

Simulation of Student t Bailey method and Quantiles

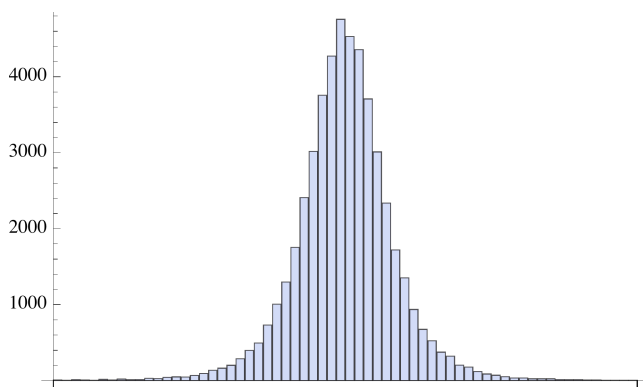
Most historical methods for sampling Student t-distribution are discussed by Shaw, J. Computational Finance, 2006 (Vol 9, No 4, pp 37-73), with exception of very new work on ratio of uniforms. Main contribution of that paper is to review quantile methods, introduced by Hill (1970), a summary of closed forms quantiles (see Wikipedia on "quantile function") and series for quantile e.g. for cubic power law form. For many banks a key method is Box-Muller method for Gaussian. Bailey modified this to Student t in one line change: Tell the Banks!!

Bailey, R.W., 1994.
Polar generation of random variates with the
t - distribution.
Mathematics of Computation 62 (206), 779 -781.

Implementations:
Not many banks!
CERN code 1999, *Mathematica*

Here is simple polar form of algorithm. It is only last line (and use of just one output) that differs from normal case.

```
BaileyStudent[ $\nu$ _] :=  
Module[{ $W = 2$ ,  $u$ ,  $v$ ,  $U$ ,  $V$ },  
  While[ $W > 1$ , ( $u = \text{RandomReal}[]$ ;  $v = \text{RandomReal}[]$ ;  
     $U = 2u - 1$ ;  $V = 2v - 1$ ;  
     $W = U^2 + V^2$ );  
   $U * \text{Sqrt}[\nu (W^{(-2/\nu)} - 1) / W]$   
data = Table[BaileyStudent[4], {50 000}];  
BarChart[BinCounts[data, {-8, 8, 0.25}]]
```



Negative DOF?

Algorithm fine for $\nu < 0$:

```
datab = Table[BaileyStudent[-4], {50 000}];
```

`BarChart[BinCounts[datab, {-8, 8, 0.25}]]`

