

FAT-TAIL MULTI-ASSET CLASS RISK MODEL

› FactSet's multi-asset class (MAC) risk models have been designed and developed to serve risk and portfolio managers' growing need for reliable monitoring and proactive management of multi-asset class investment portfolios.



With FactSet's Fat-Tail Multi-Asset Class (FT MAC) risk model, we take the next step towards answering the need for predictable risk analytics and providing best-in-class solutions to the FactSet client base.

Risk management represents a critical ingredient in the investment decision-making process, and the reliability and predictability of risk estimates has become increasingly important to it. Estimates require capturing the complexity of the market dynamics, such as excessive probability of extreme events, dependencies in the occurrence of large (negative or positive) returns across markets, volatility clustering, and asymmetry of the assets' return distribution.

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MOTIVATION

Looking back to the last three to four decades, financial markets have been characterized by periods of “normal” behavior, followed by shorter periods exhibiting higher probability of extreme events, i.e. turbulence. The variable nature of turbulence, both across markets and through time, demonstrates the importance of understanding, measuring, and incorporating it into the risk modeling process. Consider the following:

- Traditional risk model assumptions (Gaussian) can suffer in times of market turbulence by assigning low probabilities to extreme events.
- Proper capture of both upside and downside extreme events identifies true drivers and diversifiers of risk, as well as assets with safe upside potential, providing insights that contribute to enhanced portfolio performance.
- A high-quality model must therefore be able to incorporate dynamic probability of extreme events, tail dependence, and asymmetry.
- However, the model should be sensitive to said market turbulence and in times of calm should echo the investment opportunities of traditional models.
- The model should cater to the needs of portfolio risk managers and regulatory reporting workflows by improving VaR exceedances and avoiding assigning unnecessarily high levels of risk during calm markets.

MODEL OVERVIEW

FactSet’s fat-tail modeling methodology incorporates dynamic probability of extreme events, tail dependence, and asymmetry. The introduction of this new approach improves VaR backtesting results on the risk factor, asset, and portfolio levels, and provides further trustworthiness of the portfolio risk forecasts. It also provides a dynamic view on possible extreme events of the risk factors and assets by accurately capturing the degree of tail-fatness and skewness exhibited in their returns distribution.

FactSet’s FT MAC risk model enhances the scenario generation methodology of the MAC model, allowing each risk factor to follow a dynamic fat-tailed distribution and capturing tail-dependence via a copula function. This new risk model incorporates the existing factor structure of the FactSet Multi-Asset Class (MAC) risk model while applying the fat-tail methodology described in this summary.

More information on the underlying factor structure, Monte Carlo simulation process, and covariance matrix construction can be found in the *FactSet Multi-Asset Class (MAC) Risk Model* whitepaper.

FIGURE 1: NORMAL DISTRIBUTION

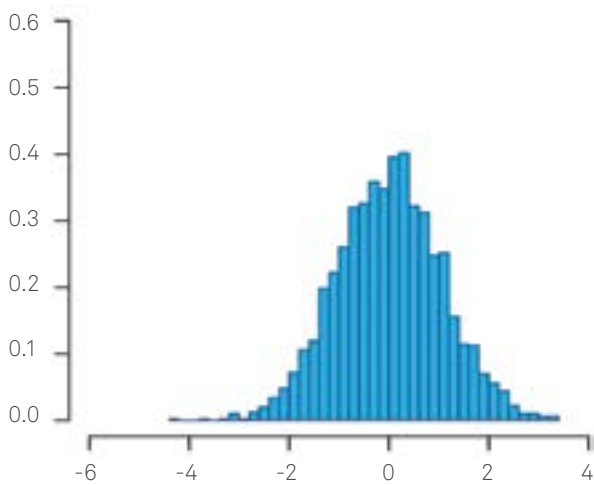
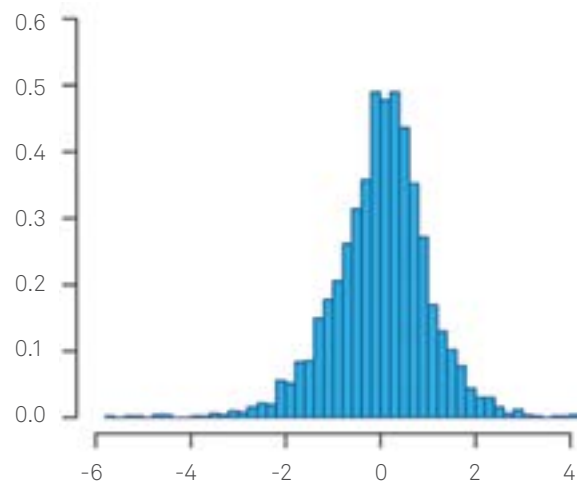


