even though recent experience from the global financial crisis starting in 2008 have cast doubt upon the attractiveness of real estate as an asset class, as both the diversification and return contribution have been lacking, the results of the crisis should also make the results more robust.

This paper extends and deepens the analysis of the Hoesli et al. paper of 2004. The purpose is to investigate how the choice of leverage and real estate portfolio composition impacts the ability to achieve two sets of objectives, risk diversification objectives and return enhancement objectives, when management costs and leverage costs are taken into account, as well as reviewing the pre-crisis analysis with a longer set of data. The paper contributes to the body of knowledge by exploring how the effects the underlying tenant demand type and the inclusion of leverage impacts the portfolio composition problem for real estate investors.

The paper is organized as follows. The next section discusses the current status of the literature, followed by a description of the model used. In the fourth section, the data and parameter assumptions are presented, after which the analysis and results are presented. The paper is concluded with a summary and discussion of the results.

2. Literature review

Kennedy, Baum (2012) defines asset allocation as the process in which allocations between discernible and distinguishable asset classes that maximizes the probability of achieving the return objectives of the investor is determined. It is well understood that real estate, being a discernible and distinguishable asset class, could have a role to play in the asset allocation of institutional portfolios, but there are several views on what this role could be. In general there are four candidates for the role real estate can play, namely as a diversifying asset class, an asset class that can be used to match liabilities, an inflation hedge and lastly a return enhancing asset class.

The methodology for devising an asset allocation strategy varies between various investors, depending on their definition of the investment universe as well as the
objectives of the investor. Kennedy and Baum observe that different objectives and perceptions of risk lead to different results, and that real estate in this context, being a complex, unstandardized asset class, can be seen to fulfill different roles. From this follows that there are possibly multiple answers as to what role real estate, or any other asset class for that matter, should perform in the portfolio. It also follows that there is not one answer to how the allocation should be split between the various asset classes.

A reason for viewing real estate as fulfilling different roles depending upon the objective is due to the complexity of this relatively simple asset class. Ang (2009) explores the characteristics of real estate in the context of its real assets characteristics as well as real estate’s role in the asset allocation puzzle. He concludes that real estate is different from other asset classes due to a number of reasons, including the idiosyncratic risk, the heterogeneity of the assets, the fixed income characteristics caused if leverage is introduced, and the requirement of active management of any real estate holding. Ang also points to the difficulty of including real estate in any asset allocation model on par with stocks and bonds; direct real estate total returns are not returns in the same sense as total returns for the other asset classes, as real estate total returns are not transaction based nor is there a way to measure the whole market. This is not to say that real estate does not have a role to play, but rather that the only return derived from real estate measured on the same frequency as the return to mature asset classes is the income return.

Real estate suffers from being homogeneous enough to be easily defined as an asset class, and thus not necessarily requiring harmonization and standardization through securitization to be managed as an investment, but heterogeneous enough to generate significant spread of performance within sub-markets and thus introduce a significant specific, difficult to diversify, risk versus the benchmark used for calculating the asset allocation weighting. As Kennedy and Baum, as well as Ang observe, a further complicating factor is that only a fraction of the real estate universe is measured for performance in indices, and that a large part of institutional investment portfolios include assets that do not share the same characteristics as the the investments underlying the data for the asset allocation studies, such as transitional assets. This
benchmark mismatch could be problematic as the actual portfolios might deviate significantly from the assumptions made in the asset allocation decision.

Nevertheless, several studies have been performed on the role of real estate as a component of asset only portfolios, focusing in particular on the diversification benefits of real estate by including unleveraged real estate. Most of these studies conclude that the allocation to real estate should be in the range from 10 percent and upward. Using a transaction based real estate index for the U.S., and thus addressing the return measurement problem for real estate to a large degree, Fisher et al (2007) conclude that a 43 percent allocation to real estate is supported by the data.  Hoesli et al. (2004) analyzes the impact of an international real estate component in the multi-asset portfolio construction problem, taking into account both valuation smoothing and currency hedging. It is concluded that both domestic and international real estate contributes risk diversification, and therefore portfolio efficiency, to the multi-asset portfolio, and that the data supports an allocation to real estate between 15-25 percent, depending upon risk preferences and country of domicile of the investor.

Many of these studies do not cover the full period of the financial crisis following the sub-prime bubble in the U.S., but do cover the period running up to the crises. It would be expected that any study including the crises will produce a lower allocation to real estate, as the crisis caused correlations to increase broadly.

There are methodological difficulties with including private market data in an analysis framework that has been developed to analyze public market instruments. These issues pertain to liquidity, dependability of valuations, asymmetry in access to information, transaction costs, etc., i.e. market efficiency assumptions. Some of these issues have been addressed in the literature, such as valuation smoothing (Geltner, 1993) and and sample selection bias (Goetzmann and Peng, 2006), but several issues remain challenging due to the different nature of private markets as pointed out by Ang (2009), such as information asymmetries between sellers and buyers being an area that needs further research. All these aspects of private market returns lead to some of the underlying assumptions of mean variance analysis not being met, such as normally distributed returns, the assumption of equal access to information and sufficient liquidity to offer the ability to rebalance portfolios. Cheng et al (2011) point
out that the violation of the i.i.d assumption resulting from these imperfections makes any allocation study based on a one period holding framework faulty, and that a different framework is needed. Kennedy and Baum (2012) also recognize that the optimization framework is controversial, and despite several attempts to improve this analysis framework, exact conclusions from such analysis, in particular if the analysis includes private market investments, should be challenged. However, it is also pointed out that it is easy to criticize any approach to analyze the complex problem of asset allocation, but far more challenging to develop better methodology.

