HIPES RESEARCH, INC.
MATHEMATICAL & FINANCIAL SOFTWARE

MRPA ESSENTIALS

- MRPA is a versatile, multi-regime model for the analysis of financial time series
- MRPA offers new insights and quantitative tools for portfolio risk management, counterparty exposure netting, and active trading strategies: regime-dependent risks and rewards
- Financial-market empirical distributions generally display fat tails and time-varying correlations/volatilities, making standard statistics unsuitable and potentially misleading
- MRPA uses a novel multi-regime factor analysis to capture the fat tails (see Fig. 1) and time-varying correlations and volatility
- Our point of view is that market history *does* repeat itself as the market returns to established regimes, so these regimes may be accurately characterized (see Fig. 2)
- MRPA incorporates multi-asset correlations naturally through its use of factor models, so MRPA yields accurate distributions for portfolio returns
- MRPA estimation is fast, accurate and convenient, so extensive time-series data can be included, permitting a rich collection of actual market events to be used for training the model
- MRPA tail-risk calculations are fast, accurate and based on large, historical data sets
- Cross-market MRPA models may be easily estimated from the single-market MRPAs, facilitating the construction of return distributions for larger cross-sections of assets
- The MRPA toolkit includes confidence intervals and graphical displays to support a critical evaluation of the calibration results
- MRPA is currently distributed as MATLAB scripts and functions

Figure 1: Illustration of how multiple regimes (mixtures) improves the estimation of fat tails. The blue line in both charts in the empirical distribution of daily changes in six month LIBOR. In the chart on the left, the red line is the Gaussian approximation to the data, and it clearly falls too rapidly to the left. In the chart on the right, the green line is the MRPA approximation using a mixture of four regimes, and it clearly fits the empirical fat tail much better.

One-Year Moving Average of Regimes

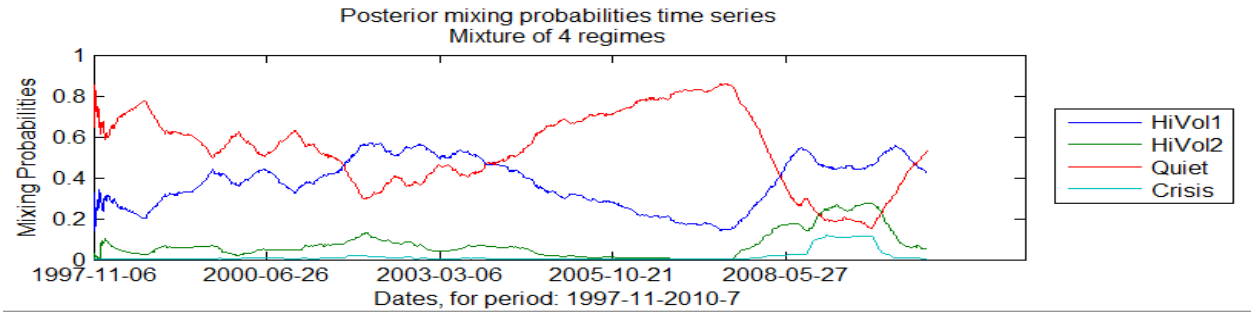

Figure 2: Dynamics of regime mixtures in the USD swap market. The regime with the lowest volatility is labeled Quiet; the regime with the highest is labeled Crisis; the intermediate regimes are labeled HiVol. This estimation is based on daily data. Although the market switches between regimes frequently and MRPA "assigns" each day to a regime (or sometimes, a mixture), it is interesting here to display the moving average assignment so that the long-term dynamics can be seen.