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Real Estate

How much of their portfolio should
European pension funds allocate to real estate?

JPMorgan Asset Management

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About us

JPMorgan Asset Management is one of the five largest active asset managers in the world, managing assets of nearly €650 billion for institutions, governments, corporates and individuals in 38 locations around the world.

With over 580 investment professionals worldwide, our expertise covers core, specialist and atlernative investment strategies covering every key economic region and asset class.

In the alternative space, we have experienced teams dedicated to real estate, managed currency and hedge funds.

We combine disciplined process with team-based decision-making and rigorous risk control to deliver historically strong risk-adjusted performance. Our focus on innovative thinking means we are constantly seeking new ways to capture sources of investment return across financial markets.

Executive Summary

The purpose of this paper is to try to lay down some broad guidelines on the weighting European pension funds should assign to real estate in their investment portfolios. Unfortunately, it is difficult to give a precise answer to this question. Current weightings range from 1% in some countries to over 20% in others, with a European average of around 6%, although this appears to be rising.

In this paper we start by looking at the invested and investible real estate stock relative to the total investible stock of assets in Europe. We then – after trying to deal with some well-known data problems – include real estate in a multi-asset modelling exercise, and discuss the asset's role in matching assets to liabilities.

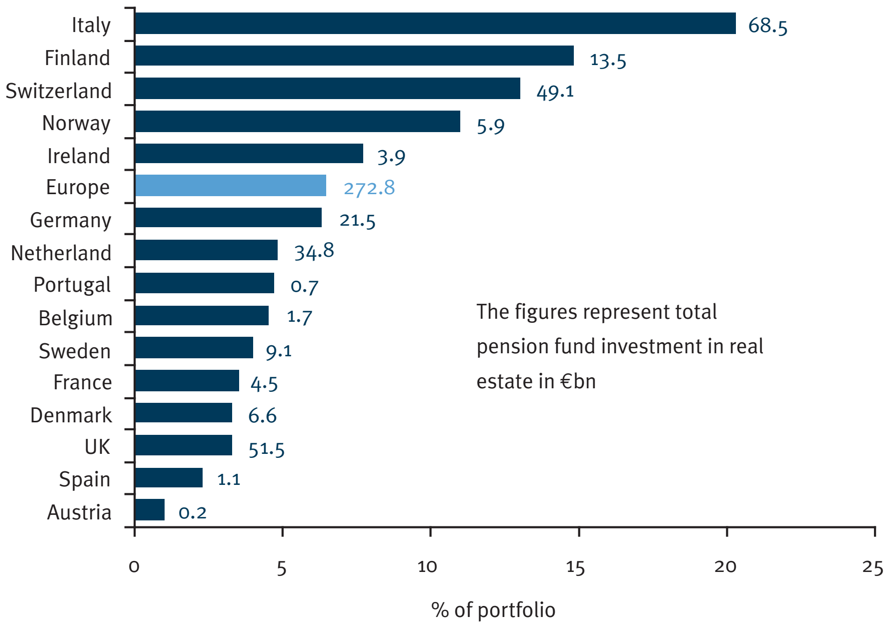
Our conclusion is that the average pension fund should hold between 10% and 15% of its assets in the form of real estate – although due to differing liability streams this optimal proportion will vary significantly between plans.

How much of their portfolio should European pension funds allocate to real estate?

Current weightings

Currently, pension funds across Europe have widely-differing views as to the appropriate allocation to real estate, according to estimates by Mercer (Figure 1). At one extreme, Austrian pension funds typically hold only 1% of their assets in the form of property investments; at the other, Italian pension funds devote over one fifth of their portfolios to real estate. On a GDP-weighted basis, these figures place the average pension fund exposure at around 6%. However, European pension funds place significantly more faith in property than is the case in other parts of the world; for example, PREA report average pension fund real estate weightings of 3.4% for the United States, and weights are probably below 1% in Japan.

Figure 1: Pension fund allocations to real estate by country (end-2002)

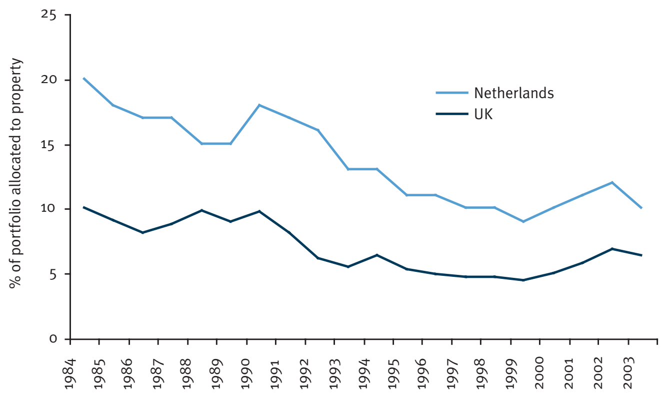


Source: Mercer Investment Consulting, JPMorgan Asset Management

These weights have of course changed over time. Getting hold of historical data for pension fund allocations is not straightforward, but the WM Company provide a 20-year series for the UK and the Netherlands [1].

