



# Flylets and fixed-income portfolio risk management

The 'flylet' approach to fixed-income risk management introduces exposure to atypical yield curve moves and allows risk managers to simultaneously hedge on local and global levels. All businesses can benefit, says [Tudor Investment Corporation](#)

## What are flylets and why are they important for fixed-income portfolio risk management?

**Tudor:** One of the main challenges for risk management of fixed-income products arises from the high correlation of interest rates across maturities. This allows practitioners to measure interest rate risk in terms of two or three 'typical' moves, called principal components (PCs), but leaves them exposed to breakdown of the correlation structure. In particular, market-making desks routinely take large notional positions across various maturities, which they hedge with a few on-the-run instruments by offsetting their PC risk, leaving them unprotected in case of idiosyncratic moves in those maturities. What we have proposed is a risk management approach that combines traditional principal component analysis (PCA) – which takes advantage of historically observed behaviour of the yield curves – with exposures to atypical moves. We break down those atypical moves into basic elements called flylets, which represent local deviations from principal components. This allows a systematic way of quantifying interest rate risk that is not captured by PCA.

## What are the main issues addressed in this framework?

**Tudor:** Four drawbacks of the traditional PCA approach have been addressed:

- Requirement of multiple risk limits avoided through a combined risk measure
- Missing convexity also addressed by the combined measure
- Residual risk represented intuitively with a novel flylet basis
- Impact of fat tails taken into account.

## What does a bond portfolio manager need in order to implement the flylet methodology for their risk management?

**Tudor:** The PCA methodology has been a staple of interest rate trading since its introduction by Robert Litterman and Jose Scheinkman in 1991. In addition to historical yield curve moves, PCA requires only standard linear algebra routines. Once the principal components are available, flylets are simply constructed to be orthogonal to PC1 and PC2 and do not require any special analytics. Standard rates and bond analytics can be used to compute sensitivities of portfolios to the principal components and flylets that are used in the framework.

## What other asset classes can benefit from the use of flylets?

**Tudor:** Assets that involve a term structure – commodities and credit, for example – will have highly correlated maturities across the curve and could benefit from the use of flylets.

## Why are flylets a more intuitive measure compared with standard PCA?

**Tudor:** Standard PCA works well for low-order risks represented by PC1 and PC2. Representation of residual risks in the PCA framework presents three problems that have vexed practitioners for a quarter of a century. First, the higher-order principal components are less intuitive. While PC1 and PC2 can be interpreted as the level and slope of the yield curve – and PC3 as twist – higher-order PCs cross zero at multiple points across the curve and are hard to grasp. Second, higher-order PCs have lower variance, which decreases with order, and are therefore harder to estimate due to numerical errors. Third, PCs are global in nature, and exposure to higher-order PCs will include all the points on the yield curve. As a result, representing risks with principal components beyond the first few is unintuitive, unreliable and global by construction. On the other hand, flylets are:

- Intuitive – they are just curve flies, albeit with non-standard weights
- Robust – all flylet volatilities are of the same order of magnitude
- Local by construction – they represent the local curvature of the yield curve.

## What types of institution would benefit from their implementation?

**Tudor:** Both buy-side and sell-side firms can benefit from implementing this framework. For buy-side firms, flylets and invariant risk metrics can facilitate risk management at a book and firm level, and provide a common basis for communication. For example, the invariant risk measure encapsulates all the PC1 and PC2 risks, including convexity effects, in one number, so trading desks and risk managers can focus on the overall risk rather than individual limits. Flylets bring to light the risks not captured by the first two PCs and give a clearer picture of leverage and residual risk. On the sell side, the flylet framework can benefit dealers immensely by allowing them to avoid unexpected profit and loss swings by providing them a clear view of risks lurking in the space orthogonal to PC1 and PC2.