Problem Set 3

Econometrics

Name: Tan Sein Jone

3a.

```
set.seed(123)
n <- 30
x <- rnorm(n)
u <- rnorm(n)
y <- 1 * x + u
```

3b.

```
beta_tilde <- sum(x^3 * y) / sum(x^4)
beta <- sum(x * y) / sum(x^2)
print(beta_tilde)
```

```
## [1] 0.9053626
```

```
print(beta)
```

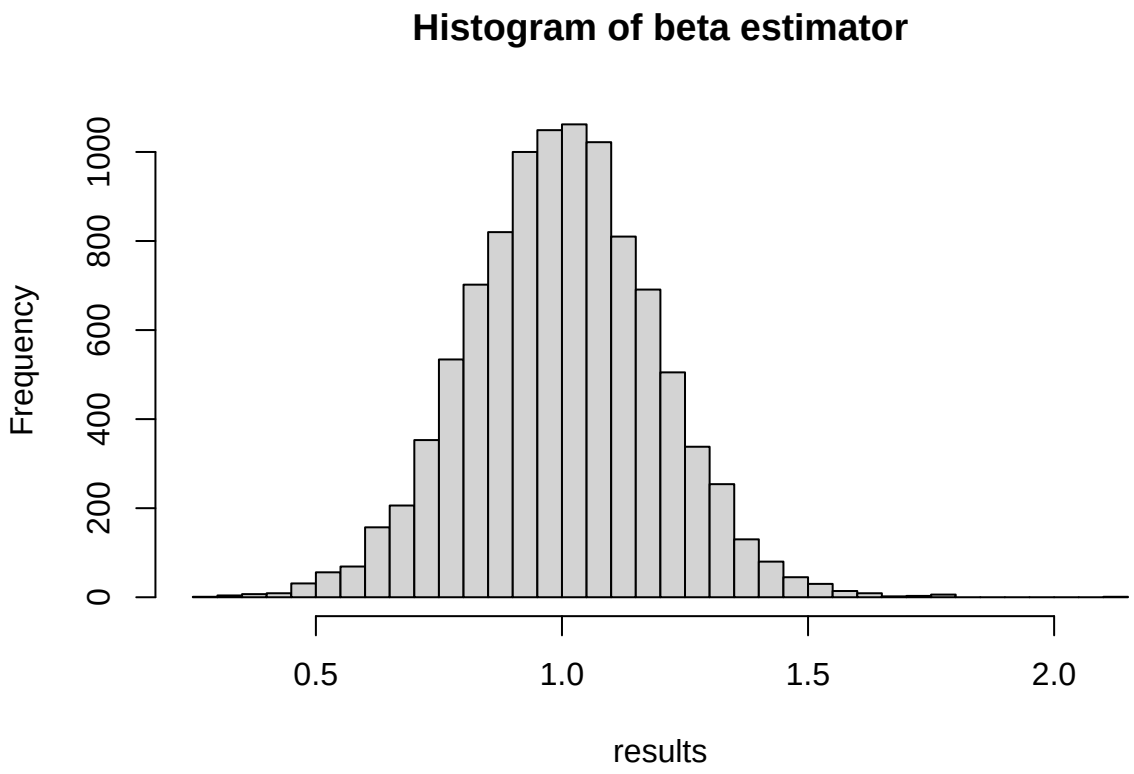
```
## [1] 0.8572767
```

3c.

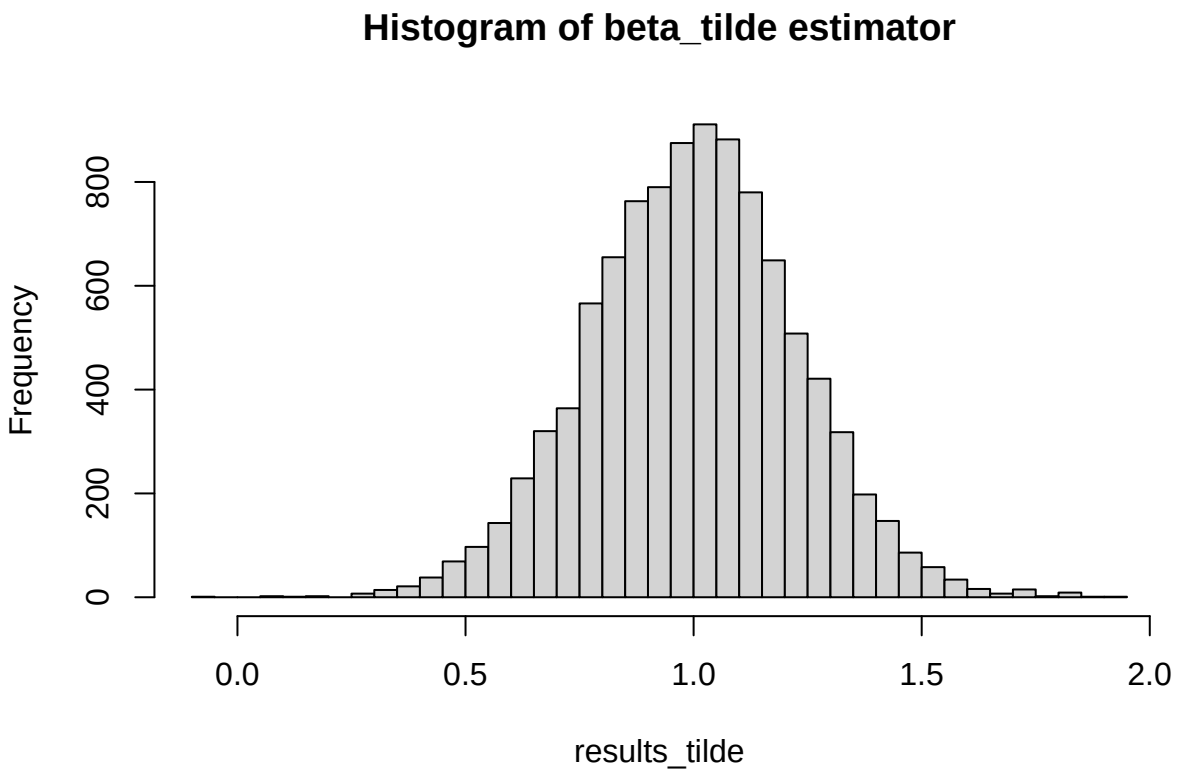
```
r <- 10000
results <- numeric(r)
results_tilde <- numeric(r)
for (i in 1:r) {
    x <- rnorm(n)
    u <- rnorm(n)
    y <- 1 * x + u
    results[i] <- sum(x * y) / sum(x^2)
    results_tilde[i] <- sum(x^3 * y) / sum(x^4)
}
```

3d.

```
hist(results, breaks = 50, main = "Histogram of beta estimator")
```




```r
hist(results_tilde, breaks = 50, main = "Histogram of beta_tilde estimator")
```



3e.

```
print(mean(results))
```

```
## [1] 1.000009
```

```
print(mean(results_tilde))
```

```
## [1] 0.9990115
```

These two estimators are close to the true value of 1. This means that they are unbiased.

3f.

```
print(var(results))
```

```
## [1] 0.03628703
```

```
print(var(results_tilde))
```

```
## [1] 0.0516399
```

The variance of the beta estimator is smaller than the variance of the beta_tilde estimator. This means that the beta estimator is more efficient than the beta_tilde estimator.