Gallo, Lockwood and Zhang (2013) use one such possible methodology. They use cointegration methodology on monthly data from 1992 to 2009 to form global listed real estate portfolios. They find that there is no cointegration between regions, but do find cointegration within regions, thus indicating that global portfolios can substantially improve the efficiency of the listed real estate portfolio. Unfortunately this is a data intensive approach of analysis and as yet not possible to apply to private real estate markets.

Other issues, discussed in Fisher, Gatzlaff, Geltner och Haurin (2003) and more recently by Goetzmann and Peng (2006) are the effect on index estimates of time varying liquidity and sample selection bias introduced by seller reservation prices, evident in both the commercial and the residential market. When taking into account the cost of liquidity by defining the market value as the mean of the buyer reservation price distribution, a different return pattern emerges, which has implications on the correlation characteristics of real estate, reducing its diversification potential. A similar bias impacts investment indices through the population of transactions available to the valuer to determine price evidence. Thus, there is a risk that the return indices measuring the performance of private real estate are based on market evidence that suffer from selection bias, thus skewing the characteristics of the private real estate returns.

Studies combining real estate with other asset classes generally come to the conclusion that the allocation to real estate should be significantly larger than the allocations seen in institutional investors’ portfolios (Hoesli et al, 2005), but smaller than the estimates of the relative capitalization of the investable real estate market as
compared to the market capitalization of other asset classes (Kennedy and Baum, 2013). There are several possible explanations for this, including that the asset class is too difficult to manage efficiently, both on the operational level as well as from an asset allocation perspective. Hoesli Liljeblom and Löflund (2012), analyzing the effect of lock up periods on REIT data, conclude that the illiquidity of real estate in fund structures reduces the weight in the optimal portfolio to between 9 and 13 percent, or about half of the allocation reached when not including the impact of lock up periods. Another reason could be that an investor holds real estate exposure through ownership of other companies, who hold real estate on the balance sheet. Thus, the actual allocation to real estate is higher than is measured by looking purely on the real estate portfolio.

Another possible explanation for the discrepancy between actual and theoretical allocations to real estate is that the traditional mean variance analysis does not factor in the liability aspects, a factor that most institutional investors need to contend with. Brounen et al (2010) analyse the effects of various liability regimes, and conclude that the impact of the liability constraint is to reduce the allocation to real estate. When accounting for liability obligations real estate offers some hedging benefits against inflation and interest rates but has a negative correlation with actuarial movements. The analysis indicate an allocation between 10 and 25 percent, depending on the level of risk tolerance.

Real estate is also often to be viewed as a real asset from an inflation hedging perspective, although there is little support in the data for real estate offering any short term inflation hedging characteristics. The IPF (2011) does not find a support for that real estate, neither domestic nor international, is a contemporaneous inflation hedge for a U.K. investor, and Ang (2009) conclude that real estate has some, but far from complete inflation hedging capabilities for the U.S.

Institutional investors, however, also hold other views on why to invest into alternative investments, including real estate. These views are best summarized by the Endowment Model pioneered by David Swensen of the Harvard Endowment (Swensen, 2000). In the Endowment model the attraction from real estate stems from the illiquidity premium and the inherent inefficiency of the asset class. This
viewpoint takes the very opposite view on real estate from the traditional approach to analyzing real estate in the context of the multi asset portfolio. Instead of trying to make real estate more comparable to the more efficient asset classes, the inefficiency in itself is a reason to invest in the asset class.

Real estate can be accessed through various routes, and each route has its specific characteristics. The first distinction is between public and private market access, where public market access through for instance REITs offers liquidity and information transparency but is also highly correlated to the wider equity market (Hoesli & Oikarinen, 2012). Hoesli and Oikarinen, however, conclude that REITs do behave as direct real estate in the long term. In Oikarinen et al (2011) it is concluded that the public market exposure to real estate leads the private markets, but that over the very long term the relationship between public and private market real estate is tight, and thus over long term holding periods private and public market investments offer similar diversification properties. A research report from Harvey and Cheigh (2013), go one step further and argue that with the exception of pure opportunistic real estate fund investments, REITs are superior to private market investments over all analyzed time periods for the U.S. market. However, as pointed out by Ang (2009) the REIT market only has a capitalization of less than a tenth of the private market, which can both limit the universe of investments as well as offering less market depth for large investors.

Within the private market, investors can invest into real estate either through direct investment, or indirect investments through partnership or fund structures. Andonov et al (2013) investigate the performance of institutional investors, and conclude that large institutional investors, who can internalize the management of the real estate portfolio, have a cost benefit over smaller institutional investors who need to utilize external managers. Investors who thus for one reason or another do not utilize internal resources are at a cost disadvantage to investors who do.

Most asset allocation models are based on market wide indices across all asset classes and sub-asset classes. Within real estate the sub-asset classes are normally defined as sectors, given by the tenant use of the assets, as well as by sub-markets, given by the geographical location of the asset. Jackson (2013) finds that the administrative
regions traditionally used do define the sub-markets are sub optimal, as the definitions are based on historical and governmental factors rather than market fundamentals. A more efficient way to devise a real estate strategy is to build the portfolio on the basis on the clustering derived from decernable market drivers. Lizieri (2009) notes that there is significant contagion between office markets in global financial centers. These markets tend to be subject to a number of common factors, such as a closely related development cycle, a strong commonality in investment activity and a commonality in tenant demand, leading to a close proximity in the return pattern.

