Modelling real world problems with Multivariate Distributions: An application to All Share Price Index and related financial indices

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Modelling real world scenarios using statistical distributions became an important research area nowadays. Many real world applications associate with more than one variable. Therefore, when modelling these problems, finding the most suitable multivariate distributions reveals vast interest among scholars. This study focuses on finding the multivariate distribution of All Share Price Index (ASPI) of Colombo stock exchange and related financial indices. Findings of this study will lead to improve the accuracy of stock market prediction models and hence important for many parties in the financial sector.

Analytical methods and Numerical methods can be identified in the literature which were used to find multivariate distributions. Analytical methods exhibit difficulties when the number of variables increases, as they involve heavy mathematical calculations. Numerical methods have been used by many scholars to find multivariate distributions and many were limited to combination of two or three variables.

Four related financial indices can be identified with respect to ASPI as Amex Oil Index, Amex Gold Index, World Cocoa Index and GSPC index of U.S.A. stock market. Daily data from 1st August 2007 to 31st July 2012 of above mentioned financial indices were considered for the study. As all marginal distributions of aforesaid financial indices are Scaled t distributions, multivariate Scaled t distribution was considered in the study. A local optimization method with Matlab 'fmincon' function and a global optimization method with DSO algorithm were used to solve the corresponding optimization problem that involves twenty one parameters related to five dimensions of the multivariate Scaled t distribution.

The results obtained for the maximum function values exhibit that the global optimization method provides substantially better estimates for the parameters of the multivariate Scaled t distribution than the local optimization method. The identified multivariate distribution of All Share Price Index and related financial indices is central, less peaked and has fat tails.

Key words: All Share Price Index (ASPI), multivariate distribution, local optimization, global optimization

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