SimResult

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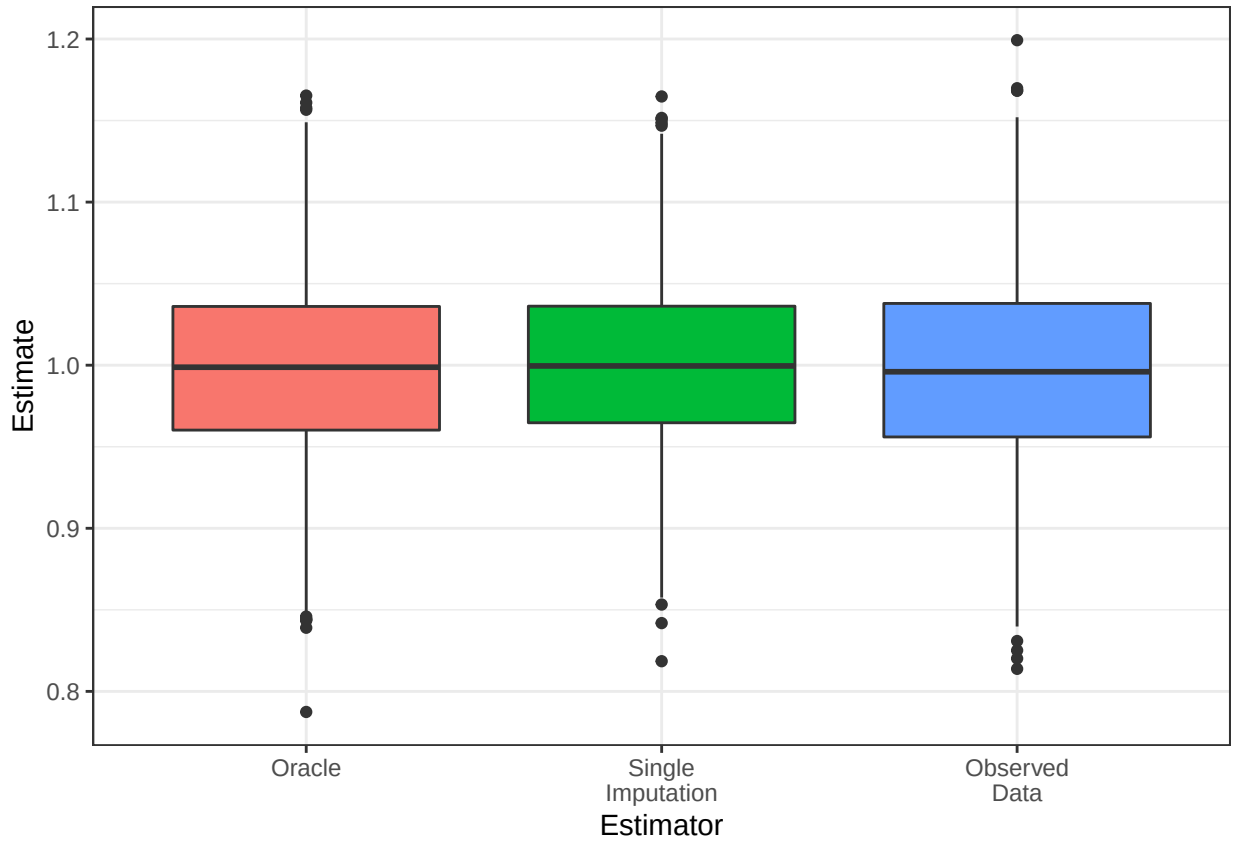
Simulation Parameter

- sample size n = 1000
- number of replicates = 1000
- $Y = G - 0.5X + 0.5Z + \epsilon$, where $G \sim Bin(2, maf = 0.25)$, $\begin{bmatrix} X \\ Z \end{bmatrix} \sim N\Big(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix} \Big), \epsilon \sim N(0, 1)$.
- Missing rate of Y is 20%.

Single Imputation

Beta known, model correctly specified

```
## Note: Using an external vector in selections is ambiguous.
## i Use ‘all_of(cov)‘ instead of ‘cov‘ to silence this message.
## i See <https://tidyselect.r-lib.org/reference/faq-external-vector.html>.
## This message is displayed once per session.
```

