

Supplementary Information, Simulation Study

In order to evaluate the accuracy of the non-centrality parameter approximations, we perform simulations for some power curves in Figures 1, 2, 5, 6 and 7 of the paper. To do this, we divide the interval $(-0.125, 0.125)$ of the measure D_1 of LD uniformly into 100 subintervals for Figures 1 and 2. Correspondingly, the 100 subintervals lead to 101 endpoints. For each endpoint, there is a set of parameters for each power curve. Using the set of parameters, 2,500 datasets are simulated for each endpoint. For each dataset, the empirical statistics $F_{m,ad}$ and $F_{m,a}$ are calculated. The simulated power of either $SF_{m,ad}$ or $SF_{m,a}$ is the proportion of the 2,500 simulated datasets for which the empirical statistic of either $F_{m,ad}$ or $F_{m,a}$ is larger than the cutting point of the corresponding F -distribution at a 0.05 significance level. Similarly, we calculate the simulated power curves for Figures 3, 4 and 5 of this **Supplementary Information**.

In Graph I and III of Figure 1, we plot the power curves of $F_{4,a}$ and $F_{4,ad}$; and the corresponding simulated power curves $SF_{4,a}$ and $SF_{4,ad}$. In Graphs II and IV of Figure 1, we plot the power curves of $F_{2,a}$ and $F_{2,ad}$; and the corresponding simulated power curves $SF_{2,a}$ and $SF_{2,ad}$. In Figure 2, we plot the power curves of $F_{3,a}$ and $F_{3,ad}$; and the corresponding simulated power curves $SF_{3,a}$ and $SF_{3,ad}$.

From the two Figures 1 and 2, we can see that the theoretical power curves of $F_{m,ad}$ and $F_{m,a}$ are excellently close to the simulated power curves of $SF_{m,ad}$ and $SF_{m,a}$. Similarly, theoretical power curves of $F_{AB,ad}$, F_{HTR} , and $F_{AB,a}$ of Figures 5 and 6 of the paper are excellently close to the simulated power curves of $SF_{AB,ad}$, SF_{HTR} , and $SF_{AB,a}$ in Figure 3 and Figure 4; theoretical power curves of $F_{ABC,ad}$, F_{HTR} , and $F_{ABC,a}$ of Figure 7 of the paper are excellently close to the simulated power curves of $SF_{ABC,ad}$, SF_{HTR} , and $SF_{ABC,a}$ in Figure 5. Thus, the non-centrality parameter approximations are very accurate.

