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Alternative asset classes: Why and what to model, and considerations for risk management

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Over the last decade, alternative asset classes have drawn significant attention among life insurance and pension companies as part of their strategic asset holdings along with traditional investments like government and corporate bonds or equities. In this context, this paper explores the challenges on the modelling of alternative asset classes and main considerations for risk management in different geographies.

Highlights of current opportunities related to investments in alternative asset classes

The attractiveness of alternative asset classes can be attributed to the following factors:

- While providing a similar or even higher upside potential that is comparable to traditional assets offering reward for taking risk (like equities or corporate bonds), they are believed to offer good diversification benefits due to relatively low correlation with those assets.
- Apart from risk premium, alternative asset classes also offers a significant illiquidity premium. Insurance and pension companies are more willing to invest in illiquid long-term assets than other industries as their liabilities can be very long and illiquid. It is particularly true for, e.g., payout annuity providers with very predictable cash flows that may be practically certain about being able to hold their investments to maturity regardless of external circumstances.
- Alternative investments start to play a very important role in promoting investing in line with Environmental, Social and Governance (ESG) principles, whether it relates to private equity, private debt or infrastructure-related investments.

Some popular examples of alternative asset classes include:

- Private equity (PE) in different investment styles (venture, buyout or growth capital)
- Hedge funds
- Private debt, e.g., small and medium enterprise (SME) lending, infrastructure debt, real estate debt, collateralised loan obligations (CLOs) etc.
- Infrastructure-related instruments
- Real estate (direct and indirect)
- Commodities

REGULATORY TREATMENT

There seems to be a consensus between asset managers in different markets that alternative asset classes may create great investment opportunities for institutional investors. Insurance and pension companies could be particularly inclined to invest in alternative assets as the nature of their business justifies illiquid commitments, which could be much more problematic for, e.g., mutual funds.

However, at this moment there is no such consensus between regulators and regimes for setting up capital requirements. For example, in many of the capital regimes, recognition of diversification benefits is not possible if, e.g., private equities are covered together with other equity investments (implying a correlation of 1.0). There could be also other regulatory limits prohibiting or limiting possibilities of investments in certain asset classes. As such, the level of “regulatory incentive” is another very important factor driving the actual attitude of companies toward investing in alternative asset classes.

In the next section we discuss the risk management practices and regulatory treatments of alternative asset classes in four major economies: US, Japan, UK and EU.

Investment, risk management and regulatory practices in different markets

USA

Under the US statutory framework, risk-based capital (RBC) is a critical tool used by regulators to monitor the solvency of life insurance companies. It establishes an objective standard for identifying companies with potentially weak capitalisation, which prompts companies to take corrective actions before triggering regulatory actions. Risk capital for asset credit risk follows a factor-based approach. The regulations have been evolving to reflect current market happenings and recent historical default experiences; some key changes to C1 include expansion of bond categories, revisions to bond capital factors and bond size factors, as well as real estate capital factors. These changes will be adopted starting in the 2021 RBC filing. It remains to be seen whether these capital regulation changes will influence the way US insurers invest, such as increasing their allocations in real estate investments, which now have lower capital factors, or altering the credit quality distribution of their asset portfolios to maximise capital-adjusted yield. Risk capital for interest rate risk is either factor-driven or is based on a conditional tail expectation (CTE) measure of runoff over real world scenarios. Additionally, US statutes recognise diversification (covariance) benefit across risk factors, with equity recognised as a distinct risk factor from credit and interest rates.