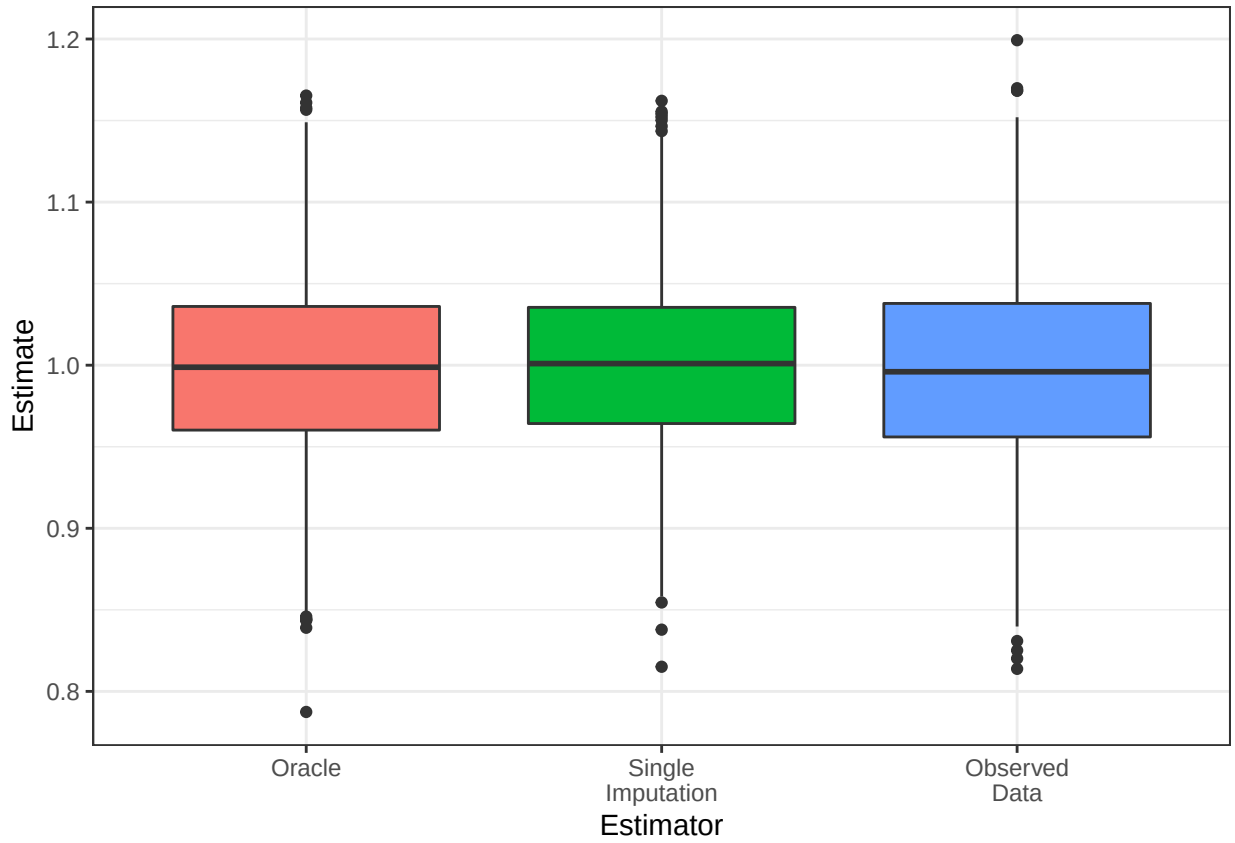



```
## # A tibble: 3 x 3
##   estimator   est     se
##   <chr>     <dbl>  <dbl>
## 1 si        0.999 0.0518
## 2 obs       0.998 0.0579
## 3 oracle    0.998 0.0563
```

```
##                oracle   observed single imputation
## empirical 0.05772189 0.05991917        0.05383904
## estimated 0.05631670 0.05789101        0.05174918
```

Beta known, model incorrectly specified

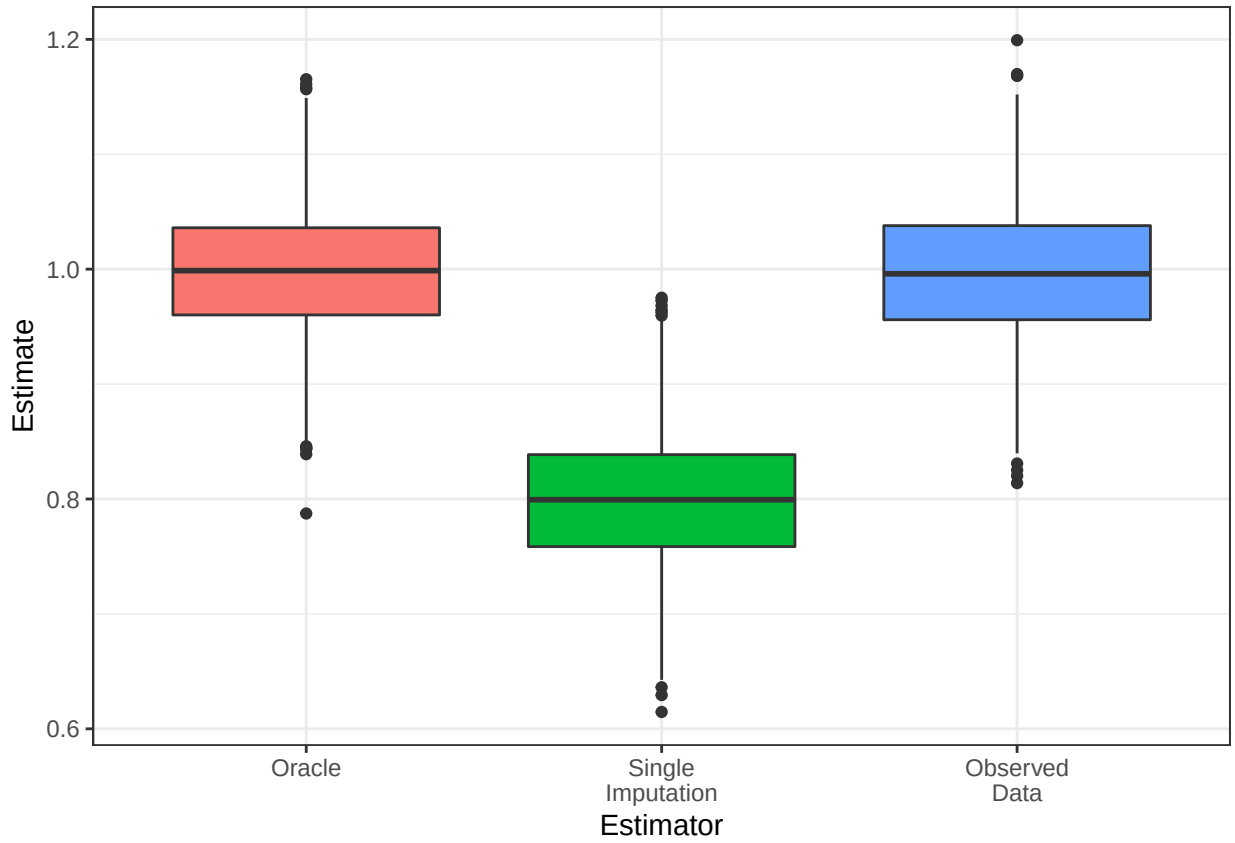
$\hat{Y} \sim G, X$




```
## # A tibble: 3 x 3
##   estimator   est     se
##   <chr>     <dbl>  <dbl>
## 1 si        0.999 0.0528
## 2 obs       0.998 0.0579
## 3 oracle    0.998 0.0563
```

```
##                oracle   observed single imputation
## empirical 0.05772189 0.05991917        0.05469555
## estimated 0.05631670 0.05789101        0.05276199
```