3. Method and approach

Despite the many studies that have been done on real estate in a multi asset framework, very little research has been made on what sectors of the real estate market best fits into the overall portfolio objectives. The aim of this paper is to investigate from an asset allocation perspective the impacts of the property portfolio on the overall portfolio when various factors that affect the characteristics of the real estate portfolio are taken into account, such as type of underlying tenant demand, management fees and leverage. Put differently; how can a private market real estate portfolio be constructed to better support the objectives of the overall portfolio.

In the private markets, investors can invest either directly or through non-listed investment vehicles. When investing internationally, the investor is at an information disadvantage versus the domestic investors. The increased importance of non-listed real estate investment forms is a possible way to remedy this information asymmetry, as a fund manager is likely to be better positioned and resourced to handle investments in these markets. With the exception of very large institutional investors, the international investment universe is not accessible through direct, and unlevered, investments, but rather through various investment vehicles. This investment route, however, usually also entails the inclusion of leverage, which could change the characteristics of the asset class. Furthermore, a fund investment also incurs costs through fees, and although investing with internal resources in no way is to be considered costless, the fee’s incurs a higher cost for investment than in-house managed real estate investments.
The inclusion of leverage when analyzing the role of real estate in a portfolio is relevant for several reasons. Firstly, the inclusion of leverage puts real estate in par with equities and listed real estate, both of which include leverage through the balance sheet of the underlying companies. Secondly the vast majority of institutional investors typically only have a choice of the level of leverage when investing outside their home market, as unlevered investment opportunities are few and few institutional investors have the size or resources needed to invest directly internationally. Thirdly, debt financing works as a partial currency hedge when investing in real estate assets domiciled in a different currency area. Finally real estate, being a real asset, is usually more cost efficient to borrow against than financial instruments, as the collateral for the loans are physical assets with a contracted income stream.

The real estate universe is, however, composed of different types of assets, with different inherent characteristics. One important distinction is what drives the underlying tenant demand for the assets. Office assets are characterized by a tenant demand that is highly dependent on business activity, which in turn is both volatile and dependent upon global influences. Office assets therefore have a relatively high variability in the market rents, in particular in sub-markets where space demand is influenced by (global) financial markets. The other groups of assets, residential, retail and industrial has a tendency to be more dependent upon domestic consumer demand, thus being less sensitive to the global economic cycle and also being less volatile. It appears likely that this fundamental difference in the composition of demand could have an impact on how real estate strategies should be defined. Thus, offices are used as a proxy for globally demand driven real estate assets, denoted Globally Dependent below, and a capital weighted composite index consisting of residential, retail and industrial assets are used as proxies for locally, domestically demand driven real estate assets, denoted Locally Dependent below.

The deficiencies of real estate data are likely to be consistent across all real estate sub-sectors within a country. Thus, the analysis will focus on determining which type of real estate, globally dependent or locally dependent, that tends to be most important to consider within the real estate portfolio from a mean variance perspective. This assumption of cancellation of errors within the real estate universe should thus allow
for a determination of which segment of the real estate universe that has the potential to be most beneficial to the overall portfolio. The purpose is not to establish the absolute allocation to real estate, but rather to determine the relative importance of sub-sections of the real estate market.

The analysis has been made from on seven generic risk strategies, starting at the minimum variance portfolio and ending at the maximum return portfolio, and five equidistant risk strategies in between, i.e., at 10, 30, 50, 70 and 90 percent distance between the two corner solution portfolios, a similar approach as the approach used in Hoesli et. al, (2004).

In an analysis only considering real estate in an unlevered environment, real estate risk and return are typically somewhere between the risk and return of bonds and listed stocks. When leverage is included in the analysis for real estate, however, the risk and return characteristics of real estate can move outside this range, both with regard to risk as well as return, whilst the impact on correlation should be marginal, if any, as the leverage amplifies the distribution of returns, not the return pattern itself, unless there is an independent change to the access to, or pricing of, financing.

The analysis is done on an unhedged basis, i.e. all returns are impacted by currency movements over the time period 1987-2011, one years’ worth of observations lost in the desmoothing process. The rationale for performing the analysis on an unhedged basis is that the analysis is done over a long time period, and that the currency fluctuations over these long periods should be incorporated into defining the investment strategy. Furthermore, the currency exposure across all asset classes would be expected to cancel out over time, as the exposure is spread over multiple currencies. In practice, most institutions also handle their currency exposure as a separate asset class, why the hedging decision resides elsewhere with the investor, currencies being treated as a separate asset class.

The analysis is based on a mean variance optimization. Mean variance optimization including private market returns poses methodological problems that, to an extent can be accounted for, but not fully. At the same time the methodology give powerful insights into the interaction of markets in a wider portfolio perspective. As a
consequence, any asset allocation model output based on purely quantitative measures will have to be adjusted for the limitations of the model.

An obvious limitation with this approach is that the model will be based on core real estate, i.e. income producing assets, as measured by IPD, and not what Kennedy and Baum (2013) refer to as transitional real estate, i.e. real estate assets that have non-standard characteristics such as development risk, repositioning risk or releasing risk.
4. Data

The data used in this study consists of index series of annual returns for cash, equities, bonds and real estate for Australia, France, the Netherlands, Sweden, the U.K. and the U.S. In comparison to the Hoesli et al 2004 paper, the Swiss market has been excluded as the index only measures residential assets, thus not making it possible to discern separate sector strategies. The data sources are presented in table 3.1. below