Alternative assets reported under Schedule BA with equity characteristics typically have the same treatment as common stock under the RBC framework. These assets have the highest standalone capital requirement, though it can be somewhat offset by diversification benefits. Some alternative assets may qualify for fixed income treatment and hence receive a lower standalone risk capital requirement. The formulas for total life RBC with and without diversification benefit are given below:

$$\text{Total Life RBC without Diversification Benefit} \\ = \mathrm{C_0 + C_{1o} + C_{1cs} + C_2 + C_{3a} + C_{3b} + C_{3c} + C_{4a} + C_{4b}}$$

$$\text{Total Life RBC with Diversification Benefit} \\ = \mathrm{C_0 + C_{4a}} + \sqrt{\mathrm{(C_{1o} + C_{3a})^2 + (C_{1cs} + C_{3c})^2 + (C_2)^2 + (C_{3b})^2 + (C_{4b})^2}}$$

where:

- C_0 is the affiliated asset risk
- C_{10} is the asset risk for other investments
- C_{1cs} is the common stock risk
- C_2 is the insurance risk
- C_{3a} is the interest rate risk
- C_{3b} is the health provider credit risk
- C_{3c} is the market risk
- C_{4a} is the business risk of guaranty fund assessment and separate account
- C_{4b} is the business risk of health administrative expense risk

The tables in Figures 1 and 2 show some simple examples of adding equities to the asset portfolio benefits from the RBC diversification benefit (covariance) formula. Note that the diversification benefit is calculated using only C1 asset risk components. In reality, there may be other diversification benefits from other risk components such as insurance risk.

FIGURE 1: EXAMPLES OF RBC CHARGES (1/2)

Allocation		100% A-rated FI	100% BBB-rated FI	100% Equity
Asset Type	A-rated FI	100.00%	0.00%	0.00%
	BBB-rated FI	0.00%	100.00%	0.00%
	Equity	0.00%	0.00%	100.00%
RBC Charge	Without Diversification	0.68%	1.27%	23.70%
	With Diversification	0.68%	1.27%	23.70%
	Approx. Diversification Benefit	0%	0%	0%

FIGURE 2: EXAMPLES OF RBC CHARGES (2/2)

Allocation		No Equity	5% Equity	10% Equity
Asset Type	A-rated FI	50.00%	47.50%	45.00%
	BBB-rated FI	50.00%	47.50%	45.00%
	Equity	0.00%	5.00%	10.00%
RBC Charge	Without Diversification	0.98%	2.11%	3.25%
	With Diversification	0.98%	1.50%	2.53%
	Approx. Diversification Benefit	0%	0.61%	0.72%

In the table in Figure 3 we also provide the C1 asset charges by credit ratings on bonds and structured securities.

FIGURE 3: C1 ASSET CHARGES BY CREDIT RATINGS ON BONDS AND STRUCTURED SECURITIES

			2021 and Beyond C1 Requirement	
Category		**MIS Rating**	**Before Tax**	**After Tax**
NAIC 1	Exempt	Exempt	-	-
NAIC 1	1.A	Aaa	0.16%	0.13%
NAIC 1	1.B	Aa1	0.27%	0.23%
NAIC 1	1.C	Aa2	0.42%	0.35%
NAIC 1	1.D	Aa3	0.52%	0.44%
NAIC 1	1.E	A1	0.66%	0.55%
NAIC 1	1.F	A2	0.82%	0.68%
NAIC 1	1.G	A3	1.02%	0.85%
NAIC 2	2.A	Baa1	1.26%	1.05%
NAIC 2	2.B	Baa2	1.52%	1.27%
NAIC 2	2.C	Baa3	2.17%	1.80%
NAIC 3	3.A	Ba1	3.15%	2.62%
NAIC 3	3.B	Ba2	4.54%	3.77%
NAIC 3	3.C	Ba3	6.02%	5.01%
NAIC 4	4.A	B1	7.39%	6.15%
NAIC 4	4.B	B2	9.54%	7.93%
NAIC 4	4.C	B3	12.43%	10.34%
NAIC 5	5.A	Caa1	16.94%	14.10%
NAIC 5	5.B	Caa2	23.80%	19.80%
NAIC 5	5.C	Caa3	30.00%	24.96%
NAIC 6 / Equity	6	D	30.00%	23.70%

The standard appraisal approach for US insurance business is focussed on a real-world present value of distributable earnings (PVDE) runoff measure under statutory accounting. In the US, risk management generally tends to focus on the impact to risk-adjusted earnings, change in capital or related outcomes under different market scenarios. It is increasingly common to see insurers look at PVDE under these scenarios. We also consider this among industry best practices when it comes to asset-liability management (ALM) and strategic asset allocation (SAA) analyses, though significant variability does exist here.

