

# Property Derivatives in the Strategic Asset Allocation

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## Motivation I

- ▶ real estate as a major asset class
- ▶ real estate's characteristics:
  - ▶ stability of their values
  - ▶ opportunity to hedge against inflation
  - ▶ specific risk-return characteristics
  - ▶ low co-movements with traditional stock and bond markets
  - ▶ lot size transformation
  - ▶ transaction costs
  - ▶ no short possibility

However, insufficient asset class for individuals!?

## Motivation II

### Benefits from property derivatives

- ▶ term transformation and liquidity
- ▶ transaction costs
- ▶ bridge finance and efficient leverage
- ▶ short possibility
- ▶ lot size transformation
- ▶ diversification
- ▶ alpha generating
- ▶ physical portfolio management
- ▶ no property knowledge

## Motivation III

### Drawbacks from property derivatives

- ▶ price to pay
- ▶ mark to market risk
- ▶ counterparty risk
- ▶ liquidity drying up
- ▶ lack of traditional alpha
- ▶ underlying risk

## Motivation IV

### UK IPD Certificate: Key Features

- ▶ underlying: IPD UK Annual Index under "All Properties TR"
- ▶ "100% exposure to physical UK commercial property"
- ▶ Issuer: Goldman Sachs Jersey (Limited)
- ▶ Guarantor: Goldman Sachs Europe and The Goldman Sachs Group, Inc. (A, A1, A+; outlook: -, -, )
- ▶ minimum investment: GBP 10.00
- ▶ issue date: 26 June 2006
- ▶ expiry date: 31 March 2011
- ▶ liquidity: continuously quoted on the LSE
- ▶ fixed leg: 2.80% p.a.

## Motivation V

Studies suggest a optimal allocation of real estate in a mixed asset portfolio of 5-25% (for an overview see e.g. Hoesli, Lekander and Witkiewicz (2004)).

The difference between suggested and actual allocation to real estate is considered to be a puzzle in real estate research (Chun, Sa-Aadu and Shilling (2004)).

Can property derivatives solve this puzzle?

- ▶ mean-downside-risk analysis
- ▶ by using forward contracts with optimal hedge ratios
- ▶ 130/30-portfolio strategy
- ▶ comparison between ex ante and ex post adjustments

# Data Collection

- ▶ included asset classes: stocks, bonds, and real estate derivatives
- ▶ based on quarterly data from Q1 1996 to Q4 2008
- ▶ investment countries: the USA, the UK, France (FRA), and Germany (GER)



# Interpolation

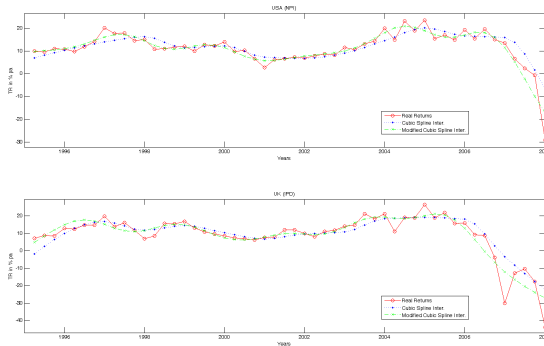
Problem: For FRA and GER only annual real estate data

Solution: Interpolation?!

- ▶ Nearest neighbor interpolation
- ▶ Linear interpolation
- ▶ Cubic spline interpolation
- ▶ Modified cubic spline interpolation
- ▶ Monte-Carlo simulation

# Interpolation Comparison

Figure: Comparison of different Spline Interpolation Methods



## Estimation Errors for the USA

The nearest neighbor interpolation (NNI), the linear interpolation (PLI), the cubic spline interpolation (CSI), the modified cubic spline interpolation (MCSI), and the Monte-Carlo simulation (MCS), are compared with the real returns (RR) by dint of the mean ( $\mu$ ), the standard deviation ( $\sigma$ ), the coefficient of variation (CV), the mean squared error (MSE), and the root mean squared error (RMSE).