[1] This data is not consistent with the Mercer multi-country data set shown above – itself a clue as to the pitfalls involved in assembling such numbers.

Figure 2: UK and Dutch pension fund allocations to real estate, 1984-2003



Source: WM Company, DTZ, JP Morgan Asset Management estimates

These numbers show two distinct phases. From the mid-1980s until the late 1990s, pension fund property weightings declined on a fairly consistent basis. Since 1999, however, weightings have started to rise again. To an extent, this merely reflects changes in relative asset values, and in particular the spectacular rise and fall of stock markets over this period. However, this does not account for all of the change in weightings; and even if it did, the funds must have made a conscious allocation decision over the years to allow their weightings to change in this way. Thus it looks as though property is coming back into vogue – though it still has a long way to go to recover the favour in which it was held two decades ago[2]. During 2004 and – on evidence available so far – 2005, institutions have continued to actively expand their real estate portfolios.

The investment universe

The starting point for any investigation such as this must be the size of the investment universe. There are two reasons for this. Firstly, and more obviously, it sets a limit on sensible weightings. We cannot seriously advocate that funds should hold more real estate than there is. Secondly, and more tentatively, the capital asset pricing model[3] holds that in an efficient capital market the actual allocation of assets is always optimal (in the sense that it has the best risk-adjusted returns), and that therefore an investor should hold assets according to their weights in the investment universe (mixed with cash or debt to provide the investor's desired risk/return trade-off).

This hypothesis can be criticised from a number of angles. Real estate capital markets are clearly not efficient; and institutions – and in particular pension funds – are not necessarily seeking the best risk-adjusted returns, since they also have a set of liabilities to be met. Nonetheless, the size of the investment universe remains an important starting point for our investigation.

[2] The decline in weightings in 2003 is, we believe, largely the result of the unanticipated recovery in equity markets, and not symptomatic of a reversal of the trend back into property.

[3] See e.g. Bodie, Kane and Marcus (2002), Chapter 9

But what exactly do we mean by this? It is important to distinguish between the invest*ed* universe and the invest*ible* universe. For exchange-traded assets these are the same thing, but for physical assets such as real estate, and in particular European real estate, they are very different. Shares and bonds come into existence only when an investor buys them, but properties are often owned by non-investors, such as the governments and corporations who occupy them[4]. The investible real estate universe is difficult to measure, since it requires an implicit assumption to be made about what proportion of non-invested stock could potentially be invested.

A number of attempts have been made to estimate both the invested and investible stock. We focus on two of the most recent set of numbers, produced by DTZ and IPD/ROZ[5]. It should be noted that while the estimates for the investible stock are reassuringly similar, estimates of the invested stock are quite different, and generally speaking significantly higher in the case of the DTZ estimates. The main reason for this seems to be that the DTZ numbers include private (i.e. non-institutional) investment – although as a partial counterbalance to this the IPD/ROZ data includes residential investment in some countries, whereas the DTZ numbers exclude residential investment where possible.

Table 1: Estimates of invested and investible property stock, end-2002

€bn	Invested		Investible	
	IPD/ROZ	DTZ	IPD/ROZ	DTZ
Austria		32		88
Belgium		44		113
Czech Rep		7		40
Denmark	23	26	83	68
Finland	20	23	55	53
France	125	203	604	588
Germany	292	396	819	837
Greece		10		55
Hungary		6		33
Ireland	5	20	55	50
Italy		128		535
Luxembourg		4		10
Netherlands	65	121	180	169
Norway	20	31	76	66
Poland		13		86
Portugal	9	22	45	54
Spain	24	71	273	284
Sweden	58	54	104	95
Switzerland		59		97
UK	358	437	625	607
TOTAL		1706		3928

Sources: Hordijk & Ahlqvist (2004); DTZ 2004)

Adding up the DTZ numbers gives a total invested real estate stock of €1.7 trillion, 43% of the investible stock of €3.9 trillion. How do these numbers compare with the total stock of invested assets? According to the World Federation of Exchanges, the total capitalisation of equity markets in the countries listed above was €6 trillion, and that of bond markets €8.5 trillion. However, this includes publicly-traded real estate equity and debt, so we exclude these to avoid double-counting. According to DTZ, of the €1.7 trillion of invested real estate at end-2002, €0.2 trillion was in the form of public-market real estate equity and traded debt.

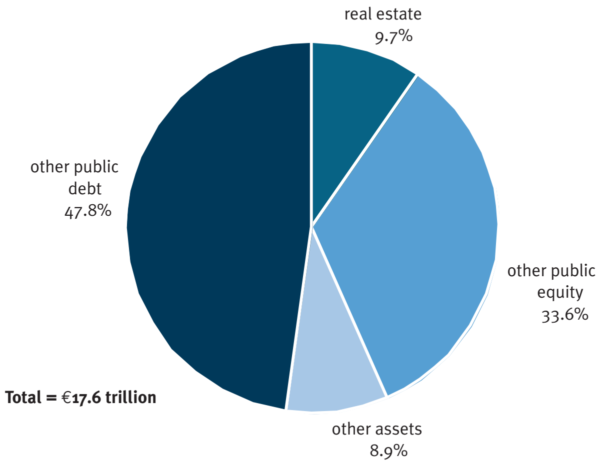
[4] It could be argued that such properties are invested, even if a sober analysis of risks and returns for owner-occupiers would show them to be rather poor investors. This is largely a definitional issue. However, most measures of the invested real estate stock in Europe do not include owner-occupied property.

