

# QQ plots

A quantile-quantile plot, or QQ plot, is a visual goodness-of-fit test. It checks if two distributions  $F$  (distribution we're testing against) and  $F_n$  (empirical distribution) are close. This is done by plotting  $F^{-1}$  on the x-axis against  $F_n^{-1}$  on the y-axis. If the points are close to the line  $y=x$ , the two distributions are close.

To plot a QQ plot:

1. Reorder the samples in increasing order. Denote the samples  $X_i$  such that  $X_i$  is the  $i$ th smallest sample.
2. Plot the points

$\$(F^{-1}(\frac{1}{n}), X_{(1)}), (F^{-1}(\frac{2}{n}), X_{(2)}), \dots, (F^{-1}(\frac{i}{n}), X_{(i)}), \dots, (F^{-1}(\frac{n-1}{n}), X_{(n-1)})\$$

$(F^{-1}(\frac{n}{n}), X_{(n)})$  is skipped because for a Gaussian cdf  $F$ ,  $F^{-1}(1) = \infty$ . If  $F^{-1}(1)$  is defined, the point can be included.)

To plot a QQ plot in MATLAB, use the *qqplot* command.

```
pd = makedist(distname, Name1, Value1, Name2, Value2, ...)
qqplot(x, pd)
```

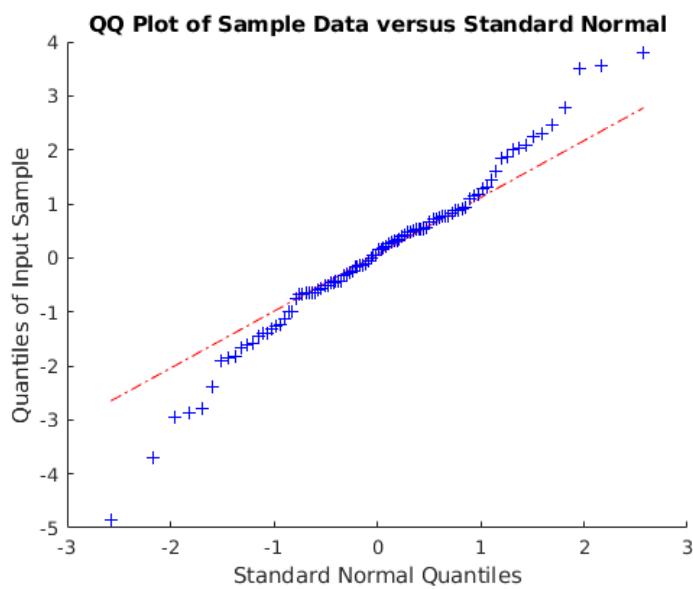
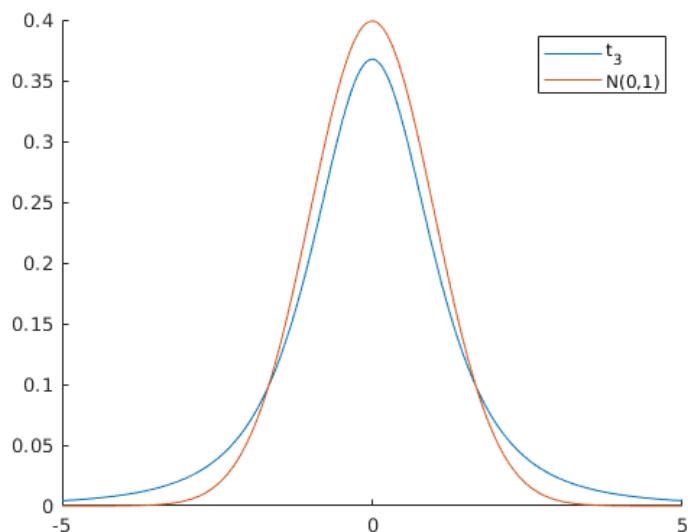
distname can be any family of distributions, including Normal, Gamma, Binomial, Beta, Uniform, Poisson, etc. Parameters of the distribution can be specified with the name/value pairs. See the [MATLAB help page for makedist](#) for more details.

x is the array of sample data.