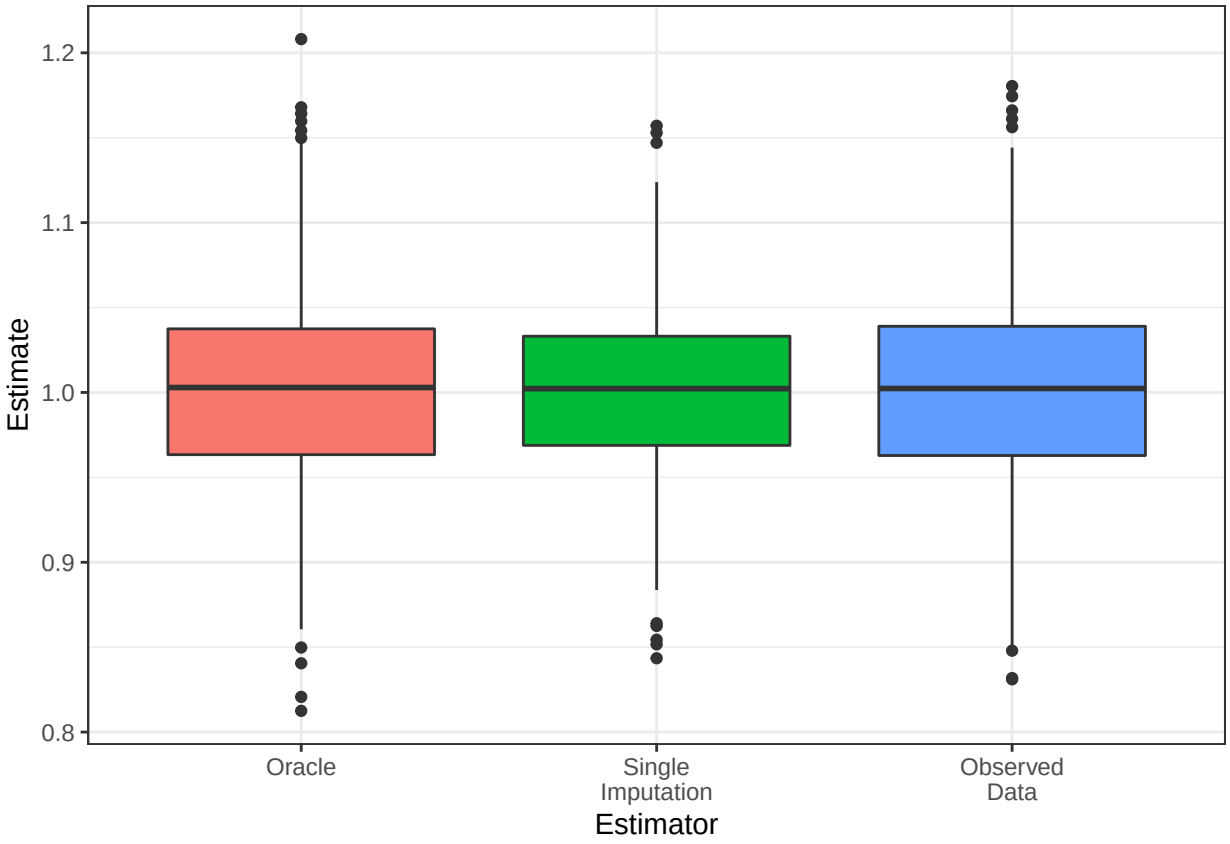
$\hat{Y} \sim X, Z$




```
## # A tibble: 3 x 3
##   estimator   est     se
##   <chr>     <dbl>  <dbl>
## 1 si        0.799 0.0543
## 2 obs       0.998 0.0579
## 3 oracle    0.998 0.0563
```

```
##                oracle   observed single imputation
## empirical 0.05772189 0.05991917        0.06025671
## estimated 0.05631670 0.05789101        0.05424222
```