[5] DTZ (2004); Hordijk & Ahlqvist (2004)

We are on far shakier ground when we try to put numbers on other assets such as non-real estate private equity and debt, commodities, derivatives and cash. For a start, it is difficult to get information on the stock of private equity and commodities[6]. However, the main problem is that cash, derivatives and private debt are "open-ended" in the sense that there is no limit on how much an investor can hold, so long as a counterparty can be found (to take deposits, write a derivative contract, or borrow funds respectively). It seems almost impossible, therefore, to meaningfully measure the size of the investible universe for these assets. We have thus used pension funds current weighting in these assets as a proxy for the invested universe – recognising, of course, that this introduces a degree of circularity to the analysis.

This gives us an invested universe of €17.6 trillion, of which just under 10% is real estate (in all its forms – see Figure 3 below). This is significantly higher than the 6% allocation that pension funds currently hold. If we include the investible (but not currently invested) real estate stock, then real estate's weighting rises to nearly 20% (though this could arguably be done for other "alternative" asset classes too). By combining these estimates with the data in Figure 1 we can see that pension funds currently invest in 17% of the invested stock, and just 7% of the investible real estate stock in Europe.

Figure 3: Estimates of European invested universe, end-2002



Source: Mercer Investment Consulting, DTZ, World Federation of Exchanges, JPMorgan Asset Management estimates

It appears, therefore, that the real estate allocations of European pension funds are not constrained by the size of the investible, or even the currently invested, universe. Current real holdings are below market weightings, and form only a small part of the invested and investible real estate universe. If we gave credence to the capital asset pricing model in a real estate context, we could also conclude that pension funds are allocating inefficiently, since their real estate weightings are below those of the market. For the reasons stated earlier, we would not wish to defend this claim. Nonetheless, it does seem surprising that pension funds hold less than the market weighting of real estate, given that the asset class has a number of characteristics that might be thought to make it particularly suited to pension funds. It is to these characteristics that we turn next.

[6] The European Venture Capital Association estimates that the total stock of private equity investments at acquisition cost in Europe at end-2002 was €123 billion, though this does not reflect current value, and much of this is closed to new investors. According to JPMorgan Asset Management rough calculations and estimates, global (not European) stocks of the commodities normally held to be investible is probably of the order of $1 trillion; however, it is not clear how much of this is truly investible.

Characteristics of real estate

In text books, an asset's investment performance is entirely described by three sets of numbers: its mean or average return; its riskiness as measured by the standard deviation of returns; and its correlation with other assets. Generally historical data is used to compute these statistics. Armed with this information, "efficient portfolios" of risky assets can be constructed (i.e. the sets of asset mixes that give the lowest possible risk for a given return target – or the highest possible return for a given risk tolerance).

In practice things are less simple, particularly when we add real estate to the mix. For a start, for real estate there is rarely enough data to be confident that we have computed accurate measures of historic risk, return and correlation, or that such measures would be good proxies for the behaviour of the asset in the future. In what follows, we try to get around this problem by focusing on the five European countries (The UK, The Netherlands, France – office sector only, Sweden and Ireland) for which IPD and its associate companies provides investment returns data going back at least fifteen years – although even this is shorter than we would like, so that some of the results reported later may have more to do with unrepresentative data sets than the underlying qualities of real estate in these countries.

Another problem is that the income and capital appreciation component of returns may have different tax implications, and certainly in the case of real estate have different liquidity profiles, with the result that certain groups of investors may prefer income-rich assets (such as bonds or real estate) over assets such as equities that rely heavily on capital appreciation to generate total return. We do not offer a formal treatment of this issue, but will come back to the point later when interpreting our results.

Much has been written about the use of standard deviation as a measure of risk. In particular, it is often observed that investors place a higher weight on losses than gains, making symmetrical measures of dispersion such as standard deviation inappropriate. This is a deep subject that we do not cover in any detail here[7]. However, in practice it is often found that standard deviation ascribes relative risk rankings to assets in much the same way as more sophisticated measures such as semi-standard deviation or value at risk. We thus stick with standard deviation for the purposes of this exercise.

A critical issue is the smoothing of real estate returns data. Although the income component of total returns can be measured, capital values of invested individual real estate assets are not known with certainty – unlike market securities which are homogenous and traded on a daily basis. Investors therefore employ professional valuers to estimate selling prices of properties in their portfolio, and it is these estimates which, in aggregate, are used to compute the capital growth component of total returns.

Valuers need to be able to justify their valuations by reference to actual selling prices of the asset being valued and comparable properties, and these are inevitably backward-looking. This means that valuations tend to be conservative in rising markets, and optimistic in falling markets. Thus while there is no reason to think that valuations-based returns data under or over estimates mean returns over the long-term, it is rather likely that it under estimates volatility. Moreover, estimates of correlations based on smoothed data are also likely to be biased downwards. This is likely to result in over-weights to real estate in asset allocation models.