Table 4.1. Data sources

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Source</th>
<th>Definition</th>
<th>Time Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>EcoWin</td>
<td>Short term interest rate</td>
<td>1986-2011</td>
</tr>
<tr>
<td>Bonds</td>
<td>EcoWin</td>
<td>Government Bonds</td>
<td>1986-2011</td>
</tr>
<tr>
<td>Equities</td>
<td>EcoWin</td>
<td>MSCI Total Return</td>
<td>1986-2011</td>
</tr>
<tr>
<td>Listed Real Estate/REITS</td>
<td>EcoWin</td>
<td>GPR Total Return</td>
<td>1986-2011</td>
</tr>
<tr>
<td>Real Estate</td>
<td>IPD</td>
<td>IPD</td>
<td>1986-2011</td>
</tr>
<tr>
<td>Financing Cost</td>
<td>EcoWin</td>
<td>Average Corporate Bond yield</td>
<td>1986-2011</td>
</tr>
</tbody>
</table>

When comparing real estate with other asset classes, there are some fundamental issues that need to be addressed. The returns calculated on stock- and bond investments are based on transactions made on more efficient markets, whilst the returns estimated for real estate are inferred from transaction on parts of the stock. Although there is an argument, in particular for large institutional investors, that as the transactions made on the financial markets are on the margin, and that the market depth for equities and bonds is not equally deep across individual stocks, the practical impacts of the difference in nature between the return series is in reality small, the difference in nature of the calculations of returns still needs to be addressed.

In this paper appraisal smoothing is corrected through an adjusted Geltner filter (1993) the impact of which is to amplify the return volatility of real estate and in the process reducing the autocorrelation of real estate. The filter used is presented in equation (1) below;

\[ r_i^{u} = \frac{(r_i^* - a^* r_{i-1}^*)}{(1-a)} \]
Where \( r_u \) is the unsmoothed change in value of the series at time \( t \), \( r^*_i \) is the measured, valuation based change in value in period \( t \) and \( a \) is the adjustment factor.

The methodology is fairly straight-forward but for determining the degree of adjustment. The real estate market is by nature an inefficient market, why taking away all the autocorrelation is at best arguable as the real estate market remains inefficient even when correcting for valuation smoothing. Thus, for this analysis, a degree of autocorrelation is allowed to remain in the real estate data. In this paper, the factor of adjustment has been determined with the presumption that the valuation process is the same across all sectors of the real estate markets on a national level, but that valuation practices vary between countries. This approach implicitly assumes that appraisers weighting between recent and historic information is constant over time and that the same weights are used in all market segments. A special assumption has been made for the Dutch retail segment that showed a substantially lower volatility when using the common national factor. Thus a specific alpha was used for this segment. The correction factors, alphas, used are presented in table 4.2. below.

### Table 4.2. Correction Factor (Alpha)

<table>
<thead>
<tr>
<th>Country</th>
<th>Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>0.3</td>
</tr>
<tr>
<td>France</td>
<td>0.35</td>
</tr>
<tr>
<td>Netherlands</td>
<td>0.4</td>
</tr>
<tr>
<td>Sweden</td>
<td>0.46</td>
</tr>
<tr>
<td>The U.K.</td>
<td>0.82</td>
</tr>
<tr>
<td>The U.S.</td>
<td>0.57</td>
</tr>
</tbody>
</table>

The correction factor used varies significantly between the various markets, from 0.82 in the U.K. to 0.3 in Australia. One interpretation of this is the efficiency of the valuation regime in each country, whereby the U.K. would have the most efficient valuation regime. Another interpretation is that the higher correction markets are more dependent upon income return, and that the variability in capital values is structurally lower. A balanced interpretation is that both of the interpretations are valid to varying degrees.
For the purpose of this paper, however, it is more important that there is a consistency between the markets, so that the assumption of market efficiency, as measured by the autocorrelation, is as similar as possible. The autocorrelation for the annual data underlying the analysis is presented in table 4.3 below.

Table 4.3. Auto Correlation

<table>
<thead>
<tr>
<th></th>
<th>All Real Estate Auto Correlation</th>
<th>Financial Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Index</td>
<td>Adjusted Series</td>
</tr>
<tr>
<td>Australia</td>
<td>0.66</td>
<td>0.33</td>
</tr>
<tr>
<td>France</td>
<td>0.72</td>
<td>0.37</td>
</tr>
<tr>
<td>Netherlands</td>
<td>0.55</td>
<td>-0.02</td>
</tr>
<tr>
<td>Sweden</td>
<td>0.70</td>
<td>0.42</td>
</tr>
<tr>
<td>The U.K.</td>
<td>0.43</td>
<td>0.35</td>
</tr>
<tr>
<td>The U.S.</td>
<td>0.45</td>
<td>0.17</td>
</tr>
</tbody>
</table>

The adjustment of the real estate series to compensate for valuation smoothing reduces the autocorrelation of the real estate data to about half, but the autocorrelation remains higher than for equities and bonds. This remaining positive autocorrelation for real estate stems from the asset class inherent inefficiency resulting from the information asymmetry between buyers and sellers as well as the long period needed for completing a transaction.

Another aspect of comparing real estate market data with financial data is that unlevered market indices are normally used, a type of investment that is not available to most investors. In order to make the analysis comparable with the actual investment universe, leverage is introduced for the real estate series. The leverage changes the risk and return characteristics of real estate, although the correlation characteristics largely remain unaffected. This paper takes this into account by evaluating different levels of leverage in the domestic and international investment universe. Levered series are calculated using formula (2), below.
\[
    r_t^F = \frac{(NOI_t^F - MF - CY + EQT_t^F)}{EQT_{t-1}^F}
\]

where, \( r \) is the return on leverage level type \( F \), \( NOI \) is the net operating income, \( MF \) is the management fee cost, \( EQT \) is the desmothed equity value for fund level \( F \), \( CY \) is cost of financing.

In order to take account of the cost of managing a portfolio, an estimate of the average management fee of global funds has been used. This estimate has been done from a database of unlisted real estate investments maintained by Aberdeen Asset Management, covering more than 2000 investments. The included management costs was estimated to be 0.5, 1.3 and 1.5 percent, for unlevered, lowly leveraged and higher levered respectively, calculated on the Net Asset Value.

