Date

$AIC = \log(S^2) + \frac{2k}{n}$

(a). The restricted model is preferred when

$AIC_0 < AIC_1$, which denotes $\log(S_0^2) + \frac{2P_0}{n} < \log(S_1^2) + \frac{2P_1}{n}$

then $\log(S_0^2) - \log(S_1^2) < \frac{2(P_1 - P_0)}{n}$,

$\log\left(\frac{S_0^2}{S_1^2}\right) < \frac{2(P_1 - P_0)}{n}$, exponent both sides (monotonic transformation)

$\Leftrightarrow \frac{S_0^2}{S_1^2} < e^{\frac{2}{n}(P_1 - P_0)}$ ①

(b). $n \to \infty$. $\frac{2}{n}(P_1 - P_0) \to 0$, then $e^{\frac{2}{n}(P_1 - P_0)} \approx \frac{2}{n}(P_1 - P_0) + 1$

① becomes $\frac{S_0^2}{S_1^2} < \frac{2}{n}(P_1 - P_0) + 1$

then $\frac{S_0^2 - S_1^2}{S_1^2} < \frac{2}{n}(P_1 - P_0)$ ②

(C). $S_0^2 = \frac{e_R' e_R}{n - P_0}$, $S_1^2 = \frac{e_U' e_U}{n - P_1}$

then ② becomes $\frac{e_R' e_R/(n - P_0) - e_U' e_U/(n - P_1)}{e_U' e_U/(n - P_1)} < \frac{2}{n}(P_1 - P_0)$

as $n \to \infty$, then $(n - P_0), (n - P_1) \to n$

then ② becomes $\frac{e_R' e_R - e_U' e_U}{e_U' e_U} < \frac{2}{n}(P_1 - P_0)$ ③

(d). $F = \frac{(e_R' e_R - e_U' e_U)/(P_1 - P_0)}{e_U' e_U/(n - P_1)}$

③ becomes $\frac{(e_R' e_R - e_U' e_U)/(P_1 - P_0)}{e_U' e_U/(n - P_1)} < \frac{2(P_1 - P_0)}{n} \frac{n - P_1}{P_1 - P_0}$

then $F < \frac{2(n - P_1)}{n}$, as $n \to \infty$, $(n - P_1) \to n$

then $F < 2$