# Supplemental Material for: Time Fused Coefficient SIR Model with Application to COVID-19 Epidemic in the United States

by

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**ARTICLE HISTORY**
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## 1. Check for MCMC Convergence

As suggested by a reviewer, we study the convergence for the chains. From design 1,d d we extracted three chains from the post-burn-in samples of $\widehat{\beta}(20)$ and $\widehat{\gamma}(68)$, and visualize the chains as in Figure 1 and Figure 2. It can be seen that with 50000 chain length, 10 thinning and 3000 burn-in, good convergence and mixing are achieved. As the numerical values of true $\beta(t)$ and $\gamma(t)$ are in general small in our simulation designs, we would like the samples drawn using the adaptive Metropolis–Hastings to be as independent as possible.

## 2. Computing Time Benchmarking

To examine the computing speed, we use the **microbenchmark** package [1] to record the running time for 20 replicates of simulation under each of the four designs for each of the three shrinkage priors. A boxplot of the computing time is in Figure 3. It can be seen that, despite the chain length of 50,000, computation is fairly fast as almost all replicates finish within 4 minutes. Out of the three shrinkage priors, the $t$-shrinkage prior on average takes the most computing time, while the horseshoe is faster than spike-and-slab by a small margin.

## References

[1] O. Mersmann, *microbenchmark: Accurate Timing Functions* (2019). Available at https://CRAN.R-project.org/package=microbenchmark, R package version 1.4-7.