Beta unkown and correctly specified

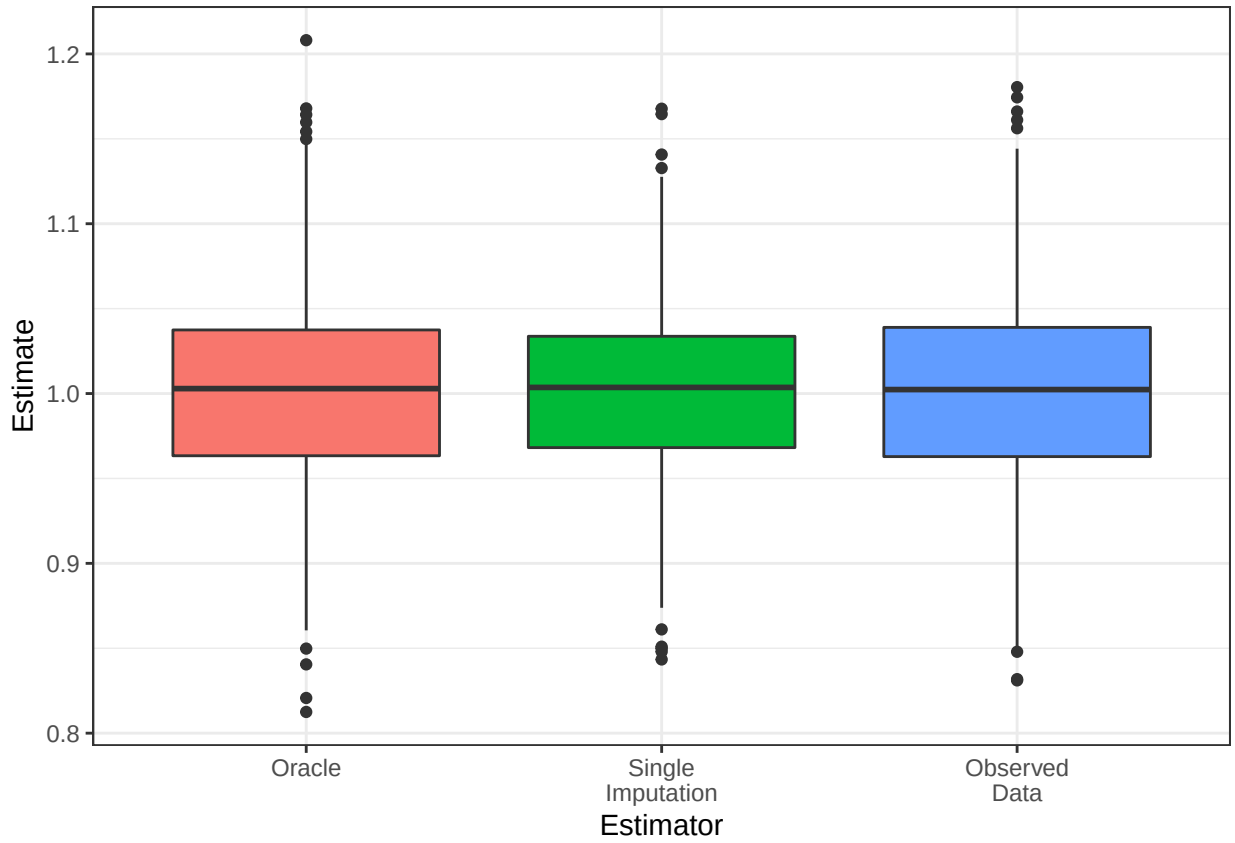



```
## # A tibble: 3 x 3
##   estimator   est     se
##   <chr>     <dbl>  <dbl>
## 1 si         1.00 0.0570
## 2 obs        1.00 0.0578
## 3 oracle     1.00 0.0563
```

```
##                oracle   observed single imputation
## empirical 0.05603238 0.05706055        0.04802895
## estimated 0.05630954 0.05781393        0.05695516
```

Beta unkown and incorrectly specified

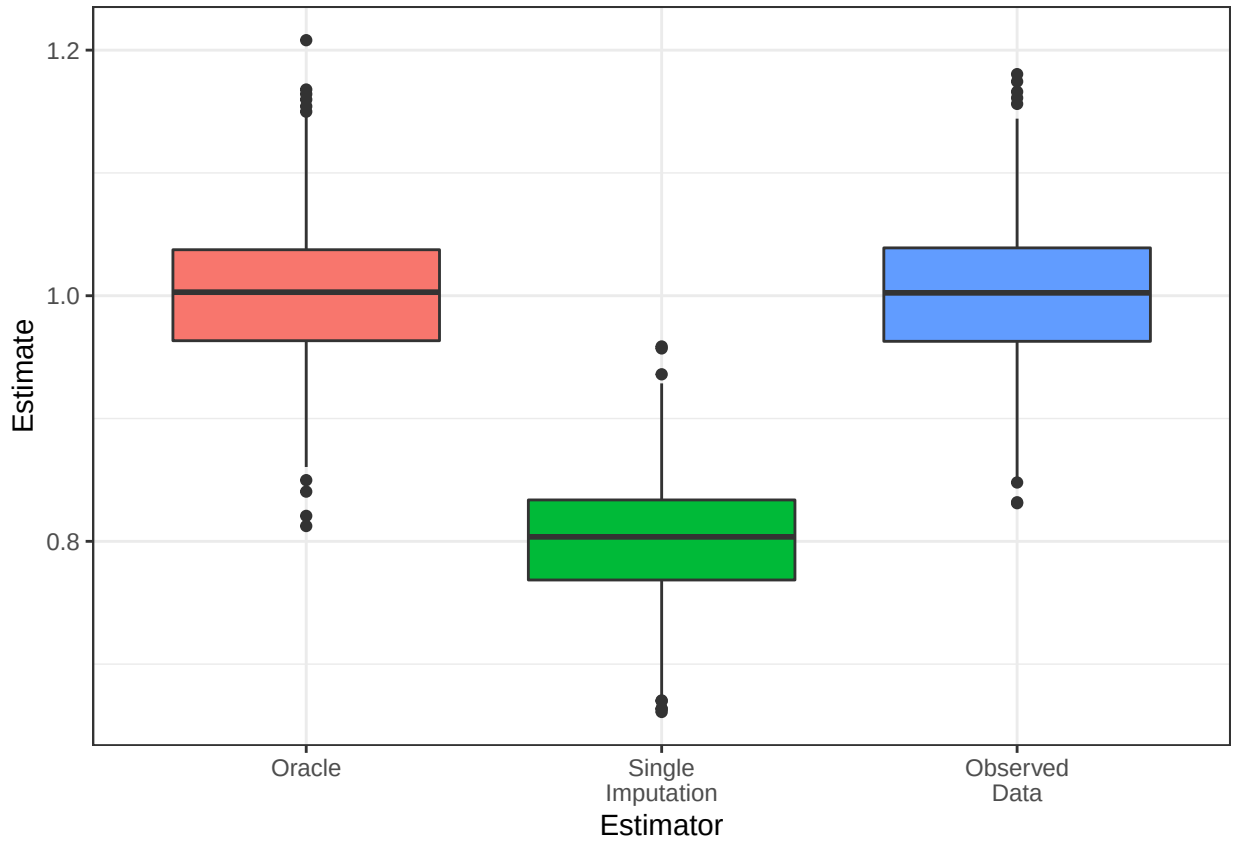
$\hat{Y} \sim G, X$




```
## # A tibble: 3 x 3
##   estimator   est     se
##   <chr>     <dbl>  <dbl>
## 1 si         1.00 0.0595
## 2 obs        1.00 0.0578
## 3 oracle     1.00 0.0563
```

```
##                oracle   observed single imputation
## empirical 0.05603238 0.05706055        0.04890523
## estimated 0.05630954 0.05781393        0.05942240
```