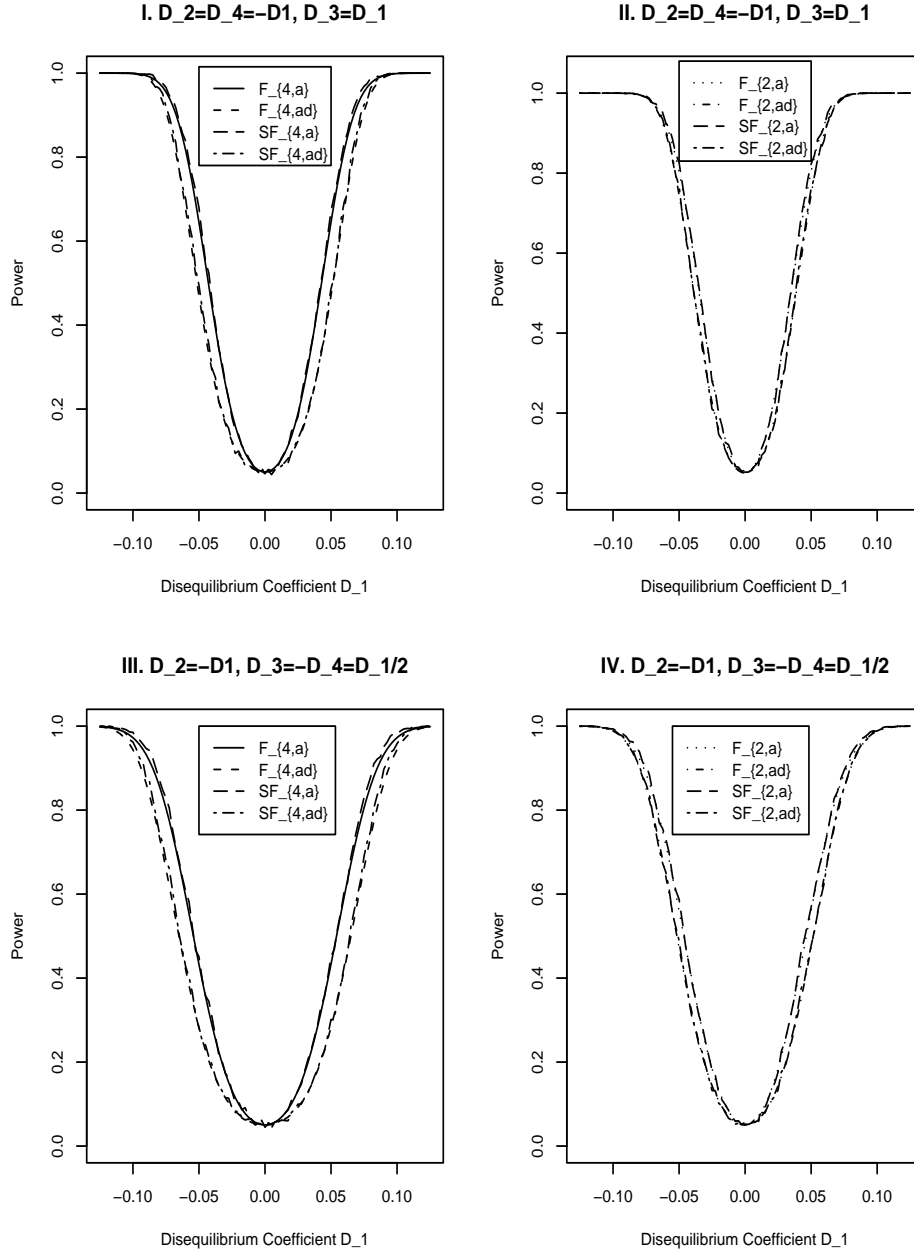


Figure 1: Graph I and III, power curves of the test statistics $F_{4,a}$ and $F_{4,ad}$, against the disequilibrium coefficient D_1 ; correspondingly, the simulated power curves $SF_{4,a}$ and $SF_{4,ad}$ are plotted. Graph II and IV, power curves of the test statistics $F_{2,a}$ and $F_{2,ad}$, against the disequilibrium coefficient D_1 ; correspondingly, the simulated power curves $SF_{2,a}$ and $SF_{2,ad}$ are plotted. The corresponding parameters are the same as those of Figure 1 of the paper.