Most companies use real-world assumptions for setting SAA, but the degree to which insurers incorporate liability information varies widely. Some companies use simple, static replicating portfolios to represent the liability, while others employ more sophisticated models of distributable earnings. The risk measure for SAA also varies. Traditionally, SAA modelled portfolio returns against volatility, but alternative risk measures include drawdown risk, conditional tail expectation, value-at-risk, variability of distributable earnings or loss under a specific adverse market event.

Companies' risk practices also often incorporate additional objectives besides PVDE stabilisation, such as management of their credit ratings, financial reporting balance sheet or liquidity risks. Other regulatory environments, such as in Bermuda, may be very relevant to parts of US companies' balance sheets, in particular those with reinsured business to Bermuda, and introduce additional market-consistent valuation measures. Insurer tax obligations also flow from both, so there is a complex interaction between the two regimes that has risk management implications.

Since the global financial crisis of 2007-2010, the life industry has also seen the growing prominence of private equity-backed insurance groups. These insurers, through organic growth and acquisitions of in-force blocks from large life insurance companies, have accumulated sizeable asset portfolios, which they have invested quite differently from many traditional life insurers. Notably, PE firms have significantly increased their holdings in alternative and structured asset classes. Their restructuring of the portfolio and investment strategies lead to different risk, return and liquidity characteristics compared to a more traditional public fixed income asset portfolio, which historically formed the bedrock of life insurer general accounts.

The apparent success of PE-owned life insurers, combined with the challenges brought by the continuing low interest rate environment, has caused many other life insurers to explore investing more heavily in these alternative assets, through third-party subadvisor relationships or reinsurance, or by expanding the mandates of their in-house asset managers. Consequently, as of 2020, insurer allocations to private bonds have increased to 37.6% of total bonds, structured assets account for another 22.9% of total bonds and schedule BA assets now account for 6.3% of all unaffiliated investments.[1]

The increased attention being paid to Environmental, Social and Governance (ESG) issues by institutional investors has further driven interest in nontraditional, alternative asset classes like infrastructure among US life insurers. Given the apparent persistency of low interest rates in advanced economies, insurers will continue to explore new opportunities for purchasing higher-yielding assets. As such, it is unlikely that current investment levels in alternatives are nearing a maximum, and we should expect to see more interest in these asset classes as barriers to access continue to weaken via expansion of expertise, greater origination and fewer potential regulatory hurdles for ESG-supporting securities.

JAPAN

Due to the longstanding low interest rate environment, Japanese life companies have been increasing alternative investments, which include various private equity/debt and venture capital funds, real estate and real estate investment trusts (REITs), hedge funds, infrastructure investments and other strategic funds such as absolute return, long/short, market-neutral etc. Many investors believe that alternative investments have a benefit of diversification effect that is better than with traditional assets. Recently, life companies have been active in infrastructure investments as a way to increase asset duration and reduce mismatch with liability duration as well as promoting ESG investments. Note that there are no regulatory restrictions on the type and volume of invested assets for Japanese life companies.

[1] Fiona Ng et al. (2021). Asset Allocations and Investment Strategies of US Life Insurers in a Low Interest Rate Environment.

