

The marginal distributions of returns and volatility

Simon R. Hurst and Eckhard Platen

The Australian National University, Canberra, Australia.

Abstract: The aim of the paper is to identify a distribution that best fits empirical asset returns. By assuming a normal-variance mixture distribution for the returns, the distribution of volatility is implied.

Key words: Asset price model, leptokurtosis, quadratic variation process, mixture distributions, Student t distribution.

AMS subject classification: Primary 90A12; secondary 60J30, 62P20.

1 Introduction

The modelling of the stochastic process followed by the price of an asset is an important part of financial analysis. An understanding of this process is the first step to the pricing of derivative securities and general risk management. It is therefore important to identify a model for asset price processes which is consistent with their major empirical properties, such as heavy tailed return distributions, volatility clustering, long memory and persistence after volatility shocks. Previous approaches have typically concentrated on specific models, e.g. ARCH, and not succeeded so far to jointly model all of the major empirical properties. To attack this problem systematically we first study the marginal distributions of returns and volatility for market price indexes. Only after that we feel a substantial effort can be made to identify further evolutionary properties of volatility and asset price processes.

In this paper we compare various distributions to model the leptokurtic marginal distribution of asset returns. The distributions considered are: the normal (or Gaussian); the stable; the normal-lognormal mixture of Clark (1973); the generalised hyperbolic which include the Student t ,