FIGURE 2: FAT-TAIL DISTRIBUTION



VOLATILITY MODEL

- The volatility estimation procedure employed combines an EWMA estimator with a Classical Tempered Stable distribution.
- This method is aimed at assessing the level of volatility of portfolios over a short horizon, and benefiting from a procedure that puts emphasis on recent observations.

MARGINAL DISTRIBUTION MODEL

- The distribution model used within the Fat-Tail MAC model is the family of tempered stable distributions. Loosely speaking, this class is an extension of the Gaussian case providing an additional set of parameters—and, controlling for the tail-fatness and skewness of the distribution.
- Like the normal distribution, tempered stable distributions allow for cross-sectional summing up of asset distributions, time-aggregation and derivatives pricing.
- The main difference is that tempered stable distributions are able to model market returns behavior—skewness and excess probability of extreme events.



FIGURE 3: CLASSICAL TEMPERED STABLE ALPHA

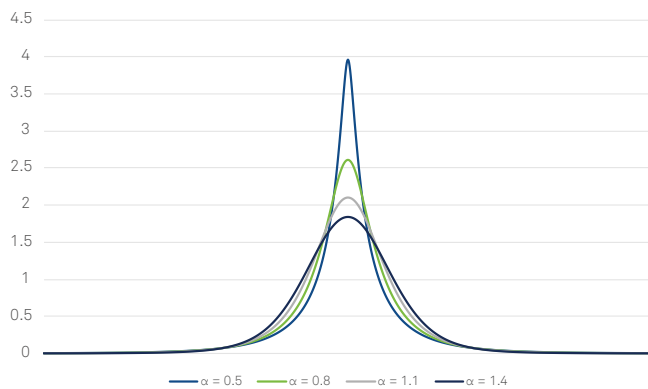
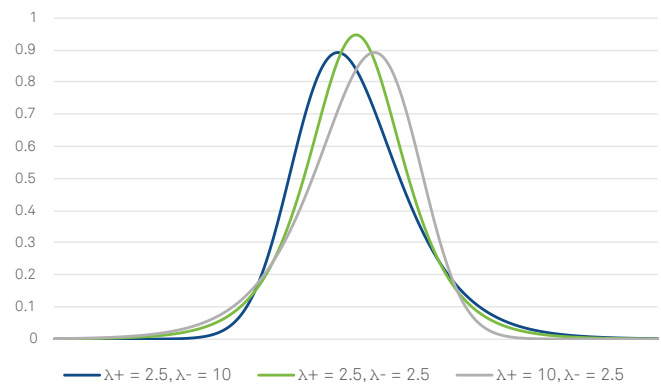


FIGURE 4: CLASSICAL TEMPERED STABLE LAMBIDAS



This new approach provides a dynamic view on possible extreme events of the risk factors and assets by accurately capturing the degree of tail-fatness and skewness exhibited in their returns distribution.

- The model scales volatility through the introduction of a variable to capture market time intensity.
- It also generates leptokurtic returns which are extended with an asymmetric component.
- The model accounts for differences in tail behavior both across assets and through time so that they can be reflected in the risk statistics on marginal and aggregate level.
- The model converges to the Gaussian model when markets are calm and avoids over penalizing risk-adjusted performance by not assigning unnecessarily high levels of risk in calm markets.

