

# Type I error and power simulation

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## Simulation Set-up

$$\begin{bmatrix} Y_i \\ \hat{Y}_i \end{bmatrix} | Z_{ik} \sim N \left( \begin{bmatrix} \beta_G G + \beta X_i \\ \alpha X_i \end{bmatrix}, \begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix} \right)$$

- $G \sim \text{Bin}(2, maf)$
- $maf = 0.25, X_i \sim N(0, 1)$
- $\alpha = \beta = 0.11, \beta_g = 0.11575982$
- missing rate  $\in \{0, 0.25, 0.5, 0.75\}$
- $\rho \in \{0, 0.25, 0.5, 0.75\}$

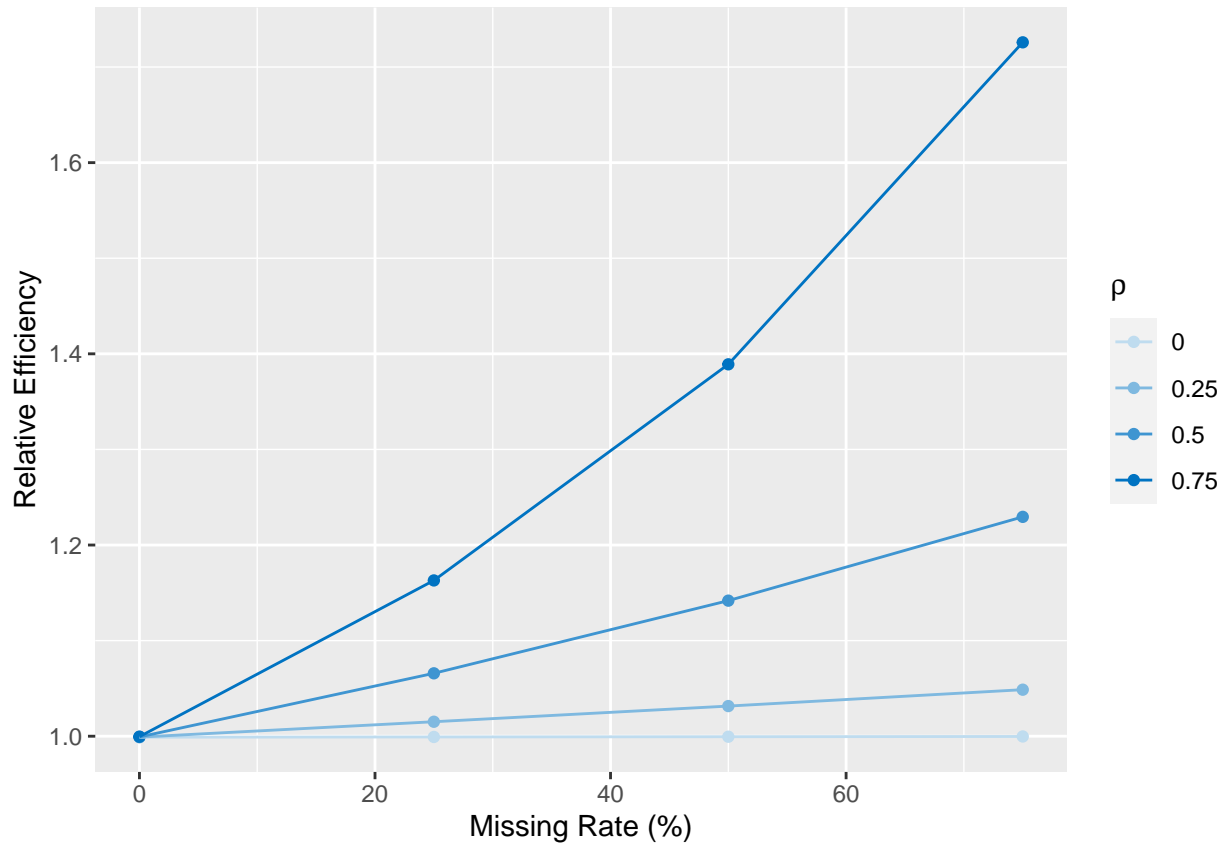
I do not think these parameters match whats in the simulation file, please confirm.

