# Financial applications of flexible copula families based on mixing.

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**Abstract**

Copulas have become recently a field of great importance due to their ability to describe complicated dependence structures. In particular, copulas model separate the marginal properties and the existing dependence of the data, allowing for flexible and realistic modelling far from simplistic assumptions like normality and linear dependence. Using copulas, the joint density function of the random variables equals to the product of their marginals times a function, that captures dependencies far from linear, i.e., the density of the copula. In addition, the measures of association used share the property of invariance which gives the flexibility to move to monotonic transformations of the variables without being affected. There are several examples that such flexible models are of particular interest.

For example, in finance, it is well known, especially after Mandelbrot's (1963a,1963b) studies, that most financial time series are fat - tailed. A lot of papers in the literature have replaced the assumption of normality with the Student-t distribution, which has fat tails. But in the multivariate case that we interested in, we need flexible models that can capture both fat tails of different extend and dependencies. As an example, when a stock return and an exchange rate series are involved, there is no obvious choice for the bivariate density. The necessity of copulas that overshoot these problems give rise to the construction of new families. The literature provides several methods to construct a new copula. The most widely known are: inversion of marginals method, mixture of copula families (see for example, Fréchet (1951), Carrière (2000)), inversion of mixed multivariate distributions (this technique is sometimes called frailty construction) and generators.

The objective of this paper is to bring together known for their extremal properties families of copula, proposing a new copula as a mixture of other families. The mixing

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families are differentiated from the structure of dependence they allow to the random variables they join, like tail-dependencies. An extensive analysis of the resulting, as well as, of the mixing copulas is provided to evaluate the inheritance of the properties to the resulting copula. Special attention is paid to non-elliptical copulas which are the goal of this study. This is the starting point to re-evaluate the efficiency of the variety of methods used for model selection. An empirical study is also provided.

*Key words*: Copulas, non-elliptical copulas, mixtures, tail dependence, measures of association.

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