When leverage is used for real estate investments, real estate is normally viewed as a less risky collateral than financing for corporate entities. However, corporate bonds yields are normally lower than the interest rate required for real estate financing, as the corporate bond market is liquid, the issuances larger, and corporate bonds are backed at least in part by hard assets. The interest rate cost used in the analysis is calculated as a fixed margin over the corporate bond yield of the market, as this allows for a dynamic evolution of the interest rate cost over time, driven by the bond markets general pricing of corporate debt. The same data base was used for establishing an estimated average margin of real estate debt over corporate debt as for the management fee. The levered real estate market series have been calculated using the corporate bond yield plus 100 bps for 20 percent leverage and 250 bps for 45 percent leverage.

It should be recognized that these estimates are static estimates, whilst in reality both the management cost and the cost of debt varies over the cycle.

For all the countries included in the analysis, two separate indices have been calculated; one domestic and one international, which includes all the other markets in
the study except the domestic market for the country in question. The indices have
been weighted using the capitalization of the markets.

As for the return estimate for the analysis, the historical time series encompass a time
during which the nature of the wider investment universe has changed. Inflation
regimes, ability to trade assets cross border, access to information etc. have all
changed. This in conjunction with estimation errors has a significant impact on
parameter estimation, in particular the expected return. In order to improve the out of
sample performance of the analysis, the expected return used in the calculations has
been calculated to reflect a higher degree of integration of markets. The expected
return for each national asset class has been calculated as the mean between the
domestic return to the asset class and the return to the global asset class over the
period 1987-2011. This procedure lessens the impact of the return parameter and
should make the results more robust.

The inclusion of real estate sub sectors allows for an analysis of which sub-sectors
best lend themselves to improve overall multi-asset portfolio efficiency. As discussed
above, it is expected that sub-sectors that are dependent on local return drivers, i.e.
where there is a degree of economic segmentation, are to be less correlated to other
asset classes than sub-sectors that have more global return drivers.

In this categorization, residential, industrial and retail investment properties are
assumed to be more dependent on domestic return drivers, and office properties are
expected to be more dependent on international return drivers. Also diversified real
estate is included in the analysis, defined as the market weighted, measured market in
each country. Diversified real estate is a proxy for a benchmark based portfolio
construction for each national market. The categories are summarized in the table
below

*Table 4.4. Real Estate market definitions*

<table>
<thead>
<tr>
<th></th>
<th>Domestic</th>
<th>International</th>
</tr>
</thead>
<tbody>
<tr>
<td>Globally Dependent</td>
<td>Domestic Office</td>
<td>Capitalization</td>
</tr>
<tr>
<td></td>
<td></td>
<td>weighted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Office return</td>
</tr>
<tr>
<td></td>
<td></td>
<td>outside the</td>
</tr>
<tr>
<td>Locally Dependent</td>
<td>Domestic Retail, Industrial and Residential, as applicable, Capitalization weighted</td>
<td>Retail, Industrial and Residential, as applicable, outside the home market, capitalization weighted</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>____________________________________________________________________________________</td>
</tr>
<tr>
<td>Diversified</td>
<td>Index Weighted Portfolio for the domestic market</td>
<td>Capitalization weighted Index portfolio outside the home market</td>
</tr>
</tbody>
</table>

An issue that is not corrected for is the heterogenous nature of real estate, and the impact of the managers’ ability to manage assets. These layers of heterogeneity and ensuing idiosyncratic risk means that the risk and return distribution within the index is likely to be wider than for the components of the index in the more mature asset classes. This effect cannot be fully captured in this paper, as the analysis is based on market level returns, adjusted for strategy defined factors.

International investments are in this paper defined as the limited investment universe of the countries included in the study, i.e. Australia, France, the Netherlands, Sweden, the United Kingdom and the United States. Thus, across all asset classes, the relative market weight for each market, excluding the domestic market, is used for calculating the international market return. This approach allows for comparing returns across the same investment universe across all asset classes, and thus also excludes the impact of emerging markets similarly across all asset classes. For this reason, these series are named “GX”, for Global Excluding the domestic market.

The risk and return characteristics, presented in Appendix 1, of the data set used falls within what would be expected. Unlevered real estate returns fall between the returns of Stocks and Bonds, as does the standard deviation. When leverage is introduced for real estate, both the risk and the return increase, but the return increases at a lower rate than does the risk, measured as the standard deviation.
The correlation matrices for the data are presented in full in Appendix 2. Overall, correlations between real estate and the other asset classes is close to zero, on average, with a general correlation to stock markets of between 0.1 and 0.5 and a negative correlation close to zero to bonds. The correlation between real estate stocks and real estate is slightly higher than for the correlation to the general stock market. The impact of the leverage does not impact correlations, as would be expected.

On average international real estate has a lower correlation to financial assets for all domiciles. As in other studies, the correlation for real estate to the other asset classes is the lowest for bonds, consistent with the conclusion that real estate can be an important risk diversifying asset class for risk adverse investors. When looking at the correlations in more detail, however, the picture becomes more complex. For Australia, France and Sweden, domestic real estate has a lower correlation to bonds than international, but a higher correlation than international real estate to general equities. For the Netherlands and the U.K. international real estate has a lower correlation to bonds and equities than domestic, whilst for the U.S. international real estate has a lower correlation to bonds, and a higher correlation to general equities. This overall implies that the domicile of the investor is an important consideration for establishing the strategy for real estate.