We have therefore used de-smoothed real estate returns data in our models. The de-smoothing method used is very simple – we assume that when accurately measured real estate has a similar risk/return trade-off to other assets[8] . The effects are shown in Table 2 on the next page, which reports risks and returns on the major asset classes in the countries in our sample. Note that returns are not changed by de-smoothing; there is no reason to think that the valuation process systematically over- or under-estimates changes in value. However, volatility is generally increased; and as a consequence assessment of correlations is also affected.

[7] But see e.g. Booth, Matysiak and Ormerod (2002)
[8] Regression-based methods were also tried but with the exception of the UK did not generate plausible results

Table 2: Risk and return of direct real estate compared to other assets

		UK	Ireland	France*	Netherlands	Sweden
Property	risk (raw data)	10.5	12.5	9.9	4.6	15.0
	risk (desmoothed)	14.6	19.6	10.2	6.7	15.2
	return	12.6	14.1	8.3	8.2	12.0
Equities	risk	32.2	26.1	29.6	23.7	30.7
	return	17.5	16.4	18.3	17.0	18.3
Gilts	risk	14.8	9.6	7.0	6.7	8.2
	return	12.2	10.6	9.3	7.7	10.6
Cash	risk	3.4	3.0	3.0	2.3	3.8
	return	9.5	7.3	7.1	5.7	8.2

* offices only

Source: IPD, ROZ, SFI, JPMorgan Asset Management

The table shows the risk and return associated with direct, unleveraged institutional real estate as measured by IPD and its affiliates in the five European countries for which there is a sufficiently long run of data to allow valid conclusions to be drawn about risks and returns. As expected, real estate turns out to have a return – and a risk – above that of cash and below that of equities. By comparison with government bonds, real estate generally has a higher risk/return profile, but this is not universally so.

As we have already suggested, investors may view income and capital returns differently. One characteristic of real estate that sets it apart from other asset classes is the high and stable nature of its income stream. On average, income accounts for around 70% of long-run total returns in Europe. As of end-2003, European property was providing an income yield of 6.0% (an average of the five countries above). By contrast, the dividend yield on the MSCI Europe equities index was just under 3%; the Citigroup European government bond index showed a gross redemption yield of 3.5%; and high-yield bonds (BB rating) were quoted by Merrill Lynch as yielding 5.0%. Moreover, this income component of total return has been very stable over time, showing a standard deviation of around 1% per annum in each of the five markets:

Table 3: Mean and standard deviation of the income component of real estate return

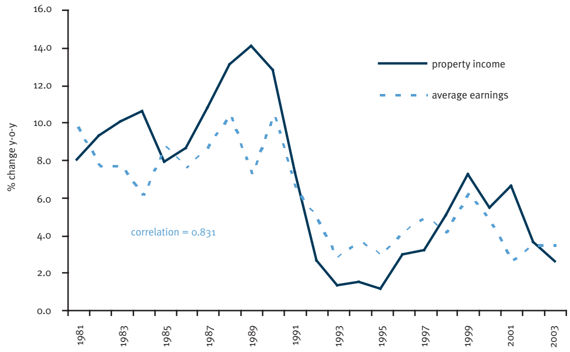
	UK	Ireland	France*	Netherlands	Sweden
Mean total return	12.6	14.1	8.3	8.2	12.0
Mean income return	7.0	7.3	6.2	7.5	6.3
STDEV of income return	1.0	1.3	0.9	0.7	1.1

* offices only

Source: IPD, ROZ, SFI, JPMorgan Asset Management

Not only is income high and stable; it also has a close relationship with average earnings. Figure 4 shows this relationship for the UK; other countries currently provide far shorter series for property income levels, but in principal we would expect real estate income to grow in line with prices of other factors of production. This, as we shall see, can be important when trying to match assets to liabilities.