$\hat{Y} \sim X, Z$

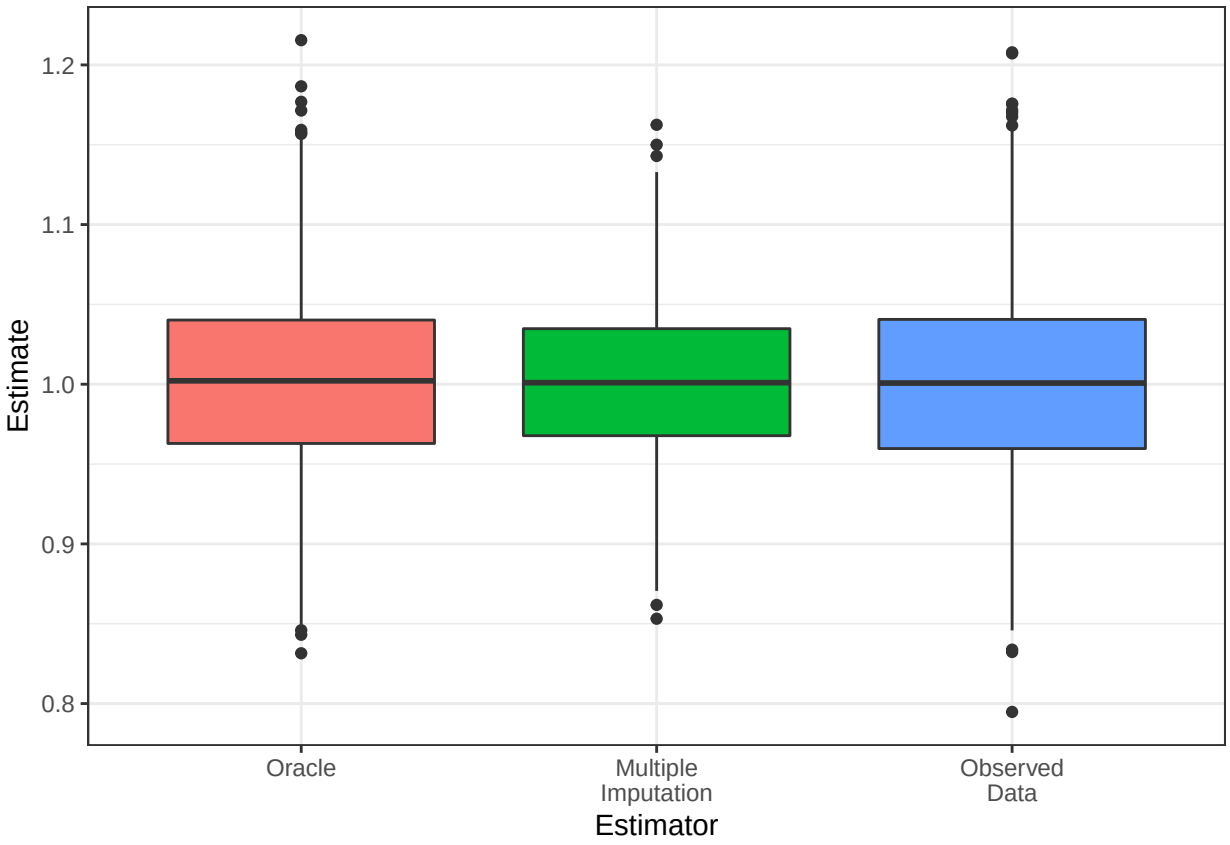



```
## # A tibble: 3 x 3
##   estimator   est     se
##   <chr>     <dbl>  <dbl>
## 1 si        0.801 0.0619
## 2 obs       1.00  0.0578
## 3 oracle    1.00  0.0563
```

```
##                oracle   observed single imputation
## empirical 0.05603238 0.05706055        0.04947508
## estimated 0.05630954 0.05781393        0.06178609
```

Multiple Imputation

Beta known, model correctly specified

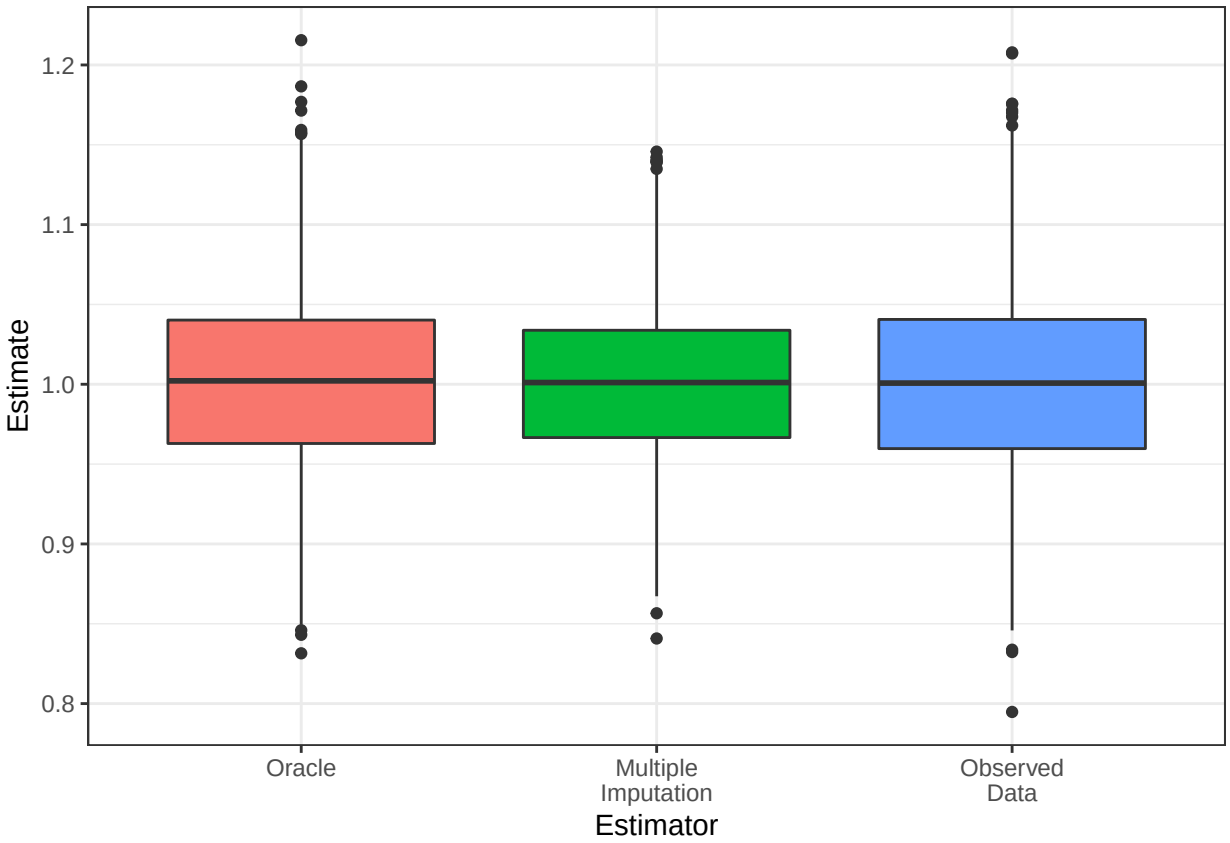



```
## # A tibble: 3 x 3
##   estimator   est     se
##   <chr>     <dbl>  <dbl>
## 1 mi         1.00 0.0572
## 2 obs        1.00 0.0579
## 3 oracle     1.00 0.0564
```

```
##           oracle_est    obs_est     mi_est
## empirical 0.05759028 0.05967830 0.04820053
## estimated 0.05635562 0.05788834 0.05708687
```