FIGURE 5: RUSSELL 1000 VAR TAIL INDICATOR

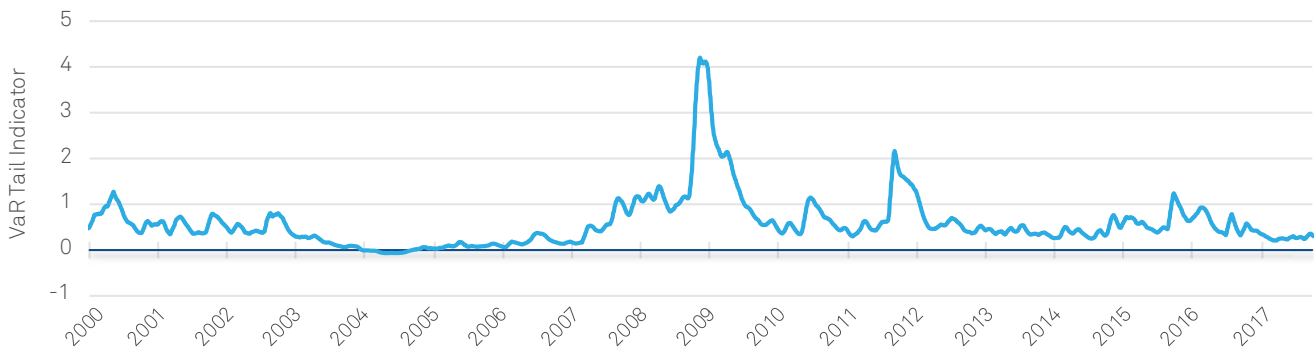
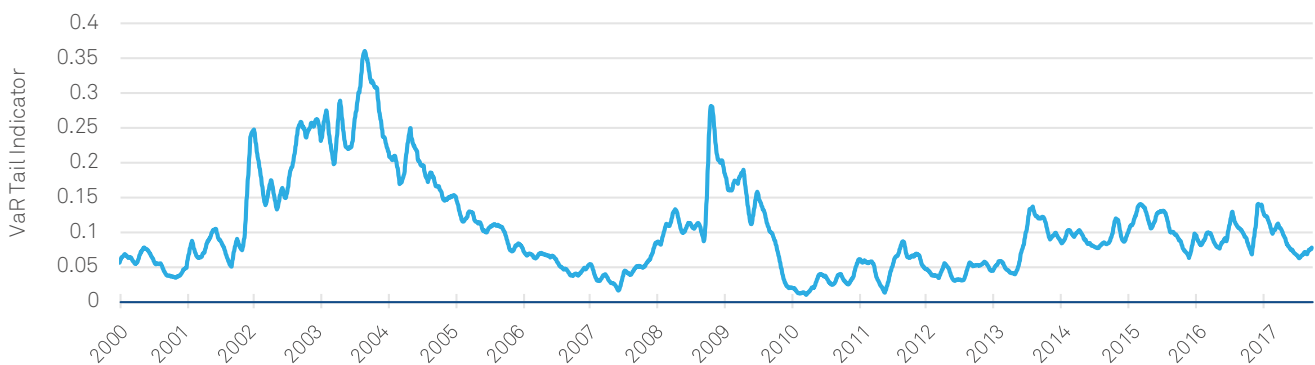


FIGURE 6: TREASURY TAIL-INDICATOR



To illustrate the behavior of the fat-tailed model during different market regimes, we can look at the way it compares to a Gaussian one. Figures 5 and 6 show the so-called Tail Indicator—the spread between one-day Gaussian VaR and one-day Fat-Tailed VaR at a 99% confidence level. We can observe that during the period from 2001 until the end of 2002 the U.S. Equity Market exhibits pronounced turbulence in line with the dot-com bubble and its burst. This is followed by a period of normal behavior i.e. no excess probability of extreme events up until 2006-2007 when the Value-at-Risk spread starts rising. We see significant tail risk already indicated in the first half of 2007.

The U.S. Treasury tail-indicator index reflects the 2001-2004 turmoil in the monetary policy, calming down in 2005-2006 and then rising again by the 2008 crisis.

MODEL FOR THE DEPENDENCE BETWEEN RISK FACTORS

- This model captures the dependence of extreme events (dependence in the tails) and captures asymmetry in that dependence.
- It explains the observed phenomena of increasing correlations during periods of market stress.
- The chosen model for capturing the dependence structure of extreme events is an extended asymmetric version of the T-copula.

MODEL DELIVERY

The fat-tail model is fully integrated with FactSet’s powerful Portfolio Analytics suite, and offers interactive and batched reporting as well as standard or customized PDF reporting featuring your firm’s branding and logo. Raw or derived risk model analytics are available off-platform via flat file, while covariance matrix and factor return data are available via Microsoft Excel integration.

The approach described throughout this overview is covered in further detail in our white paper, *FactSet Fat-Tail Multi-Asset Class Model*. To request a copy, contact sales@factset.com.