## Type I error

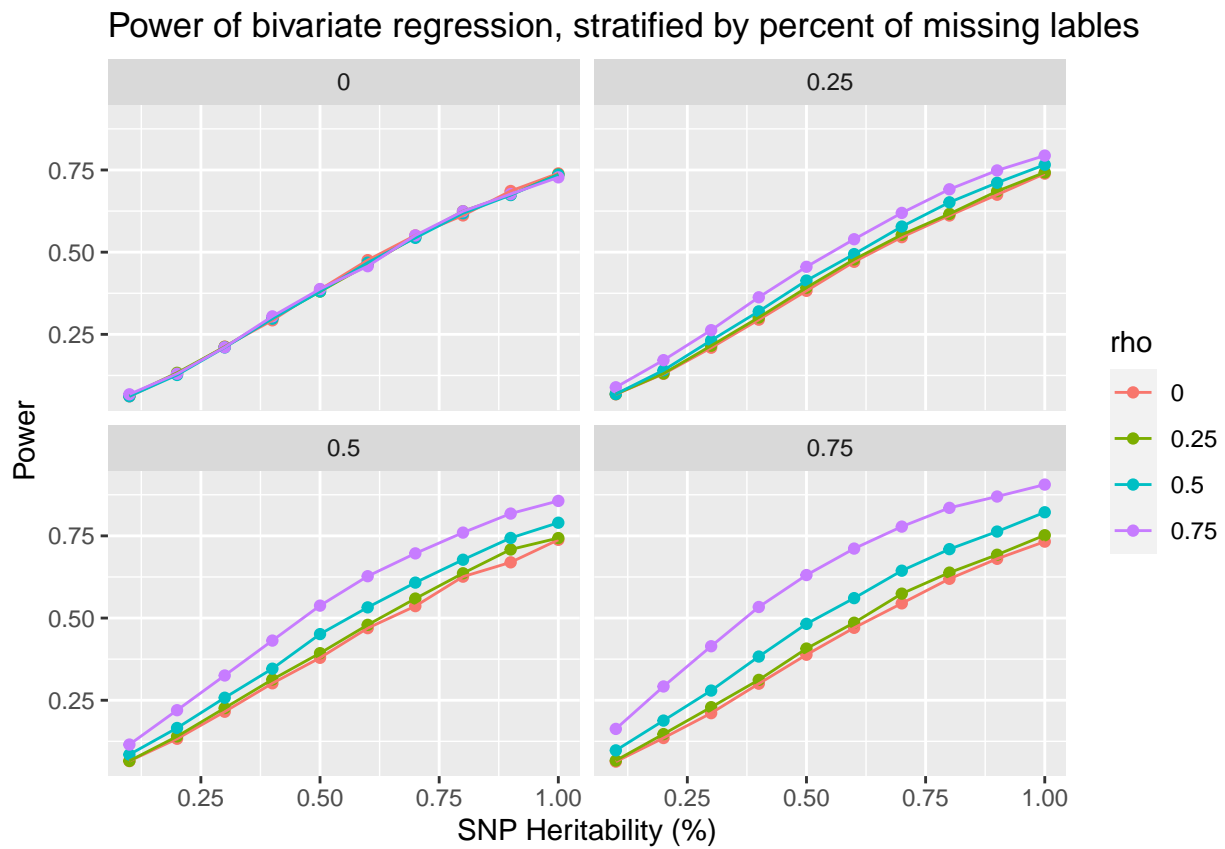
Table 1: Proportion of test making type I error

missing	rho	t1e rejection	Chisq
0.00	0.00	0.05	0.97
0.00	0.25	0.05	1.00
0.00	0.50	0.05	0.98
0.00	0.75	0.05	0.98
0.25	0.00	0.05	1.00
0.25	0.25	0.06	1.03
0.25	0.50	0.05	1.02
0.25	0.75	0.05	1.00
0.50	0.00	0.05	1.00
0.50	0.25	0.05	1.00
0.50	0.50	0.05	1.00
0.50	0.75	0.05	1.00
0.75	0.00	0.05	0.99
0.75	0.25	0.05	1.00
0.75	0.50	0.05	1.01
0.75	0.75	0.05	1.01