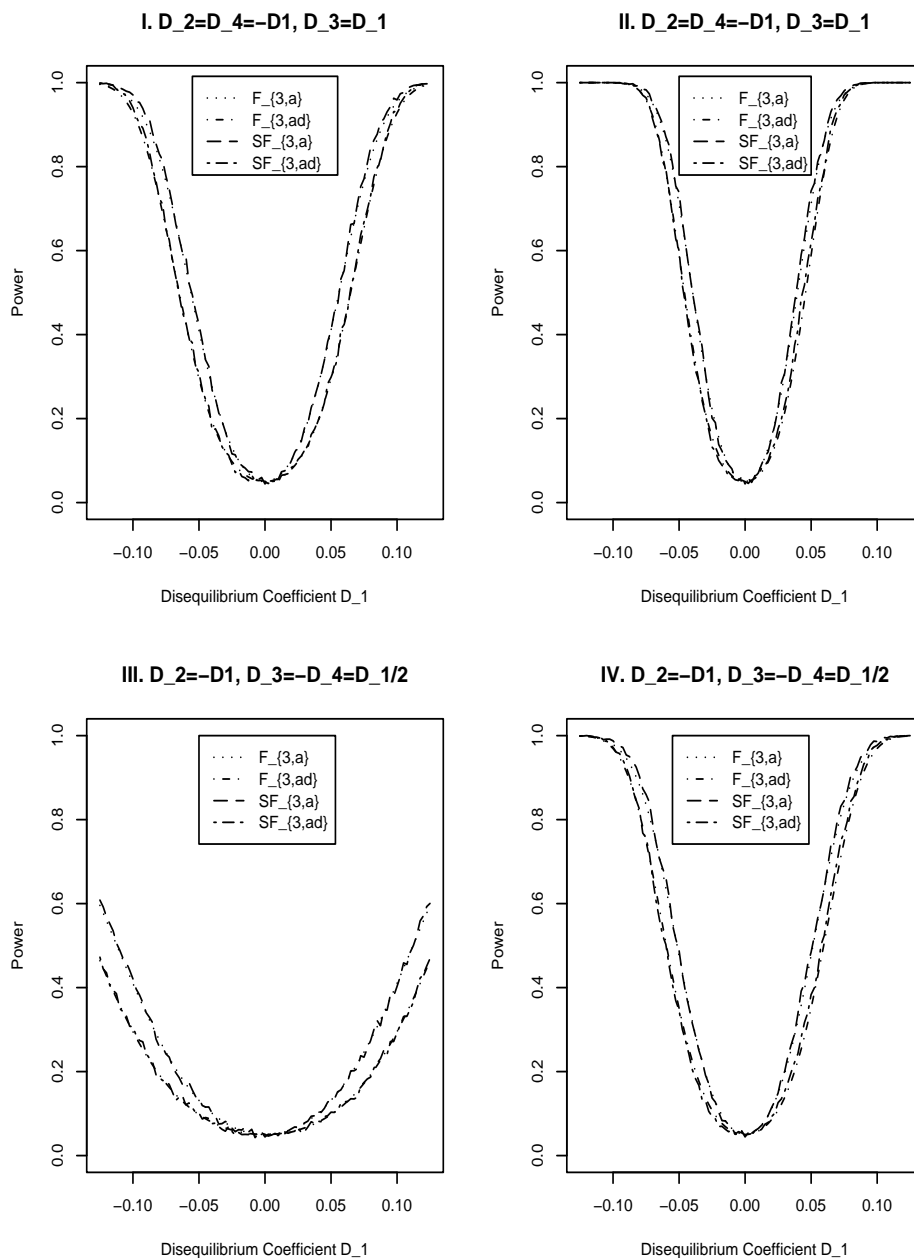


Figure 2: Power curves of the test statistics $F_{3,a}$ and $F_{3,ad}$, against the disequilibrium coefficient D_1 ; correspondingly, the simulated power curves $SF_{3,a}$ and $SF_{3,ad}$ are plotted. The corresponding parameters are the same as those of Figure 2 of the paper.

