Abstract

Since the financial crisis which started in 2007, the risk awareness in the financial sector is greater than ever. Financial institutions such as banks and insurance companies are heavily regulated in order to create a harmonic and resilient global economic environment. Sufficiently large capital buffers may protect institutions from bankruptcy due to some adverse financial events leading to an undesirable outcome for the company. In many regulatory frameworks, the institutions are obliged to estimate high quantiles of their loss distributions. This is relatively unproblematic when large samples of relevant historical data are available. Serious statistical problems appear when only small samples of relevant data are available. One possible solution would be to pool two or more samples that appear to have the same distribution, in order to create a larger sample.

This thesis identifies the advantages and risks of pooling of small samples. For some mixtures of normally distributed samples, with what is considered to be the same variances, the pooled data may indicate heavy tails. Since a finite mixture of normally distributed samples has light tails, this is an example of spurious heavy tails.

Even though two samples may appear to have the same distribution function it is not necessarily better to pool the samples in order to obtain a larger sample size with the aim of more accurate quantile estimation. For two normally distributed samples of sizes m and n and standard deviations s and v, we find that when v/s is approximately 2, $n + m$ is less than 100 and $m/(m+n)$ is approximately 0.75, then there is a considerable risk of believing that the two samples have equal variance and that the pooled sample has heavy tails.

Keywords: Small samples, Tail index estimation, Normal mixture models, Heavy tails