|          | RR    | NNI   | PLI   | CSI   | MCSI  | MCS   |
|----------|-------|-------|-------|-------|-------|-------|
| $\mu$    | 11.47 | 11.36 | 11.74 | 11.94 | 11.39 | 11.37 |
| $\sigma$ | 7.67  | 6.43  | 4.94  | 4.87  | 6.89  | 6.66  |
| CV       | 0.67  | 0.57  | 0.42  | 0.41  | 0.60  | 0.59  |
| MSE      | 0     | 20.35 | 15.67 | 17.26 | 7.82  | 21.89 |
| RMSE     | 0     | 4.51  | 3.96  | 4.16  | 2.80  | 4.68  |

Table: Estimation Errors for the USA

# AA in a Shortfall-Risk Framework I

Initial Position: International Asset Allocation

- ▶ no normality
- ▶ different currency areas

Research design:

- ▶ Mean-Downside-Risk Analysis
- ▶ by using forward contracts with optimal hedge ratios
- ▶ 130/30-portfolio strategy
- ▶ comparison between ex ante and ex post adjustments
- ▶ stochastic dominance analysis (EWP, MRP, TP)

## AA in a Shortfall-Risk Framework II

Modifying Harlow (1991), the optimization approach is defined as:

$$\min_{x_i} \rightarrow \frac{1}{T} \sum_{t=1}^T \max \left( r_{f;t} - \sum_{i=1}^N x_i R_{i;t}; 0 \right)^2, \quad (1)$$

subject to the constraints:

$$\sum_{i=1}^N x_i \bar{R}_i = \bar{R}_P,$$

$$\sum_{i=1}^N x_i = 1,$$

$$\sum_{i=1}^N (x_i | x_i < 0) \geq -0.3,$$

$$i = 1, 2, \dots, N.$$

## AA in a Shortfall-Risk Framework III

- $T$  is the number of observed periods,
- $\bar{R}_i$  is the mean return on the asset alternative  $i$  over all periods,
- $\bar{R}_P$  is the prescribed portfolio return,
- $x_i$  is the portfolio weight of asset alternative  $i$ , and
- $r_{f;t}$  is the risk free rate at the beginning of period  $t$ .

## AA in a Shortfall-Risk Framework IV

- ▶ the returns are realized in different currency areas
- ▶ the returns has to be converted for an euro-investor

$$R_i = (1 + R_i^a)(1 + e^a) - 1 = R_i^a + e^a + R_i^a e^a \quad (2)$$

$R_i^a$  is the the uncertain monthly return on asset alternative  $i$  in country  $a$ , and

$e^a$  is the exchange rate return between the euro and the foreign currency area.

## AA in a Shortfall-Risk Framework VI

$$R_i^h = R_i + h_i (f^a - e^a) \quad (3)$$

The forward premium  $f^a$  between currency  $a$  and the euro is defined as:

$$f^a = \frac{F_{t+1}^a - S_t^a}{S_t^a} \quad (4)$$

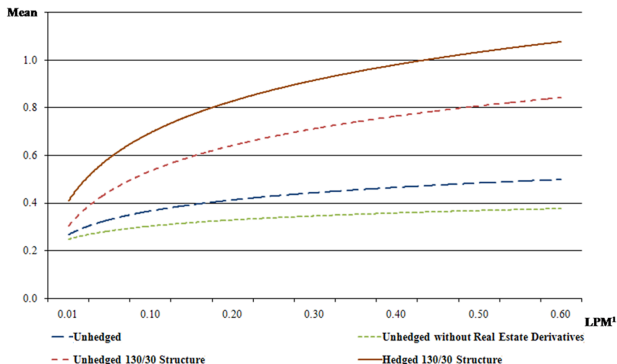
$F_{t+1}^a$  is the forward price at the point in time  $t$  for the delivery of the currency at the point in time  $t + 1$  from the perspective of the home country, and  
 $h_i$  is the hedge ratio.



