

# Gain-Probability Analysis of Skew $t$ distribution

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## Abstract

It is widely acknowledged that prices, returns, and other financial variables are not normally distributed. They have fat tails, and exhibit tail dependence so skew normal fitting is not suitable. In this paper, gain probability analysis has been extended from log-normal, skew normal, and gamma distributions to a scale mixture of skew normal, called skew  $t$  distributions, which has become a popular choice because of its heavy tails and non-zero tail dependence. Some properties of multivariate skew  $t$  and closed skew  $t$  distributions are discussed. Gain-probability analyses are obtained for both independent and dependent (matched) settings. The Monte Carlo simulation study shows that maximum likelihood estimators of parameters obtained in our main results are stable. Two real data applications are provided for illustrating the superiority of our G-P analysis under skew  $t$  settings. Free online calculators are available for computing required gain probabilities.

**Keywords:** Gain-probability analysis, multivariate closed skew  $t$  distribution, scale mixture of skew normal distribution, dependent and independent random variables