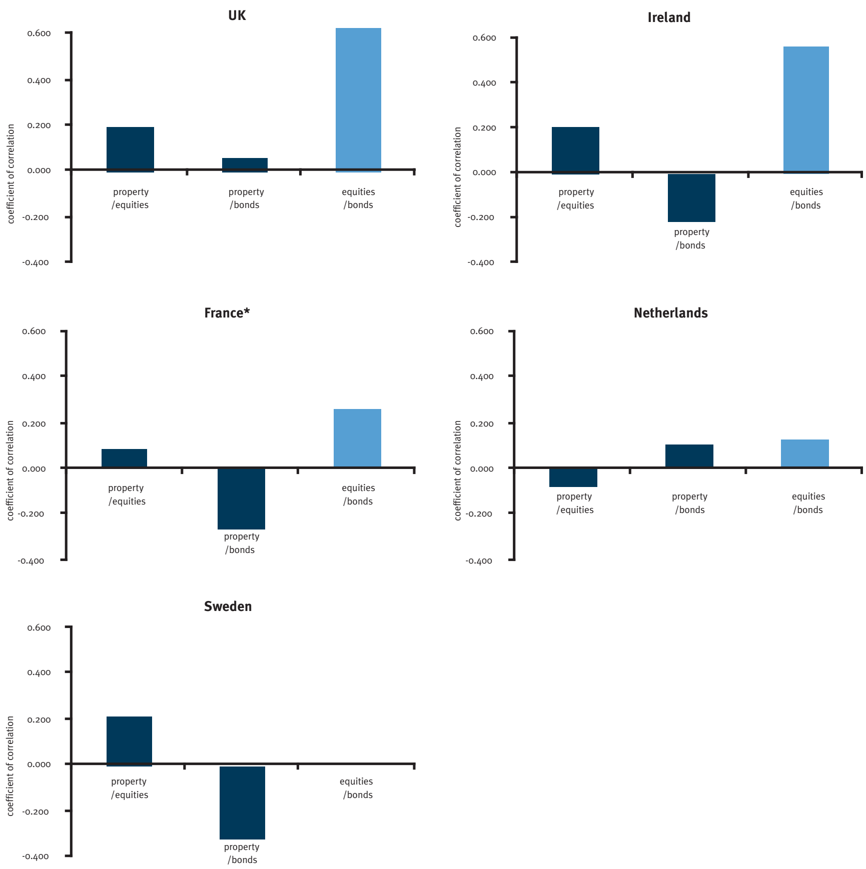
Figure 4: Correlation between property income growth and average earnings, UK, 1981-2003



Source: IPD, ROZ,SFI, JPMorgan Asset Management

We also look at the correlation between the asset classes. The charts below (figure 5) summarise the correlations between de-smoothed property, equities and government bonds in the five markets listed above. For all but one market, de-smoothed real estate has a lower correlation with both equities and bonds than these two asset classes do with each other – the single exception being Sweden where equities seem to have a stronger correlation with property than with bonds. As we shall see, the low correlation of real estate with the other major asset classes is an important input to asset allocation decisions.

Figure 5: Correlations between major asset classes



*Offices only

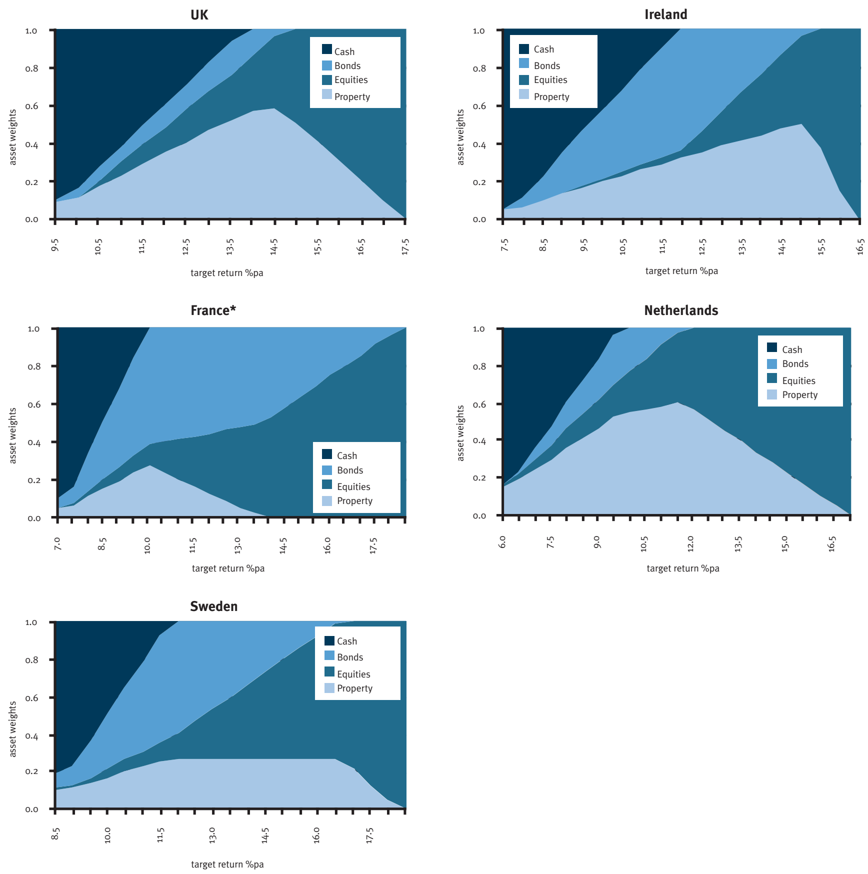
Source: IPD, ROZ, SFI, JPMorgan Asset Management

Mean-variance optimisation

The classic formal tool for deciding asset allocation is the mean-variance optimisation model developed in a classic study by Markowitz (1959). Clearly, for any combination of asset classes there will be an associated risk and return. Conversely, for any given return there must be a combination of assets that will give the lowest possible risk (or looked at from another angle, for any desired level of risk there will be a combination of assets that generates the maximum possible return). The amount of return is simply the weighted average of the returns of the individual assets. However, the amount of risk is not simply the weighted average of the risks of the individual assets. If two assets are poorly correlated with each other, they will tend to smooth out each other's peaks and troughs. Thus portfolio risk depends not just on the risk of the individual components but also the correlations between the components. An asset that has a low correlation with other assets should be awarded a relatively high weight in such an exercise – especially if it provides a competitive risk-adjusted return. As we have seen, real estate is just such an asset.

