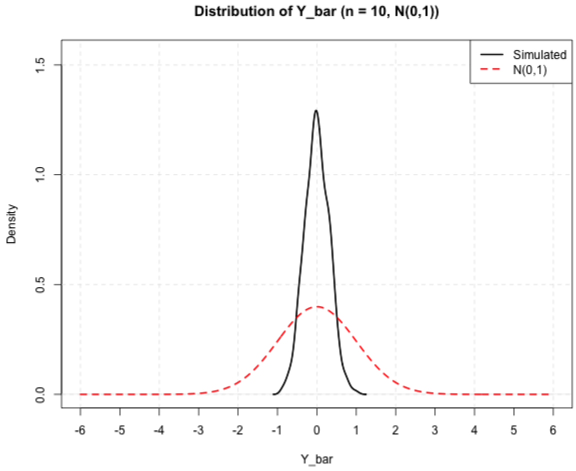
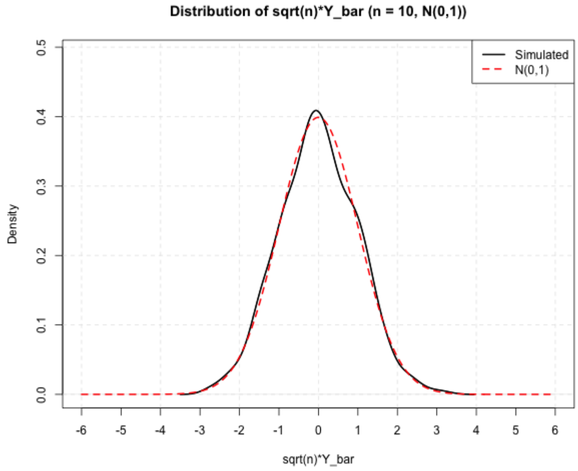
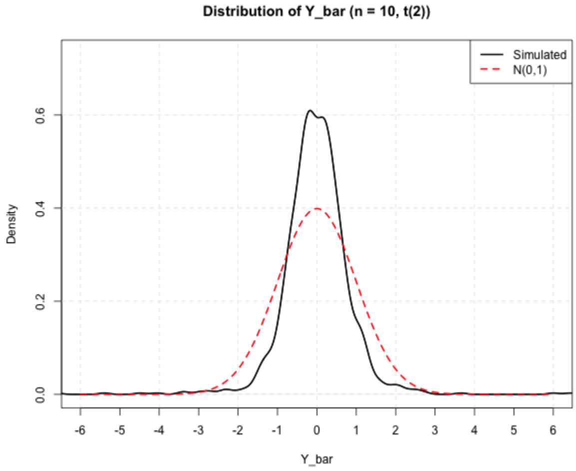
Homework: 2024/10/30

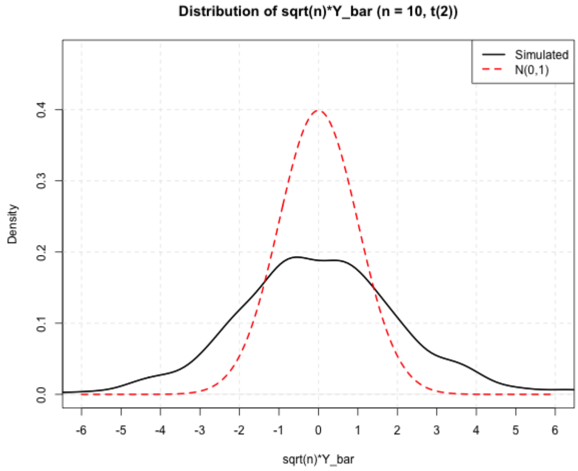
1.