Beta known, model incorrectly specified

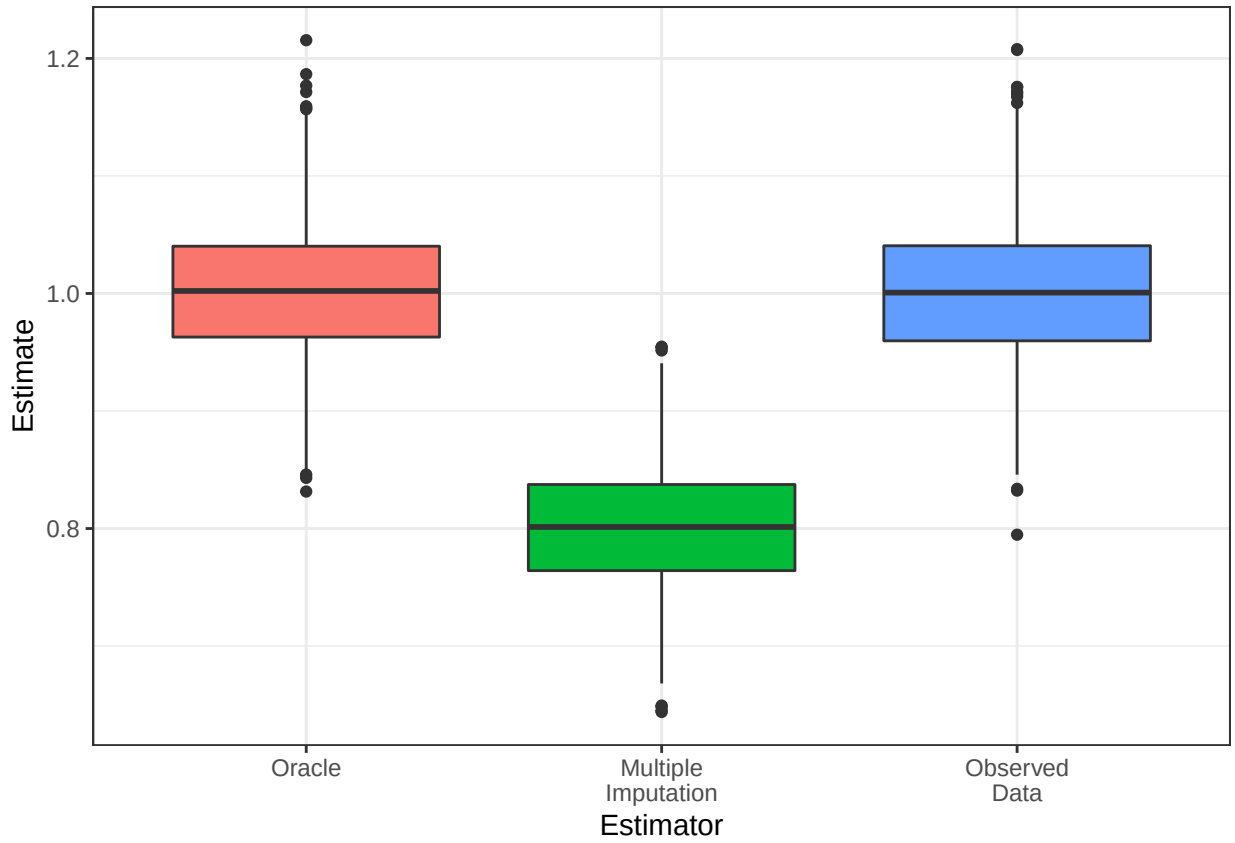
$\hat{Y} \sim G + X$




```
## # A tibble: 3 x 3
##   estimator   est     se
##   <chr>     <dbl>  <dbl>
## 1 mi         1.00 0.0581
## 2 obs        1.00 0.0579
## 3 oracle     1.00 0.0564
```

```
##           oracle_est    obs_est     mi_est
## empirical 0.05759028 0.05967830 0.04919589
## estimated 0.05635562 0.05788834 0.05801730
```