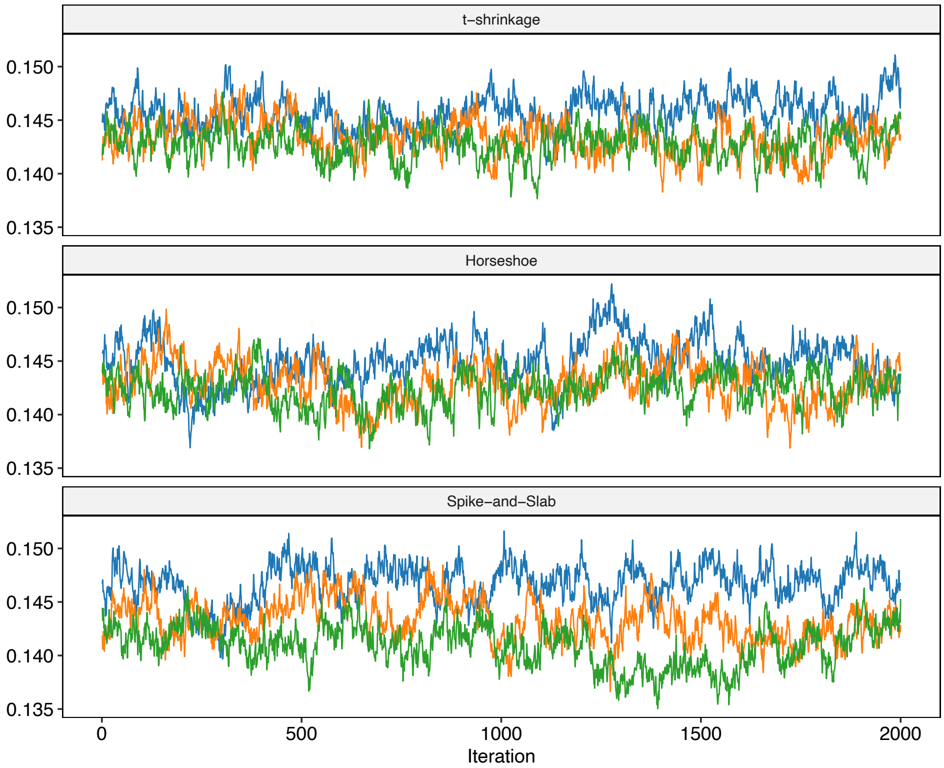


**Figure 1.** Post-burn-in trace plot for $\widehat{\beta}(20)$ obtained using the three priors.

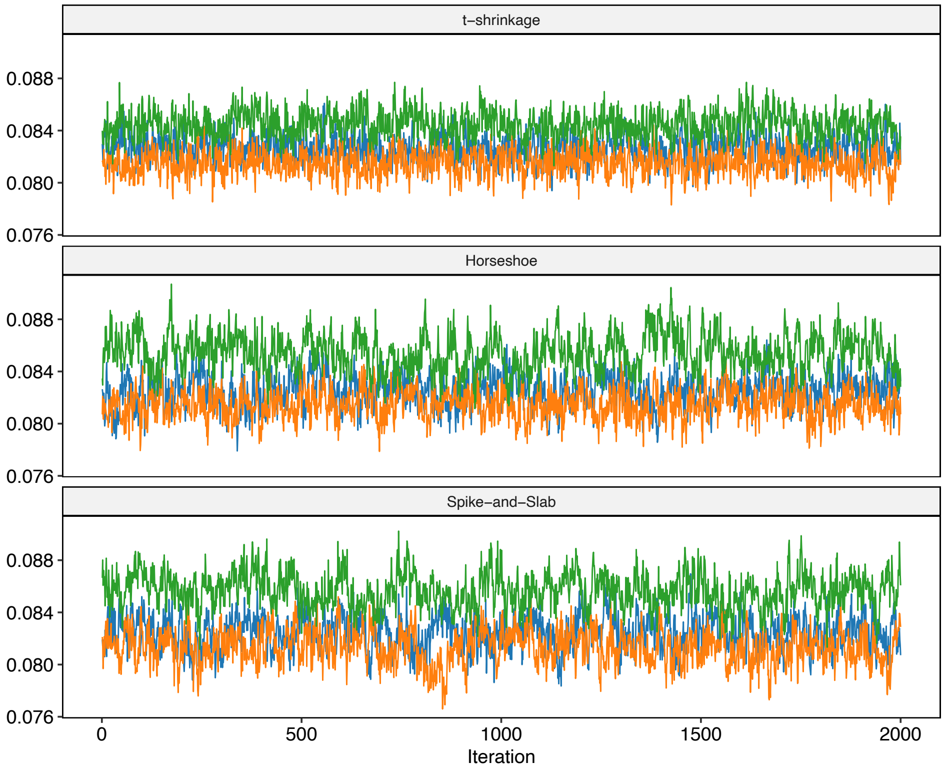


**Figure 2.** Post-burn-in trace plot for $\widehat{\gamma}(68)$ obtained using the three priors.

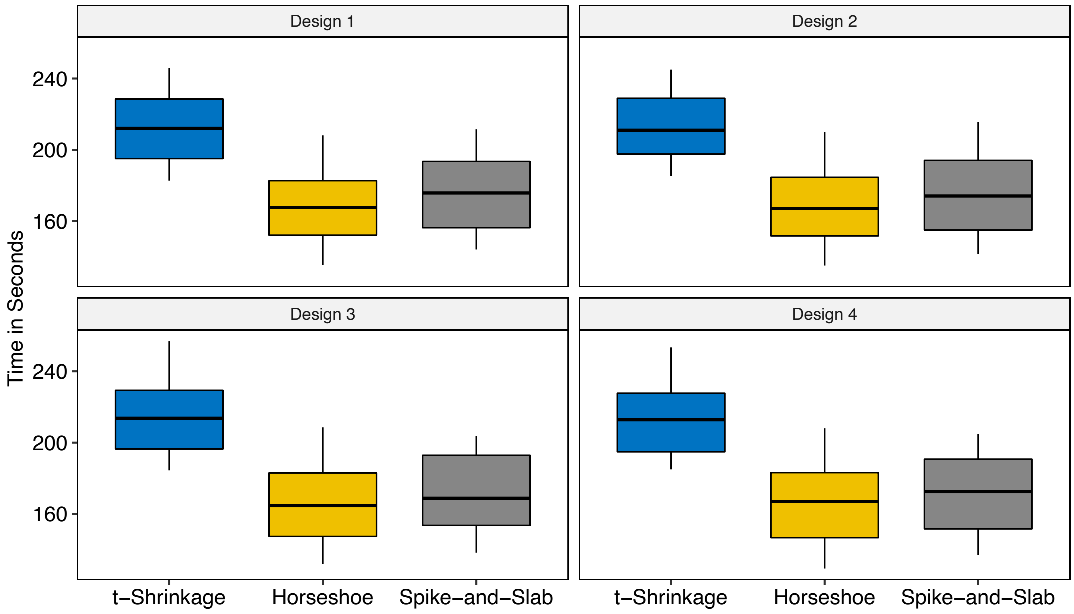


**Figure 3.** Boxplot of computing time for 20 simulation replicates for the three shrinkage priors.