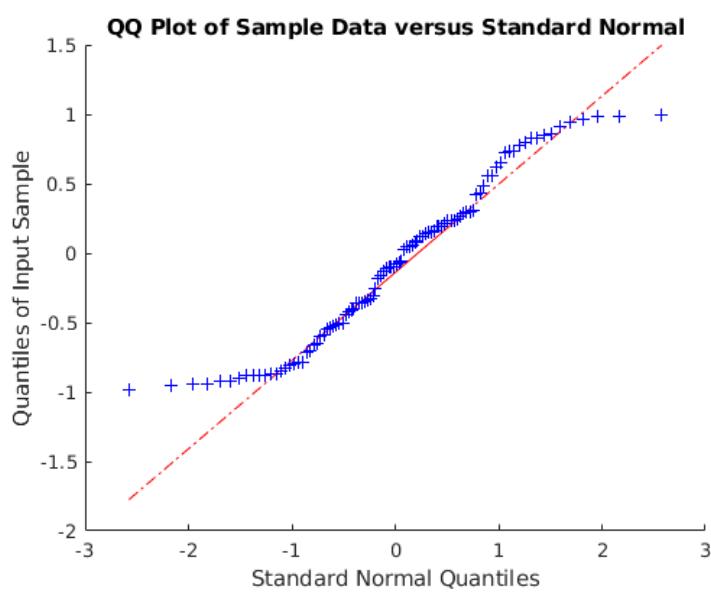
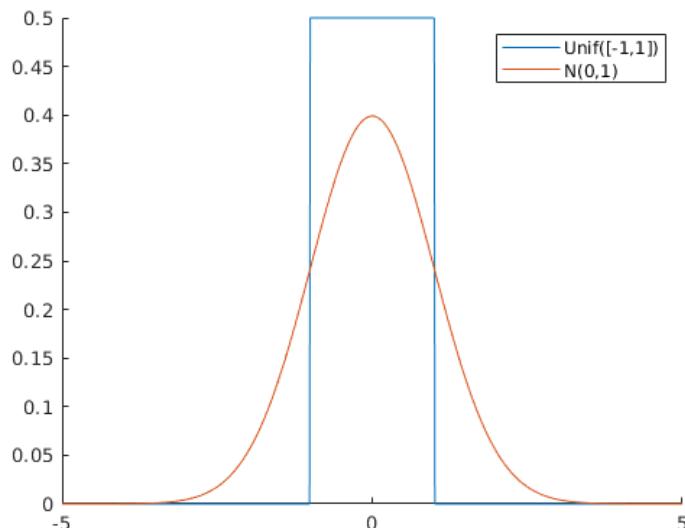
## Patterns of QQ plots

There are four recognizable patterns in QQ plots that gives information about the distribution of the sample. These plots were generated with [this MATLAB code](#).