These characteristics are consistent with what was would be expected if there is a benefit from building a real estate portfolio on the basis of the type and location of end user demand, and how that demand interacts with the other asset classes in the portfolio. It should be noted that for most investor domiciles, domestic locally dependent real estate has a higher correlation to the stock market than does the domestic globally dependent real estate.

5. Analysis
The analysis is based on an optimization across all asset classes for each individual country. Seven individual portfolios are identified, the minimum variance portfolio, the maximum return portfolio and five equidistant portfolios between the two corner portfolios, i.e. the 10, 30, 50 70 and 90 percent distance portfolios. These portfolios are to be interpreted as generic and relative risk strategies.
Although it is not the main objective of this paper to study the size of the allocation to real estate in the context of the multi asset portfolio, the results are interesting as a comparison to other studies. In general, the results are consistent with the results of previous studies, but as the analysis is based on a longer time period the results should be more robust. The allocations to real estate, as a percent of the total portfolio, are presented in detail in appendix 3. The results indicate that the data supports an allocation to real estate, when unlevered, of between 5 and 20 percent, depending on country and risk tolerance. These results are slightly lower than in Hoesli et al (2004), the most comparable analysis, but are more in line with observed actual allocations. This conclusion, however, overstates the similarities, as a higher number of real estate assets are included in this analysis, comparing to earlier, which in itself increases the allocation to real estate.

Although the crises have changed the correlations, this change is relatively slight, and is not significant enough to be the main reason for the lower allocation to real estate. Instead, the lower allocation to real estate is the result of a combination of lower returns and a higher volatility for the asset class. The lower returns are both due to the downturn in real estate values during the crises as well as due to the inclusion of management fees.

As with regard to the composition of the real estate portfolio, unlevered real estate tends to be included in the lower risk strategies, which is consistent with the diversification role of real estate.

<table>
<thead>
<tr>
<th></th>
<th>MVP</th>
<th>10%</th>
<th>30%</th>
<th>50%</th>
<th>70%</th>
<th>90%</th>
<th>MAX Sigma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>7,10</td>
<td>16,97</td>
<td>18,05</td>
<td>17,88</td>
<td>20,21</td>
<td>12,32</td>
<td>-</td>
</tr>
<tr>
<td>France</td>
<td>11,24</td>
<td>17,92</td>
<td>6,20</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>8,45</td>
<td>19,66</td>
<td>0,56</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sweden</td>
<td>5,00</td>
<td>25,22</td>
<td>21,25</td>
<td>21,04</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>The U.K.</td>
<td>16,04</td>
<td>15,13</td>
<td>4,63</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>The U.S.</td>
<td>9,74</td>
<td>19,56</td>
<td>19,02</td>
<td>18,45</td>
<td>9,81</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
When leverage is introduced at 20 percent, the allocation to real estate is reduced. The allocations to real estate range between 3.4 percent up to 15 percent, an allocation which is more in line with actual allocations. Also, for most investor domiciles, real estate is included in fewer of the strategies, an indication that the portfolio efficiency of real estate as a risk diversifying asset class is reduced when leverage is introduced.

Table 5.b. Percentage allocation to Real Estate, 20% Leverage

<table>
<thead>
<tr>
<th></th>
<th>MVP</th>
<th>10%</th>
<th>30%</th>
<th>50%</th>
<th>70%</th>
<th>90%</th>
<th>MAX Sigma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>5.47</td>
<td>11.52</td>
<td>11.25</td>
<td>13.04</td>
<td>14.58</td>
<td>13.19</td>
<td>-</td>
</tr>
<tr>
<td>France</td>
<td>8.72</td>
<td>11.78</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>6.27</td>
<td>12.31</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sweden</td>
<td>3.47</td>
<td>15.18</td>
<td>13.00</td>
<td>10.71</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>The U.K.</td>
<td>10.00</td>
<td>6.39</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>The U.S.</td>
<td>7.68</td>
<td>13.68</td>
<td>11.66</td>
<td>9.97</td>
<td>8.40</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

When leverage is allowed to increase to 45 percent (table 5.c below), there are two impacts on the allocations. Firstly, in the minimum variance portfolio, the allocation continues to decrease to levels between 1.8 and 5.5 percent of the total portfolio. This is a significant reduction of the allocation to real estate, and indicates that the diversification contribution of levered real estate investments is significantly reduced for a risk adverse investor.

Secondly, levered real estate has a higher allocation for higher return portfolios in the multi asset portfolio, and for a much greater part of the efficient frontier than for unlevered real estate. This indicating that real estate, when taking on leverage, can take on a different role in the portfolio, a role that still diversifies risk, but does so at higher return strategies for the overall portfolio. This pattern is consistent with the hypothesis of the Endowment Model (Swensen, 2000) of real estate having a role as a return enhancer when higher leverage is utilized.
Table 5.c. Percentage allocation to Real Estate, 45% leverage

<table>
<thead>
<tr>
<th>Region</th>
<th>MVP</th>
<th>10%</th>
<th>30%</th>
<th>50%</th>
<th>70%</th>
<th>90%</th>
<th>MAX Sigma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>3.40</td>
<td>17.53</td>
<td>35.63</td>
<td>59.81</td>
<td>76.06</td>
<td>91.02</td>
<td>100.00</td>
</tr>
<tr>
<td>France</td>
<td>5.53</td>
<td>10.15</td>
<td>9.03</td>
<td>8.67</td>
<td>8.33</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>3.86</td>
<td>10.45</td>
<td>13.16</td>
<td>19.47</td>
<td>25.49</td>
<td>4.39</td>
<td>-</td>
</tr>
<tr>
<td>Sweden</td>
<td>1.83</td>
<td>11.82</td>
<td>20.19</td>
<td>26.22</td>
<td>33.16</td>
<td>16.80</td>
<td>-</td>
</tr>
<tr>
<td>The U.K.</td>
<td>4.11</td>
<td>9.01</td>
<td>9.84</td>
<td>8.56</td>
<td>7.40</td>
<td>3.81</td>
<td>-</td>
</tr>
<tr>
<td>The U.S.</td>
<td>2.79</td>
<td>12.45</td>
<td>22.66</td>
<td>31.50</td>
<td>47.93</td>
<td>86.05</td>
<td>100.00</td>
</tr>
</tbody>
</table>