We have carried out a mean-variance optimisation exercise for a range of different return targets using the data for cash, bonds, equities and de-smoothed real estate reported for the five European countries in the tables above. The results are summarised in Figure 6.

Figure 6: Results of mean/variance optimisation exercise



*Offices only

Source: IPD, ROZ, SFI, JPMorgan Asset Management

A number of features stand out. Firstly, as would be expected of an asset that sits in the middle of the risk/return spectrum, optimal weights to real estate are highest for middle-ranking target returns. For return maximisers, real estate will always have a weight of zero (because equities have the highest returns); however, even risk minimisers will have some real estate weighting that ranges from 5% (France) to 15% (the Netherlands). Secondly, optimal real estate weights are quite high, peaking at anything from 28% (France) to 60% (Netherlands); average weights over the whole possible spectrum of return targets range from 8% (France) to 35% (Netherlands). The unweighted average allocation over the five countries is 24%.

Clearly, this is very significantly more than pension funds actually hold. There are three possible explanations for this: (i) the data is faulty; (ii) pension funds do not try to maximise risk-adjusted returns; or (iii) pensions funds behave sub-optimally. To some degree or another, all of these are probably true. We have already talked about the problems inherent in real estate data, and by de-smoothing have tried to compensate for them. Nonetheless, it may be that the data needs further de-smoothing, or that the correlations have not been measured accurately. In this context it is worth mentioning recent work by Lizieri and Bond (2004) which argues that traditional ways of measuring risk fail to take into account the additional risk brought about by uncertainty over selling time. Their work suggests that this additional factor could raise the true standard deviation of real estate returns by around 25% for typical holding and marketing periods. This would clearly reduce the optimal allocation to real estate, and may help to explain why institutional investors hold lower real estate allocations than mean-variance models suggest they should.

Equally, however, it might be that those responsible for making pension fund allocations may take a different view on the true risk and returns inherent in the asset class from the parameters we have used here. Although we now have enough data to make a reasonable stab at defining optimal allocations for five European countries, this was not true only a few years back. One reason that funds are now increasing their allocations to property may simply be that they feel that, for the first time, they have a basis on which to make such a decision.

Another potential flaw in our exercise is that we have excluded other “alternative” asset classes from consideration. Although this is inevitable – risks and returns for assets such as hedge funds and private equity are extraordinarily difficult to measure accurately – it is possible that allocators are using other assets to fill the role which our model ascribes to real estate. However, given the restricted size of the investment universe for these other assets the scope to do this is clearly limited.

Finally, during the 1990s pension funds seemed to behave like return maximisers, in the sense that they accepted ever-higher weightings to equities. This left some of them significantly under-funded once the equity markets crashed in 2001. As a result – and in many cases, with the encouragement of legislative changes – pension funds have become far more focussed on the need to match their assets with their liabilities.The simplest way to do this is to define benefits in terms of assets – hence the growing popularity of “defined contribution” pension schemes. Nonetheless, the bulk of existing pension schemes in Europe operate on a “defined benefits” basis. In the following section, therefore, we look at the role of real estate in asset-liability matching.

Asset-liability matching

In this section we look at the characteristics of real estate as an asset class in the light of pension funds' needs to match liabilities. However, we should stress from the outset that we will *not* attempt to undertake any formal asset-liability modelling in this section. This is not because we believe this exercise to be any less important or valid than the more traditional mean-variance modelling; on the contrary, we believe we are moving into a world in which liabilities will increasingly drive investment strategy at the cost of return, or even risk-adjusted return. However, asset-liability modelling is still a (relatively) young science. Its practitioners do not yet entirely agree what should be optimised; for example, should we be maximising the value of the funding surplus (i.e. the difference between assets and liabilities) for a given acceptable level of risk (in which case we may end up funding deficits in some years), or do we minimise risk of the overall portfolio subject to the constraint that the funding surplus is always greater than zero? These two exercises could give quite different results. If the former, do we minimise the standard deviation of the funding surplus itself, or of the rate of change of the funding surplus (which seems odd but is analogous to the mean-variance optimisation exercise described above and thus conceptually more familiar)?

More importantly, however, we have found the data on liabilities and on asset returns – for all assets, not just real estate – insufficiently robust to support asset-liability modelling exercises. Intuitively, this shouldn't be surprising. Assets (generated by asset returns) and liabilities are both large numbers, but the funding surplus or deficit – which is the difference between the two – is a small number. It is therefore not only volatile, but more importantly highly sensitive to relatively small changes in assumptions made about assets or liabilities. This in turn means that the output of an asset-liability model can vary enormously in response to small changes in the inputs. Given the paucity of data on pension fund liabilities; the range of assumptions that could be used to generate a notional liability series; and the data problems already discussed on the asset side, we find that the range of asset weightings consistent with reasonable margins of doubt on the validity of the inputs to the model is so large as to render the formal exercise of little use. At the very least, different pension funds would be likely to find very different optimal allocations depending on the drivers and duration (see below) of their liability stream.