Solvency regulation in Japan is so-called Solvency Margin Standard. Similar to RBC in the US, market risk is calculated by multiplying a risk factor to market value of invested assets, where the risk factor is defined by major asset class. As for alternative investments, companies apply risk factors of equity, real estate or bond, depending on the type and credit rating of the underlying assets. Currency risk is also considered when assets are denominated in non-Japanese yen. The Japanese regulator intends to introduce economic-based solvency regulation in 2025 to be consistent with the Insurance Capital Standard (ICS) developed by the International Association of Insurance Supervisors (IAIS), which may affect a company's preferred choice of alternative investments.

As for internal risk management, most companies monitor value at risk (VaR) for the market risk of alternative investments. VaR is generally calculated by using the historical data of the invested funds or a benchmark index when historical data is not sufficient. For example, several benchmark indices are published by different types of hedge funds. Because fund return may not follow normal distribution, other metrics such as tail VaR (T-VaR) and maximum drawdown need to be monitored to check downside risk. Also, stress testing is performed to analyse the impact on the balance sheet. The Sharpe ratio is used as a metric of investment performance. In addition to these quantitative analyses, companies conduct qualitative analysis by interviewing fund managers.

EUROPEAN UNION (SOLVENCY II PERSPECTIVE)

Starting from 2016, the Solvency II regime for setting out capital requirements has been implemented across the EU. Solvency II is based on the three pillars:

- Pillar 1: Quantitative capital requirements.
- Pillar 2: Governance, risk management and supervisory process.
- Pillar 3: Rules about disclosures.

The Solvency Capital Requirement (SCR) is calculated under Pillar 1. The SCR can be calculated either with the standard formula or with full or partial internal models. The standard formula is a risk-based capital formula in which different risks are organised into risk modules (market risks, counterparty default risks, life underwriting risks, non-life underwriting risks, health underwriting risks and, at the top, operational risks) and each of the modules is organised in submodules. For example, submodules of market risks are interest rate risk, equity risk (divided into so-called Type 1 and Type 2 equities), spread risk, foreign exchange (FX) risk, property risk and concentration risk. Correlations are applied at both levels: between submodules within each module, and between different modules, which enables us to broadly consider diversification effects. Additionally, standard formula companies have to assess internally whether all material risks faced by companies are covered by SCR calculations performed with standard formula. If not, a capital add-on needs to be applied, estimated as part of the Pillar 2 Own Risk and Solvency Assessment (ORSA).

Alternatively, companies are allowed to develop internal models in order to calculate SCR, which is defined as a 99.5% quantile of change of own funds over a one-year time horizon. The advantage of internal models is that they allow companies to flexibly design the approach to better reflect the nature of their business. Internal models are of course subject to very strict regulatory approval rules. Generally, developing internal models is a very expensive process, and in reality mainly large insurance groups have decided to invest in internal models (full or partial), while small and medium companies typically opt for the standard formula.

When applying the standard formula, the equity-like alternative asset classes (private equities, hedge funds, commodities) have to be mapped as Type 2 (unlisted) equities, with capital requirements of 49%. This is higher than for listed equities for which the capital requirements amount to 39% (up to a symmetric equity adjustment based on economic conditions in both cases). This can be seen as disincentive for some companies regarding alternative investments. In particular it could be noted that the risk of hedge funds could be materially lower than the risk of private equities,[2] while the same capital provision is applied to both. The Solvency II standard formula

[2] CEIOPS (15 April 2010). Solvency II Calibration Paper (CEIOPS-SEC-40-10). Retrieved 1 February 2022 from https://www.eiopa.europa.eu/sites/default/files/publications/submissions/ceiops-calibration-paper-solvency-ii.pdf.

