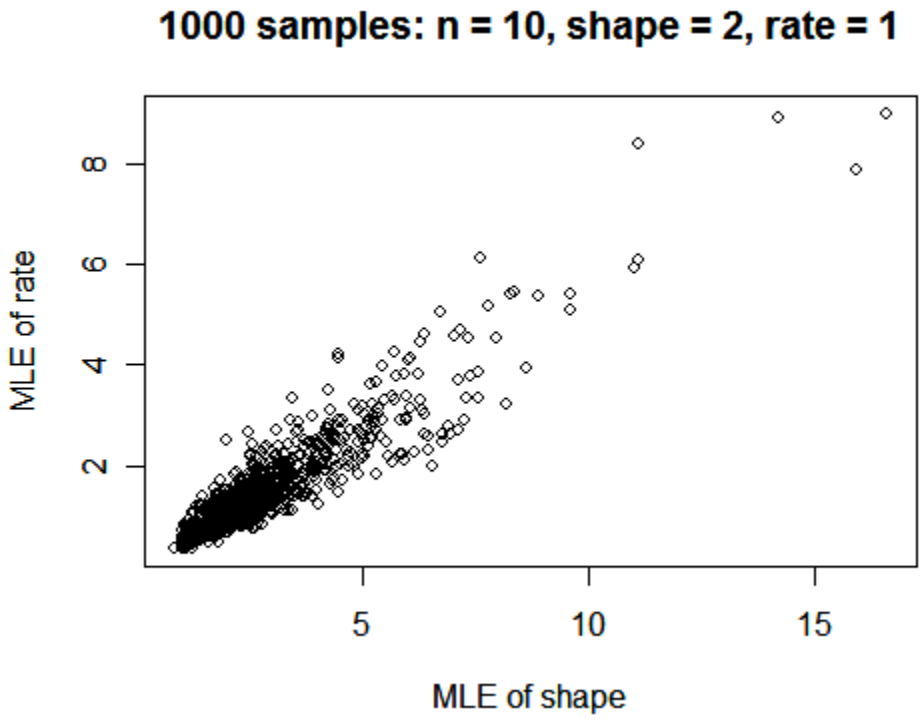
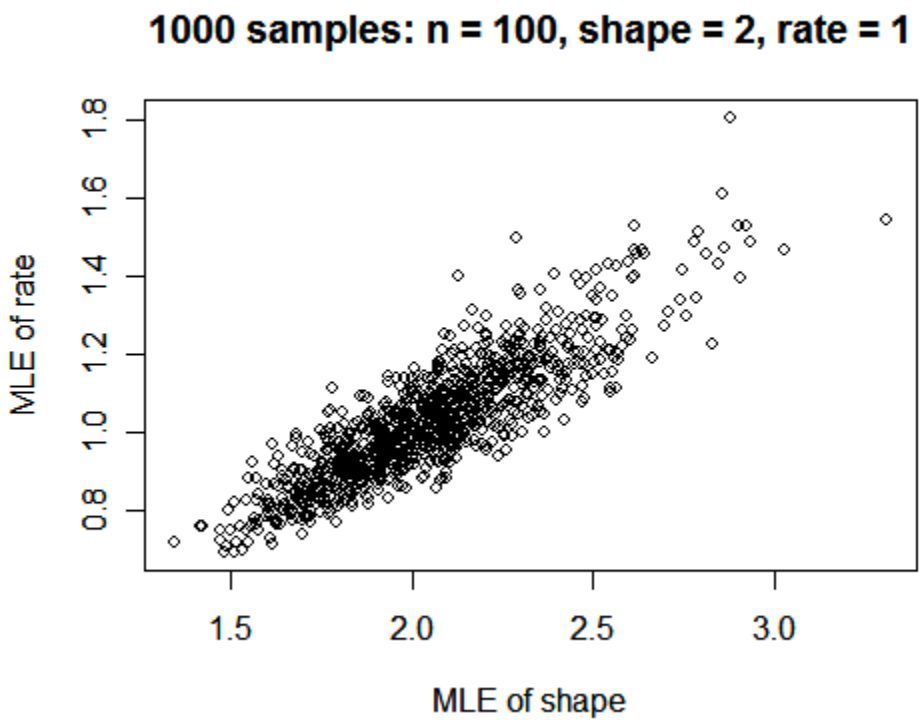
Studying the Sampling Distribution of Gamma MLE

```
> gamma.mles2
function (xx, shape0, rate0)
{
    n <- length(xx)
    xbar <- mean(xx)
    logxbar <- mean(log(xx))
    theta <- c(shape0, rate0)
    repeat {
        theta0 <- theta
        shape <- theta0[1]
        rate <- theta0[2]
        S <- n * matrix(c(log(rate) - digamma(shape) + logxbar,
            shape/rate - xbar), ncol = 1)
        I <- n * matrix(c(trigamma(shape), -1/rate, -1/rate,
            shape/rate^2), ncol = 2)
        theta <- theta0 + solve(I) %*% S
        repeat {
            if (min(theta) > 0)
                break
            theta <- (theta0 + theta)/2
        }
        if (max(abs(theta - theta0)) < 1e-08)
            break
    }
    theta
}
```

```
> xx.2.1.10 <- matrix(rgamma(10*1000,2,1),nrow=1000)
> boot.2.1.10 <- apply(xx.2.1.10, 1, gamma.mles2,shape0=2,rate0=1)
> plot(boot.2.1.10[1,],boot.2.1.10[2,],xlab="MLE of shape",ylab="MLE of rate",
main="1000 samples: n = 10, shape = 2, rate = 1")
```




```
> xx.2.1.100 <- matrix(rgamma(100*1000,2,1),nrow=1000)
> boot.2.1.100 <- apply(xx.2.1.100, 1, gamma.mles2,shape0=2,rate0=1)
> plot(boot.2.1.100[1,],boot.2.1.100[2,],xlab="MLE of shape",ylab="MLE of rate",
main="1000 samples: n = 100, shape = 2, rate = 1")
```




```
> xx.2.1.1000 <- matrix(rgamma(1000*1000,2,1),nrow=1000)
> boot.2.1.1000 <- apply(xx.2.1.1000, 1, gamma.mles2,shape0=2,rate0=1)
> plot(boot.2.1.1000[1,],boot.2.1.1000[2,],xlab="MLE of shape",ylab="MLE of rate",
main="1000 samples: n = 1000, shape = 2, rate = 1")
```