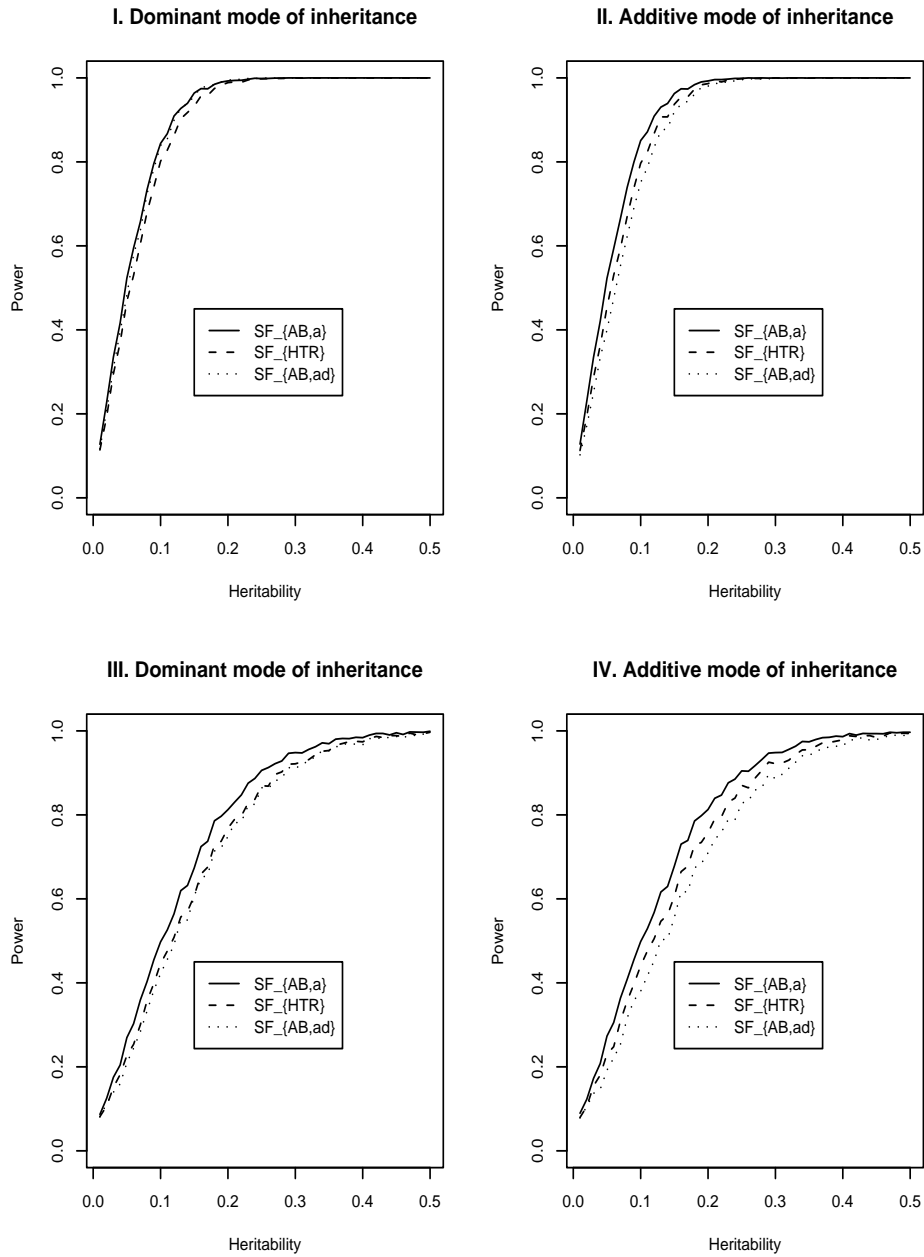


Figure 3: The simulated power curves $SF_{AB,a}$, F_{HTR} , and $SF_{AB,ad}$ against the heritability h^2 . The corresponding parameters are the same as those of Figure 5 of the paper.

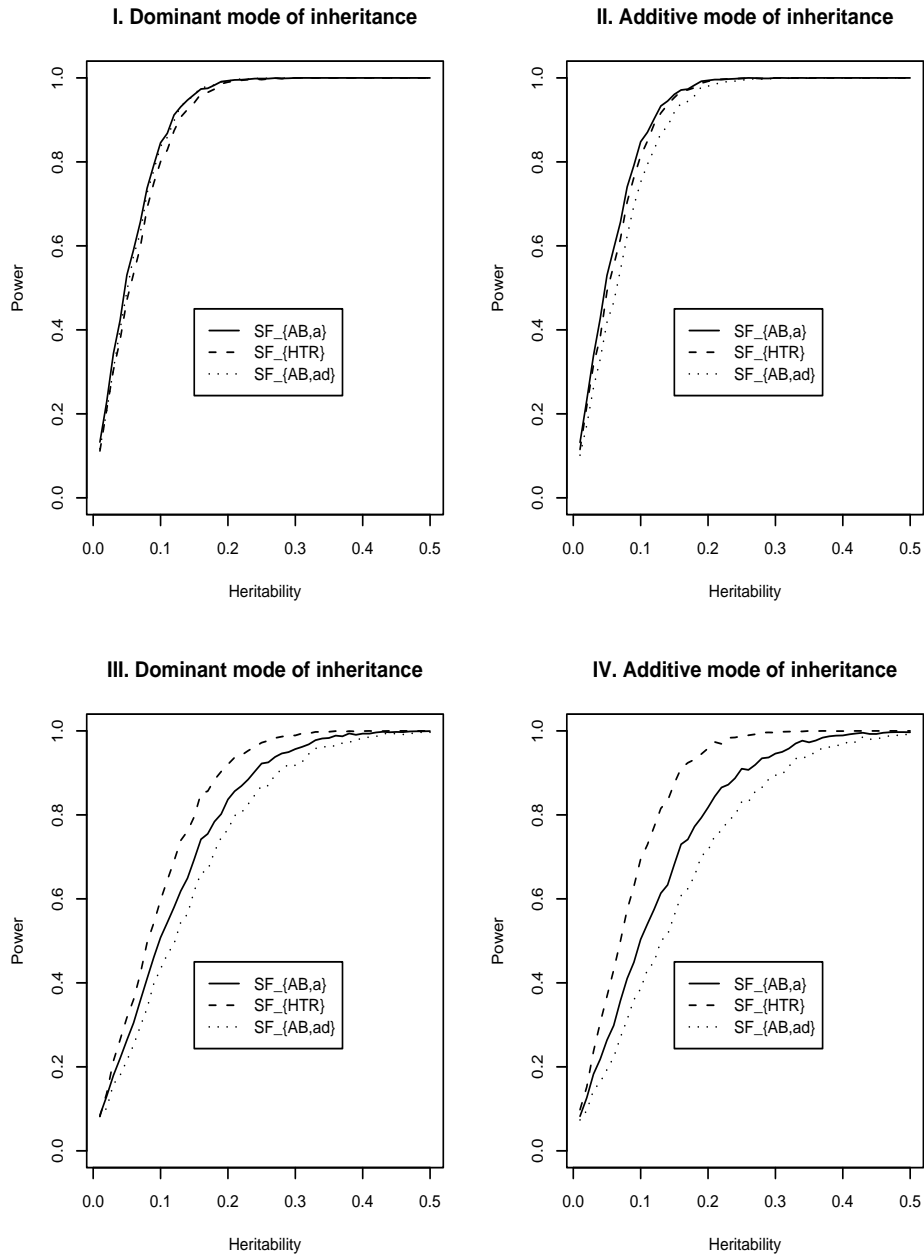


Figure 4: The simulated power curves $SF_{AB,a}$, F_{HTR} , and $SF_{AB,ad}$ against the heritability h^2 . The corresponding parameters are the same as those of Figure 6 of the paper.