The exercise has been undertaken however by Chun, Ciochetti and Shilling (2000)[9] for the United States, where direct real estate returns data may be more robust and, more importantly, long series of pension fund liabilities in various industry sectors are available. The authors find a mean optimal allocation to real estate of 15.5% – although, underlining the point about sensitivity to inputs made above, this varies significantly depending on the fund's industry sector (from 0% for food and tobacco to over 66% for services). A simpler exercise for the UK by Tyrrell and Pellicer (2003)[10] compared de-smoothed real estate data with a notional general institutional liability series and derived an average real estate weighting of 16.6% over a 33-year period.

In this section we restrict ourselves however to looking at the characteristics of real estate that suggest it might play a significant role in portfolios that seek to track liabilities. These characteristics can be grouped into two categories: risk, returns and correlations; and relationship to the variables driving liabilities[11].

[9] Chun, Ciochetti and Shilling construct a utility function that depends on the expected size and volatility of the funding surplus and maximise this function.

[10] Tyrrell and Pellicer minimise portfolio risk subject to the constraint that the funding surplus is always greater than or equal to zero.

[11] For a more detailed view of these issues from a UK perspective, see Morrell, Jones, Blundell, Walker, Waites, Cumberworth, Matysiak & Winter (2004).

The output of any optimisation exercise – whether mean-variance or asset-liability – in which the investor is in any sense risk averse, will depend heavily on an asset's risk, returns and correlations with other assets. Just as real estate's low correlation with other assets generated a high weighting in our mean-variance models, so this quality will also tend to generate significant weights for the asset in liability models.

However, in an asset-liability model we are trying not to maximise returns but to match them to a liability series. Liabilities are driven by a number of variables. Some of these may be plan-specific; but there are two classes of variables that clearly drive all sets of liabilities to a greater or lesser extent. The first is nominal variables such as GDP or, critically for many pension funds, wages or average earnings. As these rise, so generally speaking a greater stock of assets is required to fund liabilities, due to the nature of pension payments which are often linked to final wages or, if already in payment, indexed to wages or inflation. The second is long-term interest rates. The relationship here may not be so obvious. In order to compare liabilities, which are a stream of future payments, with assets, which are a stock, the liabilities must be reduced to a present value using a discount rate. What should this discount rate be? It could be argued that it should be the expected return on the investment portfolio. However, in practice funds take a more prudential approach and use the redemption yield on long-term government bonds, since this is (a) known, and (b) conservative, since government bonds are the lowest-returning of the major risky asset classes.

The relationship between property income and average earnings is shown in Figure 4 on page 9. However, because total returns have a relatively volatile capital component, the relationship between property total returns and average earnings is less clear. The correlation between property total returns and average earnings growth in the UK is positive but low – of the order of 0.115 over the period 1981-2003. We return to the relationship between liabilities and the income component of real estate returns below.

The relationship between asset returns, fund liabilities and interest rates can be considered using the concept of duration. The strict definition of duration is the money-weighted average time at which cash is returned to investors[12]; in cruder terms, this is simply the "average" time period the investor must wait to receive his or her investment returns as cash. The concept is most often used for – and best-suited to – bonds, which have clearly defined income streams and redemption values. To the extent that it is bond-like, property can also be thought of as having a duration, although the "redemption value" – the sale value at lease-end – is not known exactly. Liabilities also have a duration, although again it may not be known exactly if, as is often the case for pension funds, future payments are subject to any form of indexation.

Generally speaking, it is desirable when matching assets to liabilities to match the duration of the assets with the duration of the liabilities. There are two reasons for this. On a simple level, an institution would want its investments to be returning cash at around the same time as it needs to be paying out on its liabilities (although this is more of an issue for real estate than for exchange-traded assets such as bonds or cash which can always be exchanged for cash within minutes if required – although not necessarily at a value consistent with liabilities).

More importantly, the relationship between an asset's returns (or a stock of liabilities) and interest rates depends to a large extent on its duration. This can be easily seen by thinking of the extremes[13]. In the case of a bond which redeems in 100 years time, the present value of the redemption is trivial; the income stream is dominated by the coupon payments. Therefore if interest rates double, investors will be prepared to pay only very slightly more than half of what they previous paid for the right to receive the bond's coupon.

[12]For example, an asset which provides an income of ¤10 in one year's time and ¤90 in two years' time has a duration of (1x10 + 2 x 90)/(10+90) = 1.9 years.
[13]For a more thorough explanation, see Bodie, Kane and Marcus (2002), chapter 16.

By contrast, a bond that redeems tomorrow is worth almost exactly its redemption value, regardless of the level of interest rates. Thus sensitivity to changes in interest rates is a function of duration. If a pension fund's assets have a similar duration to its liabilities, changes in interest rates will tend to have a similar effect on assets and liabilities, making them a good match.