In charts 5.1 to 5.6 below the allocation to real estate in the overall portfolio for each risk category as a function of leverage is presented. The results are presented for domestic and international real estate as two separate strategies.
When no leverage is used domestic real estate is the absolute dominant asset class for Australia, whilst for Sweden and France, domestic is dominant for some risk strategies, in the case of Sweden higher return strategies, and in the case of France lower risk strategies. For the Netherlands, the U.K. and the U.S. international real estate is dominant for all risk strategies. The conclusions for Australia and the U.S. are the most surprising, as they are the opposite from what was found in Hoesli et al (2004). A probable explanation for the result for the U.S. is that the additional years...
of observations include a period of time when U.S. real estate values went though a price correction across the country, a situation that has not happened before. Thus, the diversification benefits that were earlier possible to gain within the U.S. were no longer achievable, why international real estate becomes relatively more attractive. For Australia, the results are likely due to that the additional data points cover a period in which Australian property values held up well in comparison to other markets, making the Australian market relatively more attractive compared to international real estate investments.

When a leverage of 20 percent is introduced, the pattern is unchanged from the unlevered analysis, but the allocation to domestic real estate generally increases, thus indicating that leverage is best taken in the domestic market of the investor. As a result the importance of international real estate decreases and real estate is only included in the two lowest risk strategies. The exception is a U.S. based investor, where the results are very similar to the results of the unlevered analysis.

When leverage is allowed to increase to 45 percent the pattern changes substantially. Firstly real estate is included also in higher return strategies for the multi-asset portfolio. Secondly, the relative importance of domestic and international real estate changes for the The Netherlands and Sweden, where domestic real estate is included for lower risk strategies, but international for higher risk strategies. This result is consistent with the conclusions in Hoesli et al (2004). For the U.K. and the U.S international real estate remains the most important asset class, and for Australia and France the pattern is unchanged.

Overall, the impact of low levels of leverage for the importance of international and domestic real estate is to make domestic real estate the more important of the two. The same conclusion can be drawn for higher levels of leverage, except for U.S. and U.K. domiciled investors, where international real estate is the more important.

The pattern of the results indicate that real estate can fulfill different purposes in the overall portfolio, depending upon which level of leverage is used. The results supports the notion of real estate’s diversification role without, or with lower levels
of leverage, as well as the return enhancing use of real estate when leverage is included.

For the purpose of this study, however, the interest is to which degree locally dependent, globally dependent and diversified real estate best complement the overall portfolio with different level of leverage. The next sub-section analyses the percentage portfolio composition in the dimensions “locally dependent”, “globally dependent” and “diversified” from unlevered returns, 20 percent levered and 45 percent levered. All the results are calculated as a percentage of the real estate portfolio, and as such take the size of the property portfolio as given. Assuming that there is a structural bias in real estate returns, and that this is constant across all types of real estate, the analysis is able to conclude what type of real estate best complements the overall portfolio in the first and second moment. In the ensuing sub-section, the overall results are discussed.

5.2. Sector Strategy: Local, Global and Diversified

The results for locally dependent, globally dependent and diversified real estate are presented in charts 5.2.1-6 below, and in more detail in appendix XX. The dimensions local, global and diversified are proxies for the fundamental attributes of the source of the demand for real estate, and these form another important consideration in the formation of the real estate strategy.

When unleveraged real estate is analysed, locally dependent real estate is the main contributor to overall portfolio efficiency for all investor domiciles for low risk generic strategies. But globally dependent real estate does have an important role to play for Dutch and Swedish investors in the minimum variance portfolio. This component consists mainly of international real estate, and this indicates that the benefit of international diversification is more powerful than the effects of the tenant demand. For both Australia and the U.S. globally dependent real estate contributes to overall portfolio efficiency higher up the risk spectrum. Diversified real estate does not play a significant role, except in the minimum variance portfolio for Australian and French domiciled investors.
When leverage is introduced at 20 percent, the importance of locally dependent real estate generally decreases, whilst the importance of globally dependent real estate increases. Locally dependent real estate, however, is the most important component for low risk strategies for most domiciles. Globally dependent real estate continues to be important for Dutch and Swedish domiciled investors in a minimum variance strategy, as well as for higher return strategies for Australian and U.S. domiciled investors.

*Chart 5.7-5.12 Composition of real estate portfolio, % of real estate portfolio*

When leverage is increased to 45 percent, locally dependent real estate increases significantly in importance for most investor domiciles. When risk is increased through leverage, the locally dependent real estate becomes the dominant strategy for most risk profiles. The exceptions to this is the Australian and U.S. investor domicile, where globally dependent real estate still has a more important role in medium to high overall risk strategies.
Diversified real estate strategies continue to have an important role in the minimum variance portfolio for Australian and French investors, but higher level of leverage also becomes an relevant strategy for higher returns for Dutch domiciled investors.