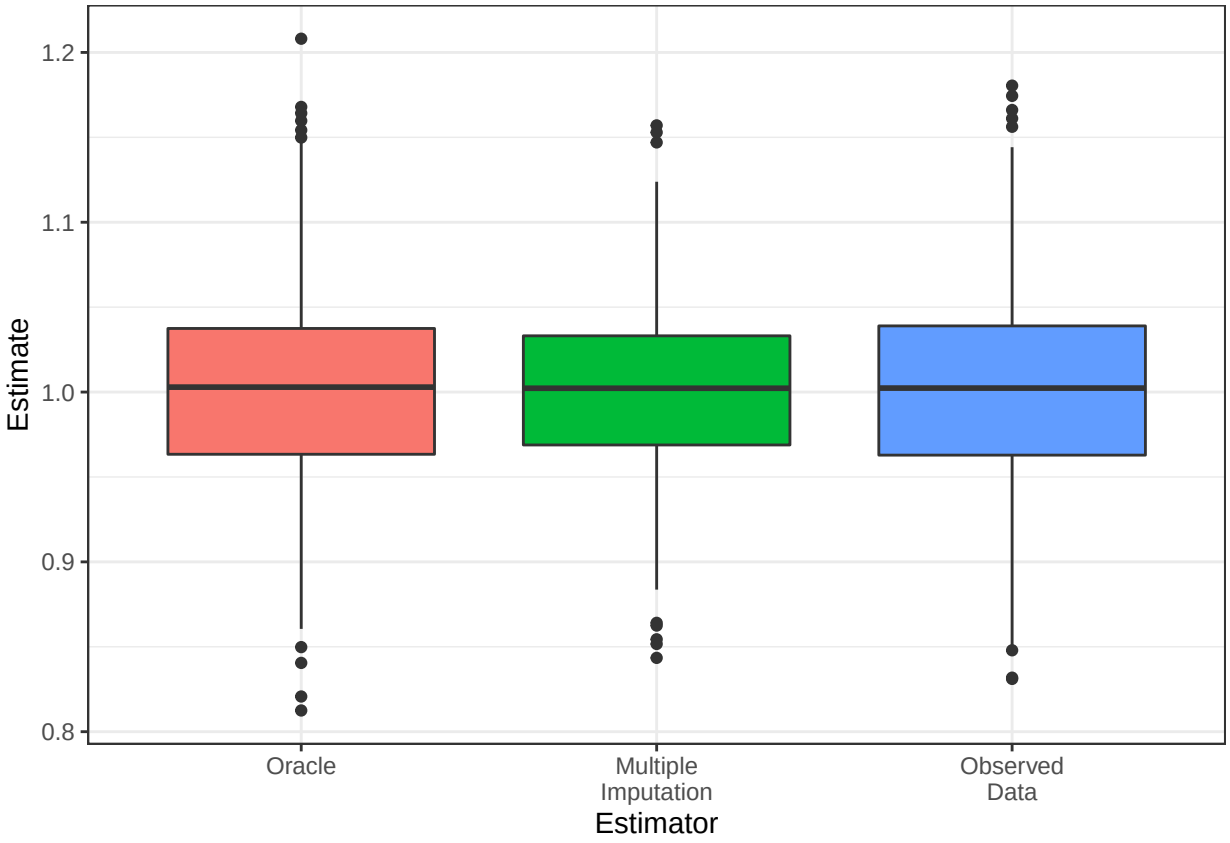
$\hat{Y} \sim X + Z$




```
## # A tibble: 3 x 3
##   estimator   est     se
##   <chr>     <dbl>  <dbl>
## 1 mi        0.802 0.0595
## 2 obs       1.00  0.0579
## 3 oracle    1.00  0.0564
```

```
##           oracle_est    obs_est     mi_est
## empirical 0.05759028 0.05967830 0.05298476
## estimated 0.05635562 0.05788834 0.05938419
```

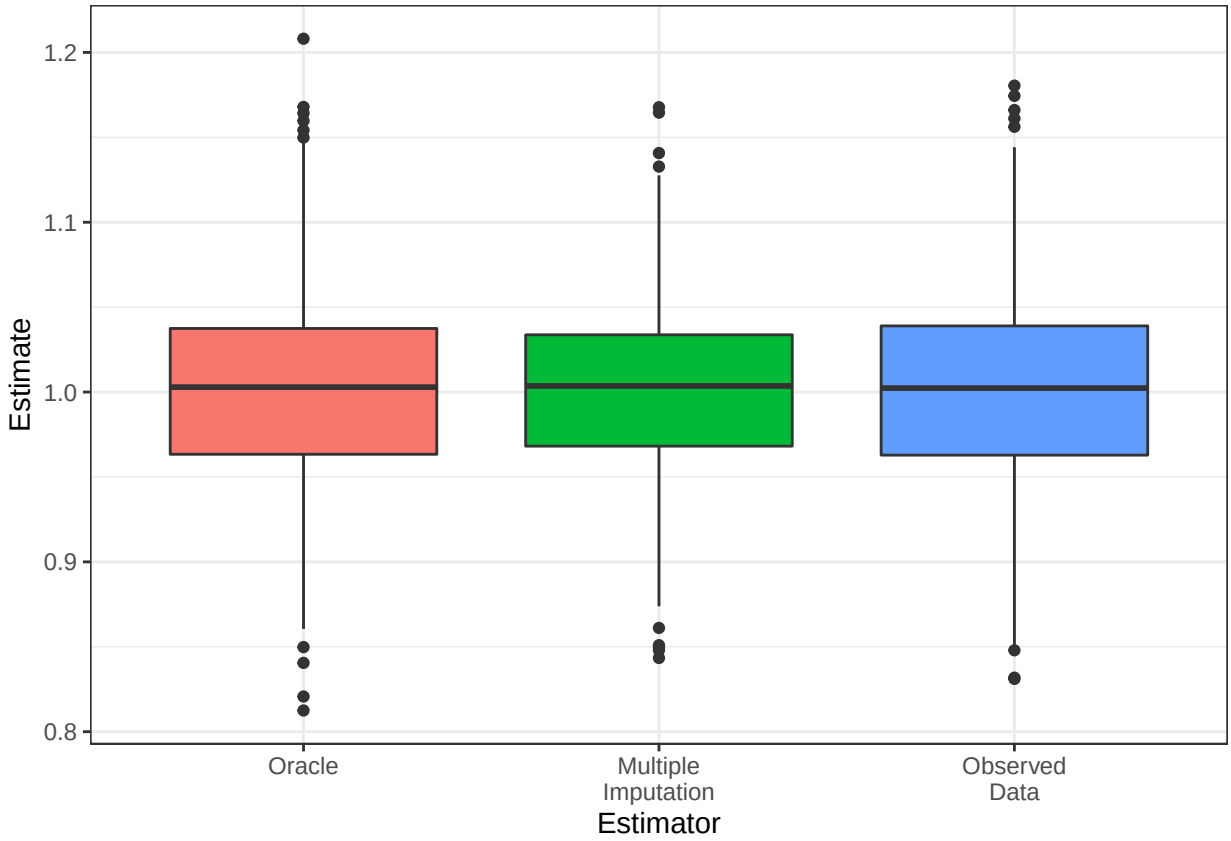
Beta unknown, model correctly specified




```
## # A tibble: 3 x 3
##   estimator   est     se
##   <chr>     <dbl>  <dbl>
## 1 mi         1.00 0.0570
## 2 obs        1.00 0.0578
## 3 oracle     1.00 0.0563
```

```
##           oracle_est    obs_est     mi_est
## empirical 0.05603238 0.05706055 0.04802895
## estimated 0.05630954 0.05781393 0.05695516
```