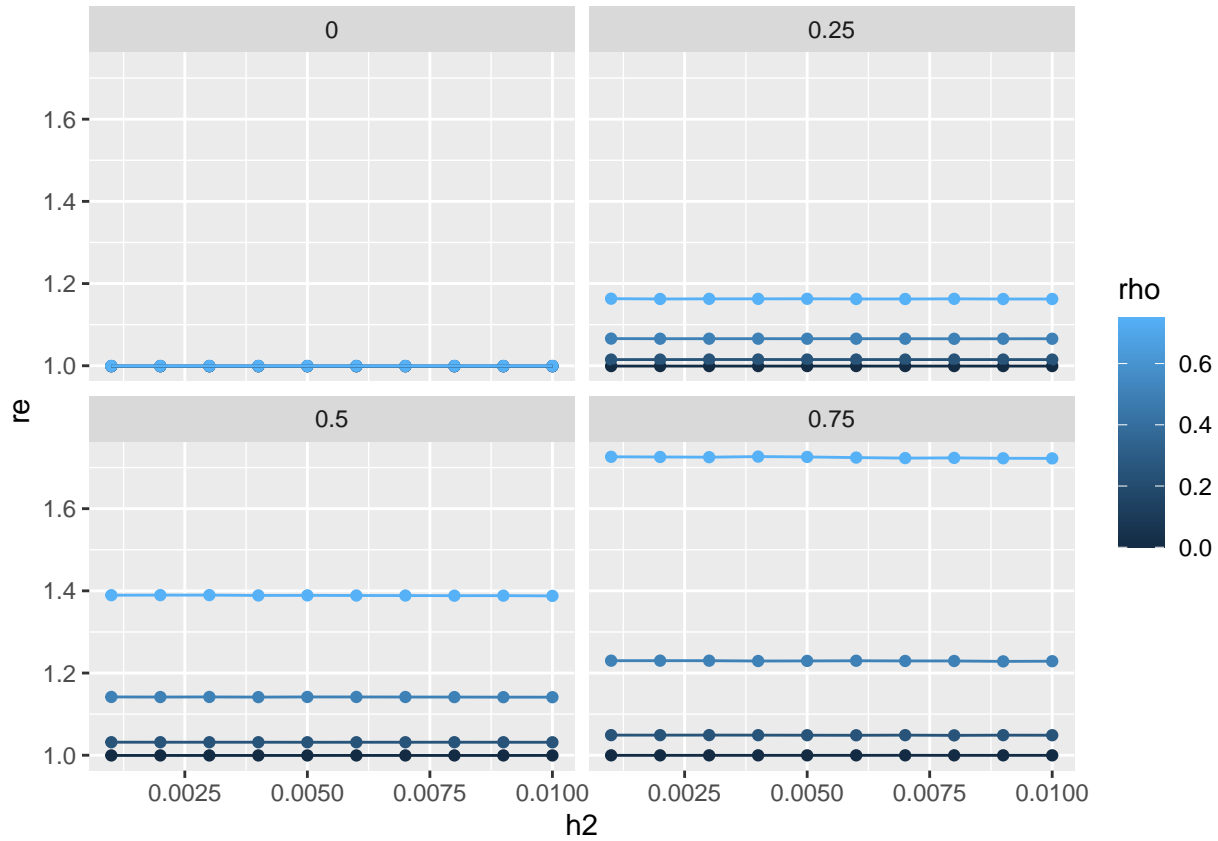
Increased Power relative to baseline GWAS



## Power as a function of heritability



Unlike the previous plot, SNP heritability plays no role in relative efficiency.



## Tables and Figures for the Manuscript

```
## % latex table generated in R 4.0.3 by xtable 1.8-4 package
## % Mon Aug 1 20:11:10 2022
## \begin{table}[ht]
## \centering
## \begin{tabular}{rrrrr}
## \hline
## Missing Rate (\%) &  $\rho$  & Type I Error &  $\chi^2$  & Power \\
## \hline
## 0.00 & 0.00 & 0.05 & 0.97 & 0.39 \\
## 0.00 & 0.25 & 0.05 & 1.00 & 0.38 \\
## 0.00 & 0.50 & 0.05 & 0.98 & 0.38 \\
## 0.00 & 0.75 & 0.05 & 0.98 & 0.39 \\
## 0.25 & 0.00 & 0.05 & 1.00 & 0.38 \\
## 0.25 & 0.25 & 0.06 & 1.03 & 0.39 \\
## 0.25 & 0.50 & 0.05 & 1.02 & 0.41 \\
## 0.25 & 0.75 & 0.05 & 1.00 & 0.46 \\
## 0.50 & 0.00 & 0.05 & 1.00 & 0.38 \\
## 0.50 & 0.25 & 0.05 & 1.00 & 0.39 \\
## 0.50 & 0.50 & 0.05 & 1.00 & 0.45 \\
## 0.50 & 0.75 & 0.05 & 1.00 & 0.54 \\
## 0.75 & 0.00 & 0.05 & 0.99 & 0.39 \\
## 0.75 & 0.25 & 0.05 & 1.00 & 0.41 \\
## 0.75 & 0.50 & 0.05 & 1.01 & 0.48
```

```

##    0.75 & 0.75 & 0.05 & 1.01 & 0.63 \\
##    \hline
## \end{tabular}
## \end{table}

```