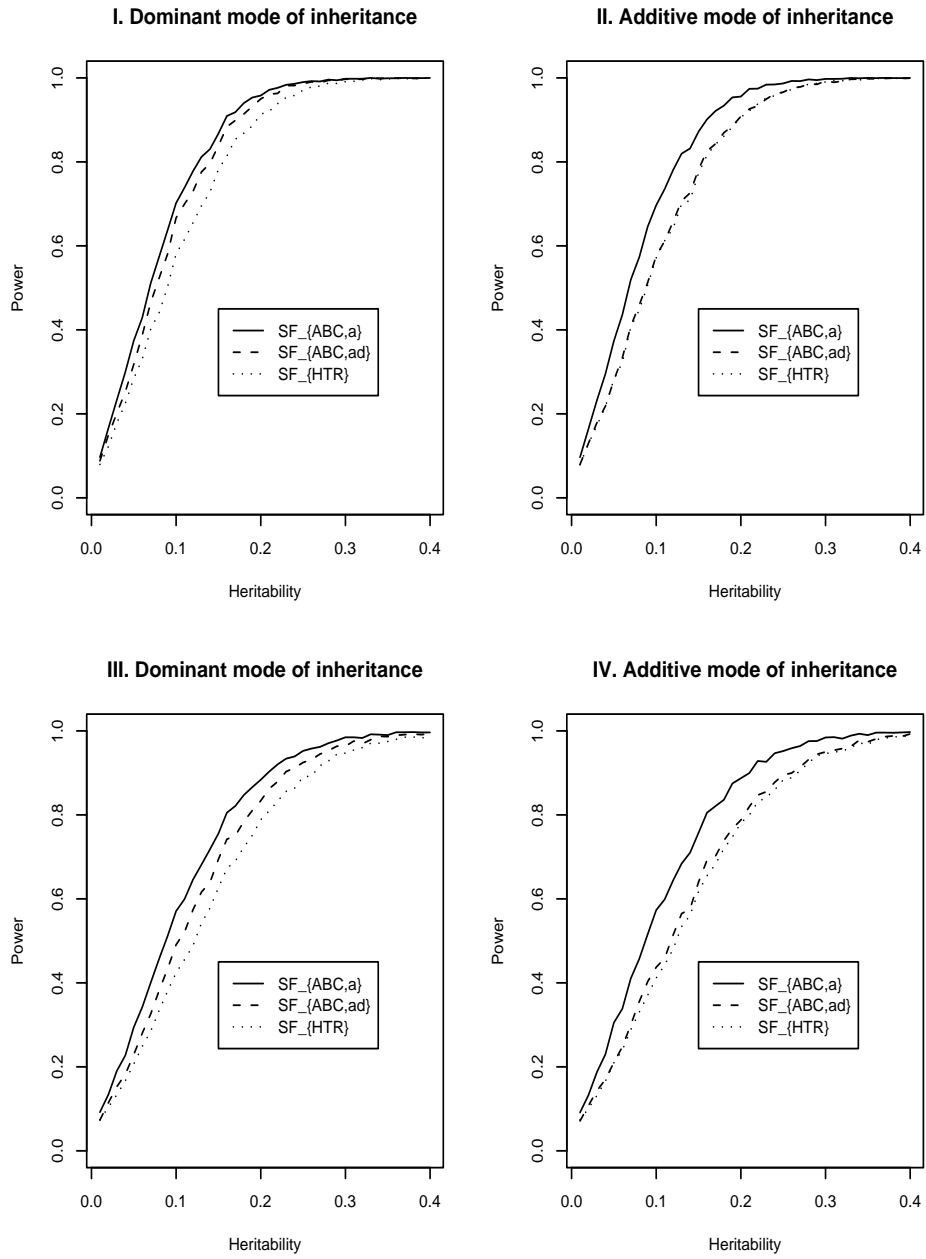


Figure 5: The simulated power curves $SF_{ABC,a}$, F_{HTR} , and $SF_{ABC,ad}$ against the heritability h^2 . The corresponding parameters are the same as those of Figure 7 of the paper.