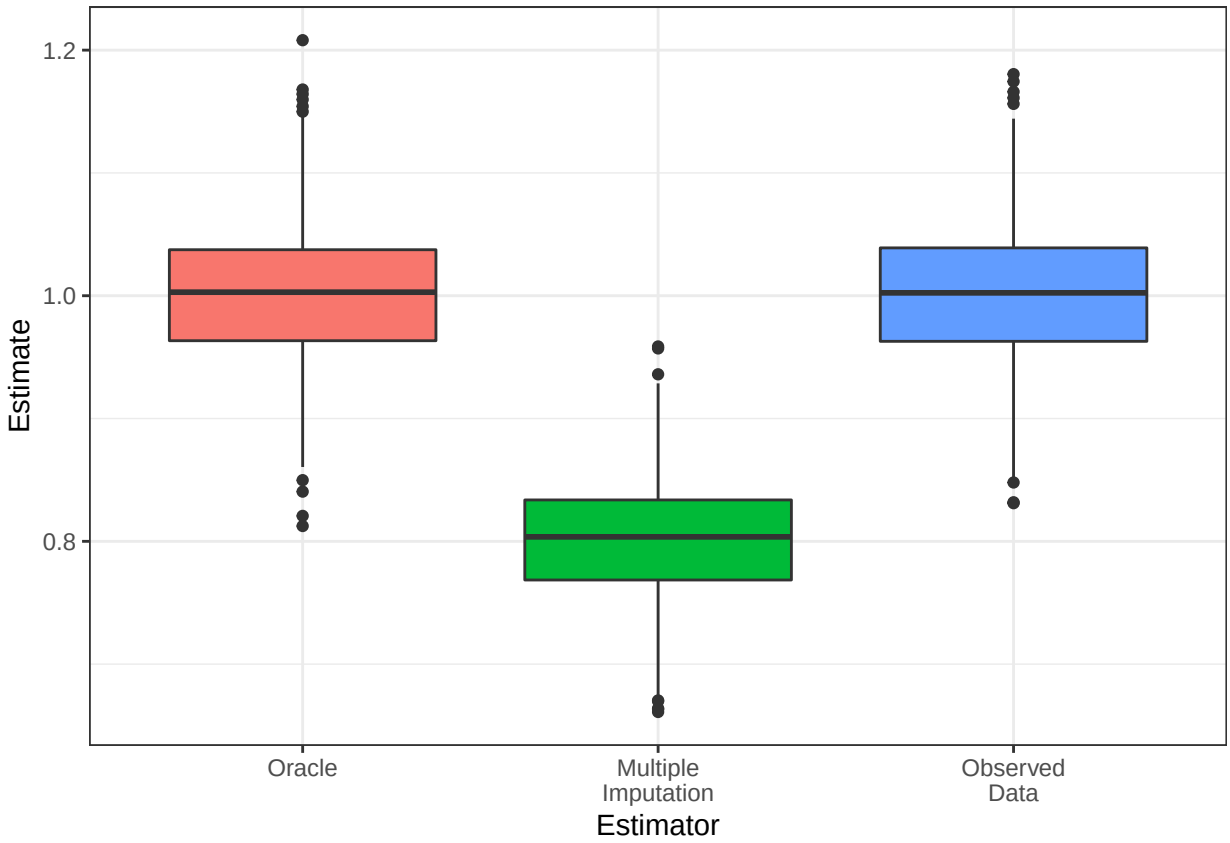
Beta unknown, model incorrectly specified



$\hat{Y} \sim G+X$

```
## # A tibble: 3 x 3
##   estimator   est     se
##   <chr>     <dbl>  <dbl>
## 1 mi         1.00 0.0595
## 2 obs        1.00 0.0578
## 3 oracle     1.00 0.0563
```

```
##           oracle_est    obs_est     mi_est
## empirical 0.05603238 0.05706055 0.04890523
## estimated 0.05630954 0.05781393 0.05942240
```



$\hat{Y} \sim X + Z$

```
## # A tibble: 3 x 3
##   estimator   est     se
##   <chr>     <dbl>  <dbl>
## 1 mi        0.801 0.0619
## 2 obs       1.00  0.0578
## 3 oracle    1.00  0.0563
```

```
##           oracle_est    obs_est     mi_est
## empirical 0.05603238 0.05706055 0.04947508
## estimated 0.05630954 0.05781393 0.06178609
```