

We have listed the results of prediction accuracy of the optimal treatment assignment on the validation dataset from the same simulation setting as discussed in Section 5 with  $n = 1000$  using LS-learning based on different tuning procedures in the following Table S1. Comparing the results in Table S1 we can see that, the SSE-based tuning provided the highest prediction accuracy (and the highest stability with the lowest standard deviation) compared to the tuning based on F-statistics, robust F-statistics, truncated F-statistics, and value information criterion (VIC), suggesting that the SSE-based tuning is deemed desirable for our LS-learning.

Table S1. Prediction accuracy of the optimal treatment assignment for the validation dataset using LS-learning based on different tuning procedures.

| Tuning criterion      | Mean Prediction Accuracy (st. dev) |
|-----------------------|------------------------------------|
| SSE                   | 0.812 (0.036)                      |
| F-statistics          | 0.739 (0.062)                      |
| Robust F-statistic    | 0.742 (0.061)                      |
| Truncated F-statistic | 0.739 (0.062)                      |
| VIC                   | 0.809 (0.037)                      |