~~Y~~ $Y = X_1\beta_1 + \cdots$ ~~X_K~~ $X_p\beta_p$

Suppose w/log $\beta_1, \ldots, \beta_K \neq 0$ and $\beta_j = 0$ $\forall j > K$
some $K \leq p$

then $\mathbb{P}($ ~~ex~~ error$)$

Let T_j be the ~~test~~ stat for the j^{th} test-statistic

then ~~$\mathbb{P}($~~ Let T^* be the ~~permuted~~ FL claimed bound

then $\mathbb{P}$(FWER $= \mathbb{P}($ at least one error$)$

$$= \mathbb{P}\left(\max_{\substack{1 \leq j \leq K \\ j > K}} T_j > T^* \right)$$

T^*_α is chosen based on the distribution of $\max_{1 \leq j \leq p} T^*_j$ which dominates $\max_{j>K} T^*_j$ given $H_{0,K}$

but by construction this is controlled to a level α

$$\max_{j>K} T_j > T^*$$

only affect of the ~~un-zero~~ non-zero ~~betas~~ betas is to make T^* more extreme.

Works for the first case but not the second