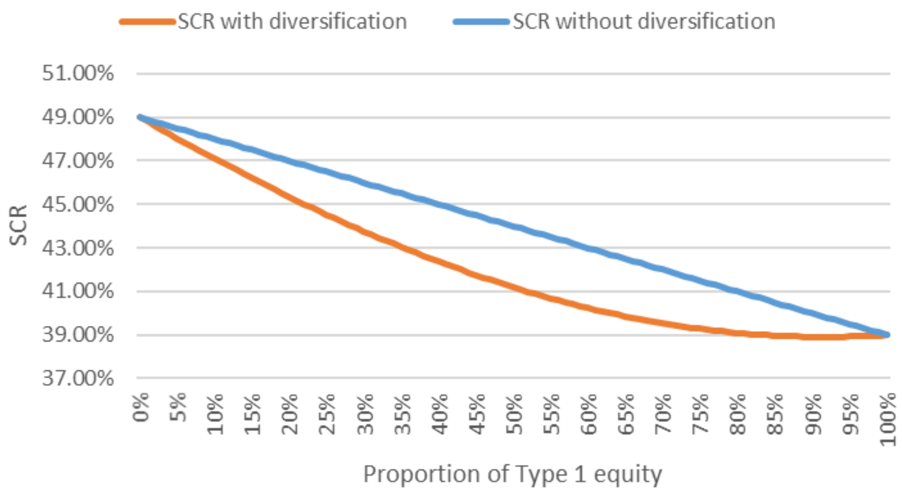
goes one step forward in terms of recognising diversification benefits compared to US or Japanese risk-based capital regimes, as it foresees a fixed correlation of 0.75 between listed and unlisted equities. More specifically, the formula for the capital requirements of the equity submodule is:

$$SCR_{equity} = \sqrt{SCR^2_{Type\ 1} + 2 \times 0.75 \times SCR_{Type\ 1}SCR_{Type\ 2} + SCR^2_{Type\ 2}}\,.$$

where $SCR_{Type\ 1}$ and $SCR_{Type\ 2}$ are, respectively, the capital requirements for Type 1 and Type 2 equities.

In Figure 4, we plot in orange the capital requirement for the equity risk submodule as a function of the proportion of listed equities in a portfolio consisting only of listed equities (Type 1) and equity-like alternative assets (Type 2). For the blue curve (without diversification), the capital requirement is computed as a sum of the capital requirements of each equity type. Note again that the correlation introduced in the standard formula brings a diversification benefit. Moreover, it is even possible to obtain a capital requirement that is slightly below 39% by holding more than 85% of Type 1 equities.

FIGURE 4: EQUITY CAPITAL REQUIREMENT AS A FUNCTION OF THE PROPORTION OF TYPE 1 EQUITIES WITH AND WITHOUT DIVERSIFICATION



For fixed income alternative asset classes, the standard formula might not be friendly in the case of counterparties without credit rating. The standard formula does not require any calculation of liquidity risk under Pillar I, but—as already mentioned—companies with significant exposures in alternative asset classes might be required to report liquidity risk as a significant risk not taken into account in standard formula calculations and to estimate capital add-ons which cover this risk.

In reality internal model companies could get better incentives to invest in alternative asset classes as they are allowed to build and parametrise their own models, which reflect risk and diversification much more closely to the reality. Also, notably capital requirements for asset classes like private equities are likely to be lower under an internal model than under the standard formula after taking into account their illiquid characteristics. However, to enjoy those benefits, companies need to overcome data availability and data quality issues related to illiquid investments.

UK

In the UK market, alternative or “less-liquid” assets have been used by life insurers in several areas. For example, private equity and hedge funds have been used to back with-profits business. Real estate has also been used to back with-profits business and also, more broadly, offered as a fund-based investment option for unit-linked business.

However, in these cases, care is clearly needed to ensure that the overall liquidity of the backing assets remains aligned to the expectations of end consumers in relation to the frequency, ease and speed with which funds can be moved or withdrawn—frequently daily trading without advance notice. Recent history has provided several examples of liquidity-driven challenges in the retail investments space such as the problems that arose during 2019 at the LF Woodford Equity Income Fund,[3] where redemptions exhausted the liquid portion of available assets and, during the market turbulence driven by COVID-19 in spring 2020, a number of real estate funds were forced to suspend redemptions due to uncertainty in the value of the underlying assets. For these funds the liquidity environment remains challenging.[4]