5.2. Discussion

The results presented in this paper indicate that real estate with no or limited leverage contributes the potential of diversification, whilst when leverage is increased, real estate increases the return potential in the overall portfolio. This conclusion is quite intuitive and supports both the diversification as well as the return enhancement argument for including real estate in the portfolio but has so far not been substantiated in studies evaluating the role of real estate in a multi asset portfolio. For Swedish, Dutch, U.K. and U.S. based investors, international real estate is more important for risk diversification than is domestic real estate, a tendency that is increased as leverage is increased, but is to an extent contradictory to earlier findings, such as Hoesli et al 2004. This is contrary to what is seen in most investment portfolios, where there is a significant home bias.

Listed real estate (either through REITs or ROCs, depending upon the national regime) was included in the optimization analysis, and did prove to be an important component in the asset allocation puzzle. In many cases listed real estate plays the opposite role to private real estate, ie as a return enhancer when private real estate is unlevered, and as a risk reducer when private real estate is levered. Given the findings in Hoesli et al 2012, an interesting question arises if not the holding period of the investments has an impact on these results. This is, however, outside the scope of this paper.

In the table below, the percentage of the investable market, as estimated by IPD for 2011, as a percentage of the total Real Estate universe used in this study is presented together with a selection of risk strategy allocations from the unlevered analysis for each country.
Table 5.3.1. Domestic Real Estate as percent of total Real Estate Universe

<table>
<thead>
<tr>
<th></th>
<th>Australia</th>
<th>France</th>
<th>the Netherlands</th>
<th>Sweden</th>
<th>the U.K.</th>
<th>the U.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual 2011 (IPD)</td>
<td>7%</td>
<td>10%</td>
<td>5%</td>
<td>4%</td>
<td>12%</td>
<td>62%</td>
</tr>
<tr>
<td>Analysis (MVP)</td>
<td>100%</td>
<td>78%</td>
<td>25%</td>
<td>0%</td>
<td>44%</td>
<td>5%</td>
</tr>
<tr>
<td>Analysis (30 %)</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

With the exception of the U.S. and Swedish investor domicile, the analysis indicates that there is a good reason for home bias for investors seeking to minimize risk, but there is no support from this analysis for home bias in higher risk strategies.

It is likely that these discrepancies are due to the perception of risk for international real estate. With geographic distances, the level of perceived risk increases. In no segment of the real estate market is this more evident than in what has been defined as domestically dependent real estate. An important reason for domestically dependent real estate offering better diversification benefits, and why it is behaving differently from other parts of the real estate market, is that these segments of the markets are different from a tenant demand perspective.

6. Conclusions

Overall the results from this paper supports the notion that investors can hold real estate for at least two purposes, diversification and return enhancement. The results indicate that the diversification role of real estate, and the ensuing allocations, are broadly consistent with the findings in previous studies, i.e. the analysis supports the notion to consider unleveraged, core type real estate allocations in the range between 5 and 20 percent for most investor domiciles in order to diversify total risk. These results include the impacts of several crises, the most recent being the global financial crisis started in 2008. Real estate is a cyclical asset class, but also exhibits a boom-bust behavior, which together with the low level of liquidity in the asset class, the effect of lock up periods and other aspects of the real estate market makes the asset class less attractive from an asset allocation perspective, why there are good reasons to consider even lower allocations to the asset class, as observed in Hoesli et al (2012).
Although there are several cycles included in the data set the last cycle was unique in at least one way. The last cycle exhibited a common factor in the form of a global low interest rate environment, that synchronized real estate markets globally to an extent not seen before. This common factor impacted many if not all asset classes, resulting in a concurrent bust across several asset classes. In these types of market environments, the diversification benefits of real estate are non-existent. Despite this, over the longer term, real estate still appears to have at least two potential roles in the asset allocation puzzle, diversification when lowly levered, and return enhancement when leverage is increased.

Institutional investors may hold real estate for different reasons, as well as having different restrictions (exogenous through regulations or endogenous due to liquidity needs) that restricts the ability and appetite for real estate. As a result of this the exact allocation level is difficult to ascertain in theory as well as in practice. Although this is not a direct aim or objective of this paper, a fair conclusion is that the allocation to real estate should not be higher than 15-20 percent, except in certain instances where real estate is more highly leveraged and invested in as a return enhancer, as in the “endowment model”.

Generally, the analysis shows that the introduction of leverage reduces the allocation to real estate for diversification purposes. This is what would be expected as leverage amplifies returns and risk, but with a reducing risk and return tradeoff. The reduced tradeoff is, however, relatively small. From a practical perspective this has important ramifications, in that if the risk cost of information asymmetry from investing internationally is mediated through a the use of a manager, this manager cost does not consume all the risk diversification benefits from using an intermediary model when investing internationally.

In matter of how real estate strategies should be fashioned, however, an important conclusion of this paper is that an investor tends to benefit more from real estate strategies that are dependent upon local demand, both when investing in the domestic market as well as when investing internationally. This might appear as an intuitive conclusion, but deviates significantly from what is observed in practice, where most investment flows are focusing on the office segment of the real estate market.
The results indicate that a real estate strategy, in the context of a multi asset portfolio, benefits from considering both domestic and international real estate. Manager costs and impacts of leverage do not change this conclusion. Furthermore, locally dependent real estate tends to be dominant over globally dependent real estate, a result that is consistent with Lizieri (2009).

The inherent logic behind these findings is that real estate, with all its illiquidity, management intensity, information asymmetry, does exhibit characteristics that complement the multi-asset portfolio, and this is best achieved in types of real estate where the tenant demand is less impacted from global factors. This fundamental segmentation of locally dependent real estate (proxied by retail, residential and logistics assets) should make these types of assets more attractive for the real estate strategy than globally dependent real estate (proxied by office assets) for those investors being able to be comfortable investing in markets that in many ways are characterized by being different from the domestic market of the investor.
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