the volatility surface of the Eurostoxx 50 index, having a value of 2461.44 on October 7th, 2003. The volatilities can be found in table 4. For the sake of simplicity and to focus on the essence of the stochastic behaviour of the asset, we set the risk-free interest rate equal to 3 percent and the dividend yield to zero. The results of the calibration are visualized in Figure 1 and Figure 2 for the NIG-CIR and the BNS model respectively; the other models give rise to completely similar figures. Here, the circles are the market prices and the plus signs are the analytical prices (calculated through formula (8) using the respective characteristic functions and obtained parameters).

| | |
|---|---|
| HEST | |
| $\sigma_0^2 = 0.0654, \kappa = 0.6067, \eta = 0.0707, \theta = 0.2928, \rho = -0.7571$ | |
| HESJ | |
| $\sigma_0^2 = 0.0576, \kappa = 0.4963, \eta = 0.0650, \theta = 0.2286, \rho = -0.9900, \mu_j = 0.1791,$ $\sigma_j = 0.1346, \lambda = 0.1382$ | |
| BN-S | |
| $\rho = -4.6750, \lambda = 0.5474, b = 18.6075, a = 0.6069, \sigma_0^2 = 0.0433$ | |
| VG-CIR | 1. |
| $C = 18.0968, G = 20.0276, M = 26.3971, \kappa = 1.2145, \eta = 0.5501,$ $\lambda = 1.7913, y_0 = 1$ | |
| VG-OUΓ | |
| $C = 6.1610, G = 9.6443, M = 16.0260, \lambda = 1.6790, a = 0.3484,$ $b = 0.7664, y_0 = 1$ | |
| NIG-CIR | |
| $\alpha = 16.1975, \beta = -3.1804, \delta = 1.0867, \kappa = 1.2101, \eta = 0.5507,$ $\lambda = 1.7864, y_0 = 1$ | |
| NIG-OUΓ | |
| $\alpha = 8.8914, \beta = -3.1634, \delta = 0.6728, \lambda = 1.7478, a = 0.3442,$ $b = 0.7628, y_0 = 1$ | |

Table 1: Risk Neutral Parameters

In Table 1 one finds the risk-neutral parameters for the different models. For comparative purposes, one computes several global measures of fit. We consider the root mean square error ($rmse$), the average absolute error as a percentage of the mean price ($ape$), the average absolute error ($aae$) and the average relative percentage error ($arpe$):

$$rmse = \sqrt{\sum_{options} \frac{(\text{Market price} - \text{Model price})^2}{\text{number of options}}}$$

$$ape = \frac{1}{\text{mean option price}} \sum_{options} \frac{|\text{Market price} - \text{Model price}|}{\text{number of options}}$$

$$aae = \sum_{options} \frac{|\text{Market price} - \text{Model price}|}{\text{number of options}}$$



1. y0 is unknown, the rescaling through y0 discussed in C7 of Wim's book, isn't needed, we just fit on the rescaled CF (wiht y0=1)