A Summary of Selected Previous Research: Tom McCurdy

Much of Tom McCurdy's recent research deals with developing and applying quantitative methods for investigating the dynamics of asset returns. He has a particular interest in the sources of volatility and nonlinear dynamics in asset returns, as well as the measurement and management of risk that results from that volatility. Understanding the sources of volatility should improve one's ability to forecast, resulting in more effective management of the risk for one's portfolio or business.

Current research projects include: sources of intraday and long-memory components of volatility in asset returns; generalized distributions for volatility modeling; and semi-Markov models of asset return and volatility dynamics. Details of some recent and current research in these areas follow.

Earlier research with Ieuan Morgan focused on measuring intertemporal risk in foreign currency markets. This work highlighted the importance of using flexible econometric techniques. For example, allowing both the price and the quantity of risk to vary over time was important in capturing predictable components of returns. These contributions included publications in *The Review of Financial Studies, The Review of Economic Studies, Journal of Applied Econometrics* and *International Journal of Forecasting.*

A *Journal of Econometrics* paper with Thanasis Stengos compared the efficacy of parametric versus nonparametric methods for predicting time-varying risk premiums associated with Japanese equity returns. "Hedging Foreign Currency Portfolios" (*Journal of Empirical Finance*), joint with Louis Gagnon and Greg Lypny, tested for portfolio effects in a time-varying hedge ratio setting. The intraday pattern of volatility associated with changes in foreign currency prices has been analysed in a paper with Dirk Eddelbuettel entitled "The Impact of News on Foreign Exchange Rates: Evidence from High Frequency Data".

The above projects utilized generalized ARCH structures to capture time-variation and persistence in the volatility or co-variability of returns. However, in some cases, the ARCH specification is inadequate. For example, failure to match the persistence pattern in the volatility of observable returns may be particularly costly for forecasting. One way to improve the specification is to generalize the functional form by making it more flexible. "Capturing Long Memory in the Volatility of Equity Returns: the Fractionally Integrated Asymmetric Power ARCH Model" (with

Michaud) pursues this extension. Alternatively, one could generalize the maintained conditional distribution, as in "Covariability, Multivariability and Flexibility: Conditional CAPM and Time-Varying Risk Premia" (with Lim and Martin). This approach can characterize a range of distributional shapes including both skewness and kurtosis.

Many financial applications can be modeled as mixtures of distributions. Regime-switching models allow for discrete structural shifts (for example, associated with policy or market changes) in a probabilistic setting. McCurdy's *Journal of Business and Economic Statistics* paper with Mike Durland provided a nonlinear probability filter and estimation algorithm which allowed transition probabilities to depend on duration in the latent state. This parsimonious representation of high-order temporal dependence can be used to identify turning points and to capture long-swings or cycles.

In joint work with John Maheu ("Identifying Bull and Bear Markets in Stock Returns", *Journal of Business and Economic Statistics (2000)*), the duration-dependent Markov-switching structure has been extended in several ways. For example, allowing state-specific means and variances to be functions of duration in the inferred state reveals that returns are higher in early stages of a bull market. Also, volatility clustering in monthly returns is fully explained by duration dependence. The filter identifies all major stock market downturns in over 160 years of monthly returns. Maheu and McCurdy have used this semi-Markov approach in a variety of other financial applications, for example, "Volatility dynamics under duration-dependent mixing", *Journal of Empirical Finance (2000)*, in which they compare its forecasting efficacy as compared to Markov-Switching ARCH..