The other, and most significant, area of activity in relation to the deployment by UK life insurers of less-liquid assets relates to payout annuity business. Payout annuity liabilities are highly illiquid and so offer scope to be matched in part with relatively illiquid assets. Under Solvency II the ability of insurers to pursue a long-term buy-and-hold investment strategy for such liabilities and thus to extract an illiquidity premium has been recognised via the Matching Adjustment (MA), which has been widely adopted in the UK with substantial parts of the market having approval to use it. The MA typically ranges from around 50 basis points (bps) to around 150bps, depending on the backing asset portfolio.

Given the significance of the MA and the fact that it allows firms to effectively bank an element of future investment returns in advance, it is no surprise that the Prudential Regulatory Authority (PRA) has been keen to ensure robust governance and risk management around its application. In particular, the PRA has set out its expectations of firms across a number of areas as follows:

- SS3/17 – Solvency II: Illiquid unrated assets. This considers the use of internal credit assessments for assigning a fundamental spread (FS) as well as the particular risk associated with equity release mortgages and income-producing real estate loans.
- SS7/18 – Solvency II: Matching adjustment. This lays out requirements around asset and liability eligibility, matching requirements (including three specific tests which firms must apply) and calculation of the MA and management of the MA portfolio, including ongoing compliance and future changes.
- SS8/18 – Solvency II – Internal models – modelling of the matching adjustment. This considers the allowance to be made for the MA in the SCR, the assessment of the MA under stress conditions and continuing compliance with the MA requirements under stress.
- SS1/20 – Solvency II: Prudent person principle. This has quite a broad sweep but sets out specific expectations in relation to exposures to nontraded assets and associated valuation uncertainty.

However, the PRA has some reservations around how the current MA functions. Work to review the operation of the MA is underway and UK firms have just completed a Quantitative Impact Study (QIS) issued by the PRA. The QIS tests possible alternative constructions for the fundamental spread, with results that are more sensitive to current market spreads and less generous overall.

The result is that investment in less-liquid assets, while potentially rewarding, requires a nontrivial incremental investment from firms across a whole range of capabilities. For example, expertise is required to ensure regulatory compliance (as noted above). Asset origination is a key function where several UK players now have built out their own in-house teams dedicated to building the knowledge and relationships needed. Another area is credit assessment, which is the ability to develop credit ratings internally, as these assets are typically not External Credit Assessment Institutions (ECAI)-rated.

[3] Various sources, e.g., Morningstar, 29 July 2019.

[4] For example, see: https://www.ftadviser.com/investments/2021/06/10/property-funds-suffer-second-worst-month-of-outflows-in-may/.

The challenges in modelling alternative asset classes and related risk

MAIN MODELLING APPROACHES

Once alternative assets are part of the investment strategy, companies need to measure their own risk across geographies with relevant modelling approaches. Some popular modelling approaches for alternative assets are listed below:

- Unsmoothing techniques: Classically used to correct from the autocorrelations of the series of alternative asset classes that distort the standard volatility estimator.
- Explanatory models: The return and volatility of the alternative asset can be modulated by external factors that drive the riskiness of the investment (property value, interest rate, macroeconomic variables over the different geographies etc.).

In the following, we focus more particularly on unsmoothing techniques through a case study.

Assume that one wants to estimate the volatility of several types of private equity (PE) historical returns, while historical time series present a strong autocorrelation leading to a biased estimation of the volatility with the standard estimator. This is precisely the type of framework in which unsmoothing techniques can be used in order to recover an unbiased volatility estimate. The most standard unsmoothing technique consists in modelling the historical returns $(r_t)_t$ as an AR(1) process:

$$r_t = a + b\,r_{t-1} + \epsilon_t$$

where a and b are two real parameters and the $\epsilon_t's$ are i.i.d. noises.