# Preliminary Results

monthly data from 1998-2008/6;  $mean - lpm^1$

Figure: Efficient Portfolio Sets



# Preliminary Results

Figure: Optimal Weights for the MRP and TP Portfolios

|                                | Stocks |       |       |       | Bonds  |       |       |        | Property Index Certificates |       |      |        |
|--------------------------------|--------|-------|-------|-------|--------|-------|-------|--------|-----------------------------|-------|------|--------|
|                                | USA    | UK    | FRA   | GER   | USA    | UK    | FRA   | GER    | USA                         | UK    | FRA  | GER    |
| <b>Hedged 130/30 Structure</b> |        |       |       |       |        |       |       |        |                             |       |      |        |
| <b>Stocks and Bonds</b>        |        |       |       |       |        |       |       |        |                             |       |      |        |
| MRP                            | 0.36   | -0.08 | 0.16  | -0.32 | -0.47  | -3.32 | 72.61 | 31.06  | -                           | -     | -    | -      |
| TP                             | 0.08   | -0.60 | 0.95  | -0.41 | -28.98 | 1.52  | 5.44  | 122.01 | -                           | -     | -    | -      |
| <b>Stocks, Bonds, and PICs</b> |        |       |       |       |        |       |       |        |                             |       |      |        |
| MRP                            | -0.27  | -0.34 | 0.05  | 0.19  | -9.53  | 14.80 | 95.42 | 3.51   | 13.83                       | -0.56 | 2.21 | -19.75 |
| TP                             | -0.30  | -0.27 | -0.39 | 0.40  | -12.91 | 23.13 | 75.31 | 0.01   | 25.65                       | -4.83 | 5.51 | -11.30 |

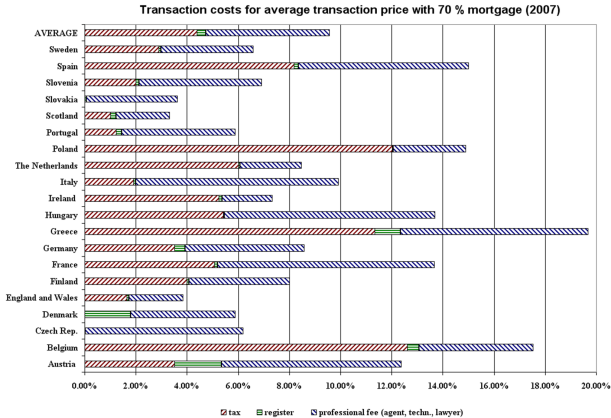
## Market Capitalization

| <b>Country</b>             | <b>Stocks</b> | <b>Bonds</b> | <b>Real Estates</b> |
|----------------------------|---------------|--------------|---------------------|
| United States              | 13,552.2      | 4,478.3      | 1,287.2             |
| People's Republic of China | 4.230.2       | 1,136.7      | NA                  |
| Japan                      | 3.211.0       | 4,854.4      | 201.2               |
| United Kingdom             | 2.621.5       | 613.5        | 411.3               |
| France                     | 1.882.8       | 954.6        | 203.3               |
| Germany                    | 1.430.5       | 946.4        | 277.6               |
| Source                     | World Bank    | BIS          | IPD                 |

Table: Market Size in 2007 (billion euro)

# Transaction Costs

Figure: Transaction Costs



## Transaction Costs

Total annualised cost of buying a commercial property unit trust and selling it after 5 years

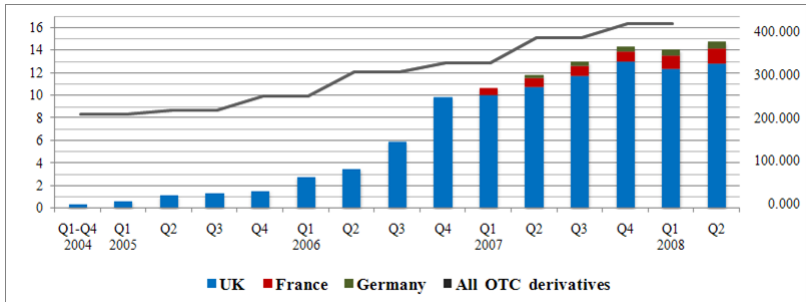
| <b>Country</b> |       |
|----------------|-------|
| United States  | 0.75% |
| United Kingdom | 0.25% |
| France         | 0.50% |
| Germany        | 0.35% |

Source: GS (2008)

Table: Transaction Costs

# Trading Volumes

Figure: Notional Amount of Derivatives



(in billion euro)