Result for $n = 10$

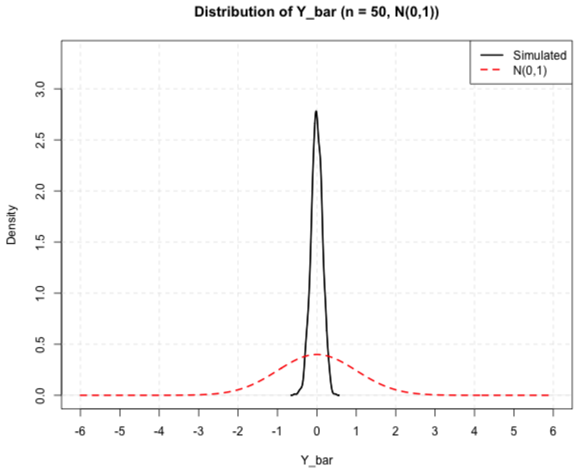


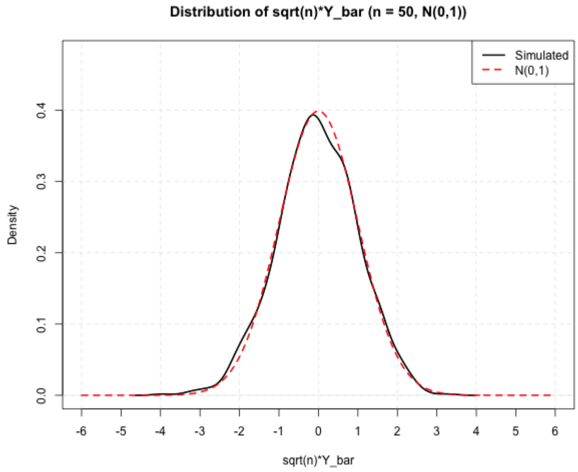


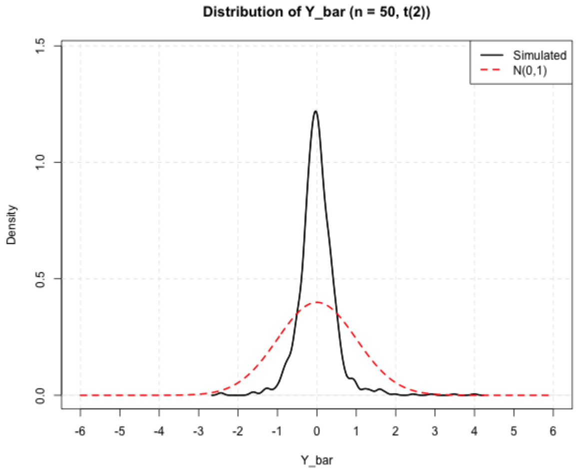


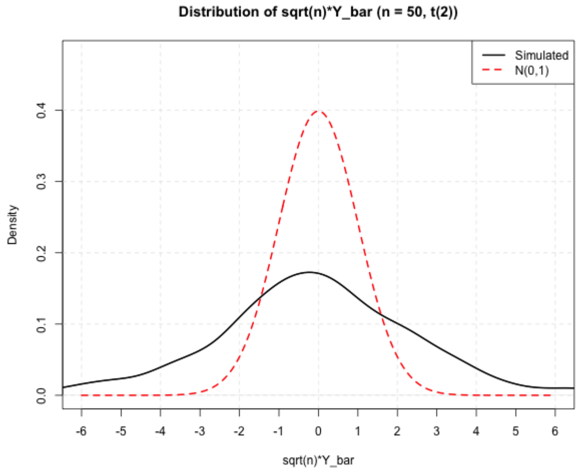


Result for $\mathrm{n} = 50$

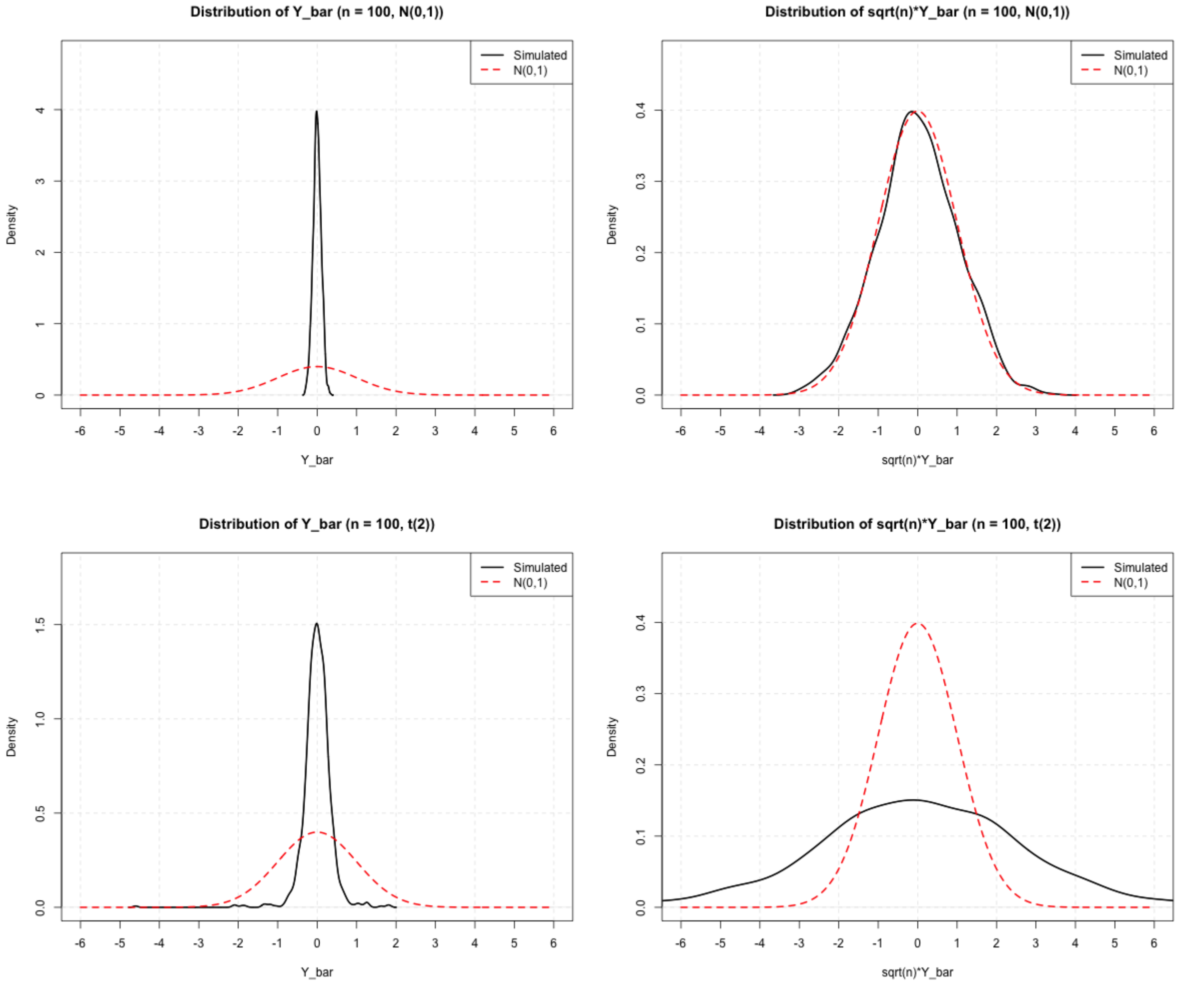








Result for $n = 100$



By these simulations, we can see that the distribution of $n^{1/2}\overline{Y}$ is closer to the normal distribution than the distribution of $\overline{Y}$ for both $N(0, 1)$ and $t(2)$ distributions.

As the sample size n increases, we can see there's a peak at the center of the density function of $\overline{Y}$, this is because the variance of $\overline{Y}$ decreases as n increases.

Comparing the density functions of $n^{1/2}\overline{Y}$ when applying $N(0, 1)$ and $t(2)$ distributions, we can see that when applying $N(0, 1)$ distribution, the density function of $n^{1/2}\overline{Y}$ is more similar to the normal distribution. But when n goes to infinity, both of the density function will be like the distribution of $N(0, 1)$ according to the central limit theorem.

2.

Result of individual Wald tests

```
Part a: Individual Wald Tests (H0: βj = 0)
      Coefficient     Estimate   Std_Error    t_value      p_value
xones       xones  0.215519353 0.061958219  3.4784627 0.0005490618
xdfy         xdfy -1.167618067 0.927018939 -1.2595407 0.2084322820
xinfl       xinfl -0.379379508 0.642884239 -0.5901210 0.5553804406
xsvar       xsvar -0.101604035 0.393862529 -0.2579683 0.7965392642
xtms         xtms -0.329207402 0.206163991 -1.5968230 0.1109472182
xtbl         xtbl -0.317573893 0.113024303 -2.8097841 0.0051549300