The parameter b, which plays a key role in the unsmoothing approach (see below), can be estimated through a linear regression on the original time series. The purpose of the unsmoothing approach is then to build an adjusted dynamic with zero autocorrelation at first order on which the volatility can be estimated without bias. This adjusted return series can be built as follows:

$$r_t^* = \frac{1}{1-b} r_t - \frac{b}{1-b} r_{t-1}. \qquad (1)$$

One can easily show that $Cov(r_t^*, r_{t-1}^*) = 0$. As $Var(r_t^*) = \frac{1-b^2}{(1-b)^2} Var(r_t)$, the unsmoothing methodology leads to a higher volatility if and only if $b \in (0,1)$.

Such an approach is, however, not adapted if the historical returns have material autocorrelation at both first and second orders. This is for example the case for the historical quarterly returns of three typical PE indices among those presented in the first section above, as shown in the table in Figure 5.

FIGURE 5: EMPIRICAL AUTOCORRELATIONS OF QUARTERLY HISTORICAL RETURNS OF THREE PE INDICES

	PE type 1	PE type 2	PE type 3
First order	40%	35%	-30%
Second order	30%	50%	15%

To deal with this case, one can model the historical returns as an AR(2) process and apply the unsmoothing technique to this process. The AR(2) process can be specified as follows:

$$r_t = \theta(1-b) + (b+\phi)r_{t-1} - b\phi r_{t-2} + \nu_t$$

where θ, b and ϕ are real parameters and $(\nu_t)_t$ is i.i.d. noise.

The adjusted returns $(r_t^*)_t$ are still defined through equation (1), and the underlying volatility can be recovered through:

$$Var(r_t^*) = \frac{1-2b\rho+b^2}{(1-b)^2} Var(r_t) \quad (2)$$

where ρ is the first order autocorrelation of $(r_t)_t$.

Note that this modelling approach has been applied to real estate by Lizieri et al. (2012).[5]

We calibrated this model on the three indices and we computed the volatility of the adjusted returns. We compare them to the volatilities obtained on the original time series in the table in Figure 6.

FIGURE 6: VOLATILITIES OF THE THREE PE INDICES WITH AND WITHOUT UNSMOOTHING

	PE type 1	PE type 2	PE type 3
Volatility of observed returns	17%	12%	15%
Volatility of unsmoothed returns	15%	10%	10%

We observe that the volatility of unsmoothed returns is lower than in the ones estimated in the original time series, which results from equation (2) and the fact that the calibrated values of the parameter b are all negative. We also computed shocks in this model and compared them to the ones determined in historical observed returns and the ones obtained with a first order unsmoothing, as shown in the table in Figure 7.

FIGURE 7: VOLATILITIES OF THE THREE PE INDICES WITH AND WITHOUT UNSMOOTHING

	PE type 1	PE type 2	PE type 3
Shock on observed returns	-36%	-25%	-33%
Shock on first order unsmoothed returns	-50%	-35%	-25%
Shock on second order unsmoothed returns	-33%	-22%	-24%

We observe that the second order unsmoothing yields less adverse shocks than the ones obtained in original historical returns, while the first order unsmoothing yields conservative shocks. This indicates that accounting for higher-order autocorrelation features can allow us to avoid potentially over-prudent shocks.

[5] Lizieri, C., Satchell, S., & Wongwachara, W. (2012). Unsmoothing Real Estate Returns: A Regime-Switching Approach. Real Estate Economics, 40(4), 775-807.

Conclusion

While it is expected that alternative asset classes will continue to be part of the investment strategies of insurance companies across geographies, there are two main challenges for companies to succeed in the transition towards more alternative investments:

- First, leveraging abilities to build an own internal model or risk assessment tool, to better reflect diversification benefits and volatility regimes of those asset classes.
- Second, leveraging the ability to reflect the regulatory treatment of alternative assets in terms of economic capital in the decision by, e.g., including the economic/risk capital charge as a constraint in the optimal allocation design.

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