So the question is – does real estate have a duration that matches that of pension fund liabilities? This is not easy to answer in the abstract, since property assets do not return capital to investors at a pre-defined time. The average new lease length in the UK is currently around 14 years; however, the average holding period is lower at around seven to ten years. Lease lengths vary between continental European economies, but are generally shorter; holding periods, however, are generally longer. The duration of pension fund assets is even more difficult to estimate, although we can be confident that it has declined over the past twenty years as the population has aged and workers have put more reliance on private pension schemes (as opposed to non-funded "hand to mouth" state schemes).

Critically, different funds will have different liability durations. A brand new pension fund whose members are all in their twenties will not start to pay out for 40 years; on the other hand, a mature fund that is closed to new entrants may have liabilities with a duration of only a few years. Overall, it does not seem unreasonable to suppose that, on average, real estate has a duration that is a fair match for at least a significant part of the average pension fund's liabilities, especially in the case of those funds that are relatively mature. But the extent of this match will vary significantly between funds.

One critical aspect of this is leverage. Real estate investments are very often leveraged; and leverage reduces duration since the effect of changes in interest rates on asset values are partially cancelled out by changes in debt values[14]. Giliberto (1989) shows that relatively modest amounts of leverage can reduce the duration of real estate investments to zero or lower.

Finally, we refer back to the discussion of the high and stable income yield associated with real estate. It is possible to think of a pension fund's liabilities as having two components: pensions currently in payment, where liquidity requirements are immediate and known within fairly narrow boundaries; and pensions not yet drawn, where the liabilities are of less certain magnitude and liquidity is not required immediately. The income component of real estate returns is clearly well-matched to the former, while equity-type exposure – including exposure to the capital value component of real estate returns – seems better matched to the latter. As noted earlier, income accounts for around 70% of total returns in the long run. As pension funds become more mature, this stable income element will undoubtedly seem an attractive match for liabilities, particularly since, as already discussed, it seems to be well correlated with nominal variables such as average earnings.

[14]For example, if interest rates rise then the value of the asset falls; but the value of the debt (defined as the present value of the interest and capital repayments) also falls, diluting the effect on the investor's net equity position.

Summary and conclusions

It is now time to gather together the strands that have made up this paper and to reach tentatively towards a conclusion. We started by looking at current allocations to real estate among European pension funds. These vary hugely, from under 1% in some countries to over 20% in others. On a GDP-weighted basis, the average holding is of the order of 6%.

We then investigated the size of the invested universe available to European investors, and concluded that real estate made up around 10% of that universe. If we assume that all investors are rational and all asset markets efficient, then theory suggests that the actual allocation is also the optimal allocation. Even if we fail to swallow this – and the assumptions are admittedly bold – it seems implausible that pension funds should wish to hold less that their "fair" share of the invested universe, given the attractive qualities real estate possesses in relation to pension funds' investment aims. At the very least, it seems there is no practical barrier in terms of investibility to pension funds expanding their current allocation considerably.

We then looked at real estate's characteristics as an investment asset. This issue is clouded by well-known difficulties in measuring real estate performance. After looking at these and making some attempt to deal with them, we concluded that real estate;

(i) has a high and stable income yield which seems to be well correlated with average earnings growth;

(ii) has total returns that are poorly correlated with other asset classes.

These characteristics were key drivers of the conclusions reached in the next two sections. We conducted a mean-variance optimisation exercise for all European countries for which we could assemble sufficient data. This resulted in average real estate weightings over the possible return spectrum ranging from 8% to 35% depending on the country, with an average weighting of 24%. There are some reasons to think that these results may still be somewhat generous to real estate.

Finally, we looked at the role of real estate in matching pension fund liabilities. We noted that it has a number of characteristics that in principal make the asset relatively well suited to liability matching – although we also noted that the results of any formal asset-liability modelling exercise are highly dependent on the assumptions that are fed into it, and could vary very significantly between funds. We also reported the results of two more formal asset-liability modelling exercises conducted for the US and UK, both of which indicate an average real estate allocation of a little over 15%.

If we interpret these results conservatively, we might conclude that *an average European pension fund should probably seek to hold between 10% and 15 % of its assets in real estate*. It should be stressed that this result is not only subject to a considerable margin of error, but will also vary significantly between funds, and is likely to be especially dependant on their specific liability profiles. It is worth noting that our results are fairly closely aligned with the recommendations currently being promoted by a number of actuarial practices.

We have navigated an uncomfortably complex course to arrive at this simple yet still frustratingly vague conclusion. But the implication is that European pension funds currently hold only around half of their optimal real estate allocation, and this is very significant. Even if nothing else changed, this could generate substantial new investment inflows to real estate. Based on the Mercer figures quoted at the start of this paper, a shift to a 10-15% allocation would result in an additional inflow of net real estate investment from pension funds of between €150 and €350 billion (and if all investors adopted a similar re-weighting strategy the net new investment required could be of the order of €1 trillion). However, this assumes a static pension pool. With populations aging, and state “pay as you go” pension systems failing, across Europe, it is reasonable to expect the pool itself to grow over the next few decades.
It seems, therefore, that the new interest shown in the asset class by institutional investors over the past couple of years still has some considerable way to run.

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