xdfr         xdfr  0.275242786 0.148556414  1.8527829 0.0645120943
xdp           xdp  0.045320259 0.012360937  3.6664096 0.0002727608
xltr         xltr  0.126357857 0.073946585  1.7087720 0.0881238502
xep           xep -0.002077709 0.008739102 -0.2377485 0.8121751096
xbmr         xbmr  0.028790417 0.032257027  0.8925316 0.3725443638
xntis       xntis  0.070079631 0.126154466  0.5555065 0.5788007321

Significant coefficients at 5% level:
      Coefficient    Estimate  Std_Error   t_value      p_value
xones       xones  0.21551935 0.06195822  3.478463 0.0005490618
xtbl         xtbl -0.31757389 0.11302430 -2.809784 0.0051549300
xdp           xdp  0.04532026 0.01236094  3.666410 0.0002727608
```

According to the result of individual Wald tests, we can see that the p-values of intercept, tbl, xdp are less than 0.05, which means we can reject the null hypothesis of these coefficients.

Result of joint Wald tests

```
Part b: Joint Wald Test
H0: β1 = 0 and β2 + β3 = 0

Linear hypothesis test:
xones = 0
xdfy  + xinfl = 0

Model 1: restricted model
Model 2: y ~ (x - 1)

  Res.Df     RSS Df Sum of Sq      F    Pr(>F)
1    494 0.97081
2    492 0.93777  2  0.033039 8.6671 0.0001999 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

According to the result of joint Wald tests, we can see that the p-value is less than 0.05, which means we can reject the null hypothesis. The statistical meaning of this result is we reject that $\beta_1 = 0$ and (or) $\beta_2 + \beta_3 = 0$ at 5% significance level. We can see the result is aligned to the result of individual Wald tests of β_1.

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3. Source Code

Source Code