Property Derivatives in the Strategic Asset Allocation

ERES 2009 - Doctoral Session

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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 an 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

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Property Derivatives in the Strategic Asset Allocation
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).

<table>
<thead>
<tr>
<th></th>
<th>RR</th>
<th>NNI</th>
<th>PLI</th>
<th>CSI</th>
<th>MCSI</th>
<th>MCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\mu$</td>
<td>11.47</td>
<td>11.36</td>
<td>11.74</td>
<td>11.94</td>
<td>11.39</td>
<td>11.37</td>
</tr>
<tr>
<td>$\sigma$</td>
<td>7.67</td>
<td>6.43</td>
<td>4.94</td>
<td>4.87</td>
<td>6.89</td>
<td>6.66</td>
</tr>
<tr>
<td>CV</td>
<td>0.67</td>
<td>0.57</td>
<td>0.42</td>
<td>0.41</td>
<td>0.60</td>
<td>0.59</td>
</tr>
<tr>
<td>MSE</td>
<td>0</td>
<td>20.35</td>
<td>15.67</td>
<td>17.26</td>
<td>7.82</td>
<td>21.89</td>
</tr>
<tr>
<td>RMSE</td>
<td>0</td>
<td>4.51</td>
<td>3.96</td>
<td>4.16</td>
<td>2.80</td>
<td>4.68</td>
</tr>
</tbody>
</table>

Table: Estimation Errors for the USA
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:

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

subject to the constraints:

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

\[
\sum_{i=1}^{N} x_i = 1,
\]

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

\[
i = 1, 2, ..., N.
\]
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

\[ R_i = (1 + R_i^a) (1 + e^a) - 1 = R_i^a + e^a + R_i^a e^a \]  

\( R_i^a \) 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.
The forward premium $f^a$ between currency $a$ and the euro is defined as:

$$f^a = \frac{F^a_{t+1} - S_t^a}{S_t^a}$$  \hspace{1cm} (4)$$

$F^a_{t+1}$ 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

<table>
<thead>
<tr>
<th></th>
<th>Stocks</th>
<th></th>
<th></th>
<th></th>
<th>Bonds</th>
<th></th>
<th></th>
<th>Property Index Certificates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>USA</td>
<td>UK</td>
<td>FRA</td>
<td>GER</td>
<td>USA</td>
<td>UK</td>
<td>FRA</td>
<td>USA</td>
</tr>
<tr>
<td><strong>Hedged 130/30 Structure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stocks and Bonds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MRP</td>
<td>0.36</td>
<td>-0.08</td>
<td>0.16</td>
<td>-0.32</td>
<td>-3.32</td>
<td>72.61</td>
<td>31.06</td>
<td></td>
</tr>
<tr>
<td>TP</td>
<td>0.08</td>
<td>-0.60</td>
<td>0.95</td>
<td>-0.41</td>
<td>-28.98</td>
<td>1.52</td>
<td>5.44</td>
<td>122.01</td>
</tr>
<tr>
<td>Stocks, Bonds, and PICs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MRP</td>
<td>-0.27</td>
<td>-0.34</td>
<td>0.05</td>
<td>0.19</td>
<td>-9.53</td>
<td>14.80</td>
<td>95.42</td>
<td>3.51</td>
</tr>
<tr>
<td>TP</td>
<td>-0.30</td>
<td>-0.27</td>
<td>-0.39</td>
<td>0.40</td>
<td>-12.91</td>
<td>23.13</td>
<td>75.31</td>
<td>0.01</td>
</tr>
</tbody>
</table>
# Market Capitalization

<table>
<thead>
<tr>
<th>Country</th>
<th>Stocks</th>
<th>Bonds</th>
<th>Real Estates</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>13,552.2</td>
<td>4,478.3</td>
<td>1,287.2</td>
</tr>
<tr>
<td>People’s Republic of China</td>
<td>4,230.2</td>
<td>1,136.7</td>
<td>NA</td>
</tr>
<tr>
<td>Japan</td>
<td>3,211.0</td>
<td>4,854.4</td>
<td>201.2</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>2,621.5</td>
<td>613.5</td>
<td>411.3</td>
</tr>
<tr>
<td>France</td>
<td>1,882.8</td>
<td>954.6</td>
<td>203.3</td>
</tr>
<tr>
<td>Germany</td>
<td>1,430.5</td>
<td>946.4</td>
<td>277.6</td>
</tr>
</tbody>
</table>

Source: World Bank, BIS, IPD

Table: Market Size in 2007 (billion euro)
The values for Belgium, the United Kingdom, Australia, Hong Kong, Japan, Singapore, and the United States are averaged subject to the different legal basis points in their countries.
Transaction Costs

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

<table>
<thead>
<tr>
<th>Country</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>0.75%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>0.25%</td>
</tr>
<tr>
<td>France</td>
<td>0.50%</td>
</tr>
<tr>
<td>Germany</td>
<td>0.35%</td>
</tr>
</tbody>
</table>

Source: GS (2008)

Table: Transaction Costs
Trading Volumes

Figure: Notional Amount of Derivatives

(in billion euro)