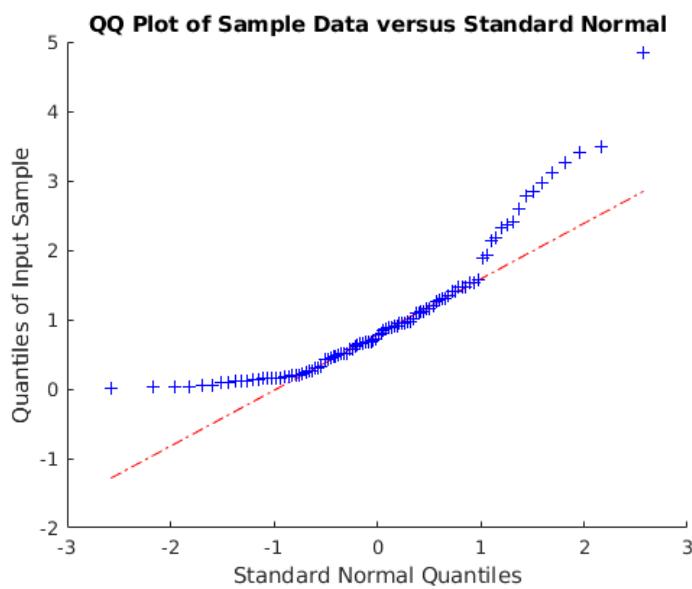
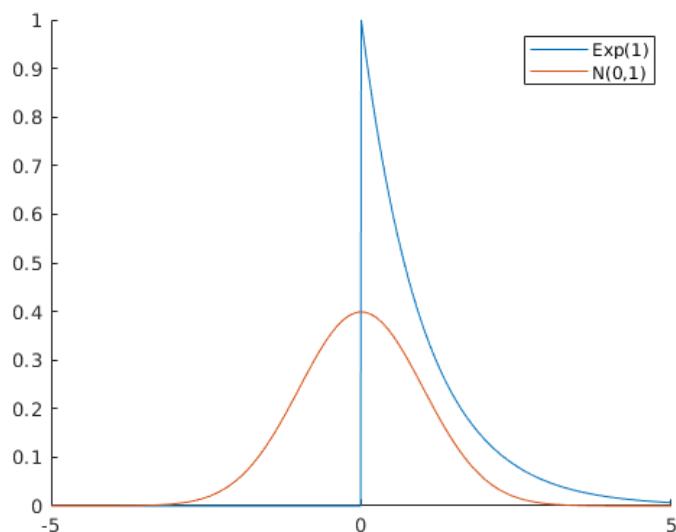
### Heavy/fat tails



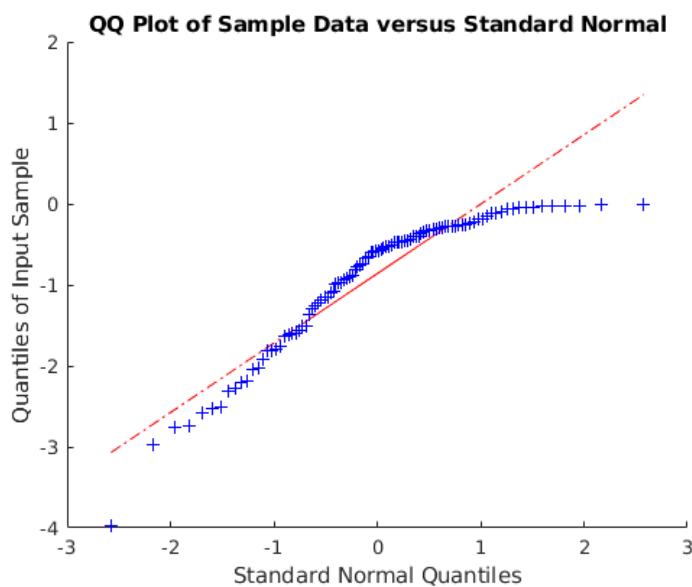
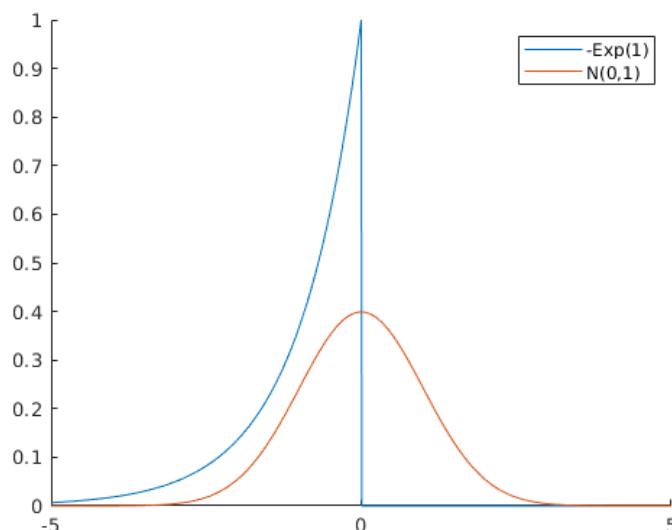
## Light/skinny tails



**Right skewed**



**Left skewed**



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