Essays on generalized volatility model for financial returns with sparse jumps

Abstract

Modeling asset returns and their time varying volatility has been a long standing challenge to the researchers in _nance and econometrics as asset return data exhibit several interesting _stylized facts_. Such stylized facts of asset returns include:

1. Return series is heavy-tailed or synonymously leptokurtic
2. Empirical data shows existence of skewness in return series
3. Asset returns are mean reverting
4. The volatility of the asset returns are found to be time-varying
5. Highly volatile period is followed by periods of similar volatility indicating volatility clustering
6. Decrease in price results in increase in volatility and vice-versa indicating correlation between in return and volatility. The correlation is also known as leverage e_ect. In addition, infrequent yet large price changes are observed in the daily return series over su_ciently long period. Stochastic volatility (SV) models has been well discussed in the literature to address such issues individually or to some extent jointly. The standard SV model postulates volatility of the return series as a latent auto-regressive (AR) process. Most popular choice for the distributions of return and latent volatility has been based on normal distribution and its location-scale mixtures to accommodate leptokurtosis, leverage e_ect and skewness along with infrequent large jumps. In the proposed work we want to investigate three particular aspects of stochastic volatility model. First, we aim to construct a general class of multivariate distributions containing skewed normal, central and non-central skewed-*t* distributions exploiting a hierarchical Bayesian structure. We propose to develop a robust model for the return and its stochastic volatility using the proposed generalized multivariate distribution which would allow heterogeneity in marginal tail-fatness as well as skewness. Such a distribution will allow to frame SV models for multiple series to have di_erent heavy tails, skewness with leverage. Next, we consider the problem of modeling infrequent but large changes in returns. Discrete time SV models with jumps which has been so far postulated concentrates on explaining the large jump size assuming constant probability of jump. However, practically di_erent days should have di_erent jump probability and further, the jumps being rare most of the days should explicate nearly zero jump probability with exception on the jump days. We would like to extend the existing SV model with jumps with dynamic jump probabilities using a hierarchical Bayesian framework for such sparse jump. Jumps in returns may be attributed to two di_erent causes, viz.surprises in scheduled news arrivals and usual news arrivals. In a such a case SV models have been proposed assuming random number of news arriving with random impact sizes distributed independently and identically (iid). The news arrival process, so far, has been considered as Poisson process although on non-jump days probability of no jumps should be higher than the same on jump days. The third essay of the thesis aims to investigate the possibility of constructing such a compound event SV model. Further, we want to extend the model to explain the jump sizes in terms of surprises from the announced news. Also we want to explore the possibility of postulating the news arrival intensity as a latent process. In doing so we adopt a Bayesian framework.