Simulation results

Xiaodan Lyu, Emily Berg, Heike Hofmann

4/6/2020

```
rm(list = ls(all = T))
```

Table 1

```
load("intermediate_results/Cor0.9_D60_nsim1000_Result.RData")
mcmse.eb <- colMeans((pred.eb.store-YbarNis.store)^2)
rdmse.alt <- function(pred.store){
  mcmse <- colMeans((pred.store-YbarNis.store)^2)
  tapply(mcmse/mcmse.eb-1, nis, mean)
}
rdmse.result <- do.call(
  "cbind",
  lapply(list(eb0 = pred.eb0.store,
              pi = pred.pi.store,
              zi = pred.zi.store,
              si = pred.si.store),
         rdmse.alt))
round(rdmse.result, 3)
```

```
##      eb0    pi    zi    si
## 5  0.050 0.052 0.184 2.903
## 10 0.058 0.059 0.234 4.940
## 20 0.071 0.070 0.305 7.696
```

Table 2

```
rdmse.store <- c()
rhos <- c(-0.9, -0.6, -0.3, 0, 0.3, 0.6, 0.9)
for (rho in rhos){
  load(sprintf("intermediate_results/Cor%s_D60_nsim1000_Result.RData", rho))
  mcmse.eb <- colMeans((pred.eb.store-YbarNis.store)^2)
  mcmse.eb0 <- colMeans((pred.eb0.store-YbarNis.store)^2)
  rdmse <- mcmse.eb0/mcmse.eb-1
  rdmse.store <- cbind(rdmse.store, tapply(rdmse, nis, mean))
}
colnames(rdmse.store) <- rhos
round(rdmse.store, 3)
```

```
##     -0.9  -0.6   -0.3      0    0.3   0.6   0.9
## 5  0.154 0.052  0.005 -0.008 -0.002 0.019 0.050
## 10 0.239 0.064 -0.001 -0.011 -0.004 0.017 0.058
## 20 0.252 0.054 -0.005 -0.011  0.001 0.024 0.071
```

Table 3

```
seeds <- 2018:2035
m12boot <- m1biasboot <- m2boot <- mseboot <- c()
ybar <- predeb <- onestep <- c()
for (seed in seeds){
  load(sprintf("intermediate_results/bootstrap/Cor0.9_D60_nsim1_seed%.0f_Result.RData", seed))
  m12boot <- rbind(m12boot, M12boot.store)
  m1biasboot <- rbind(m1biasboot, M1biasboot.store)
  m2boot <- rbind(m2boot, M2boot.store)
  mseboot <- rbind(mseboot, MSEboot.store)
  ybar <- rbind(ybar, YbarNis.store)
  predeb <- rbind(predeb, pred.eb.store)
  onestep <- rbind(onestep, mse.eb.store)
}
mcmse <- colMeans((predeb - ybar)^2)
evalmse <- function(estmse){
  data.frame(
    rbmse = colMeans(estmse)/mcmse-1,
    cp = colMeans(abs(predeb - ybar) <= 1.96*sqrt(estmse)))
}
output <- do.call("cbind", lapply(list(
  onestep = onestep, boot = mseboot, semiboot = onestep + m2boot),
  evalmse))
output <- apply(output, 2, tapply, nis, mean)
rownames(output) <- unique(nis)
round(output, 3)
```

```
##    onestep.rbmse onestep.cp boot.rbmse boot.cp semiboot.rbmse semiboot.cp
## 5          0.361      0.961      0.472   0.950          0.427       0.964
## 10         0.117      0.928      0.291   0.925          0.182       0.933
## 20         0.453      0.975      0.571   0.972          0.540       0.981
```

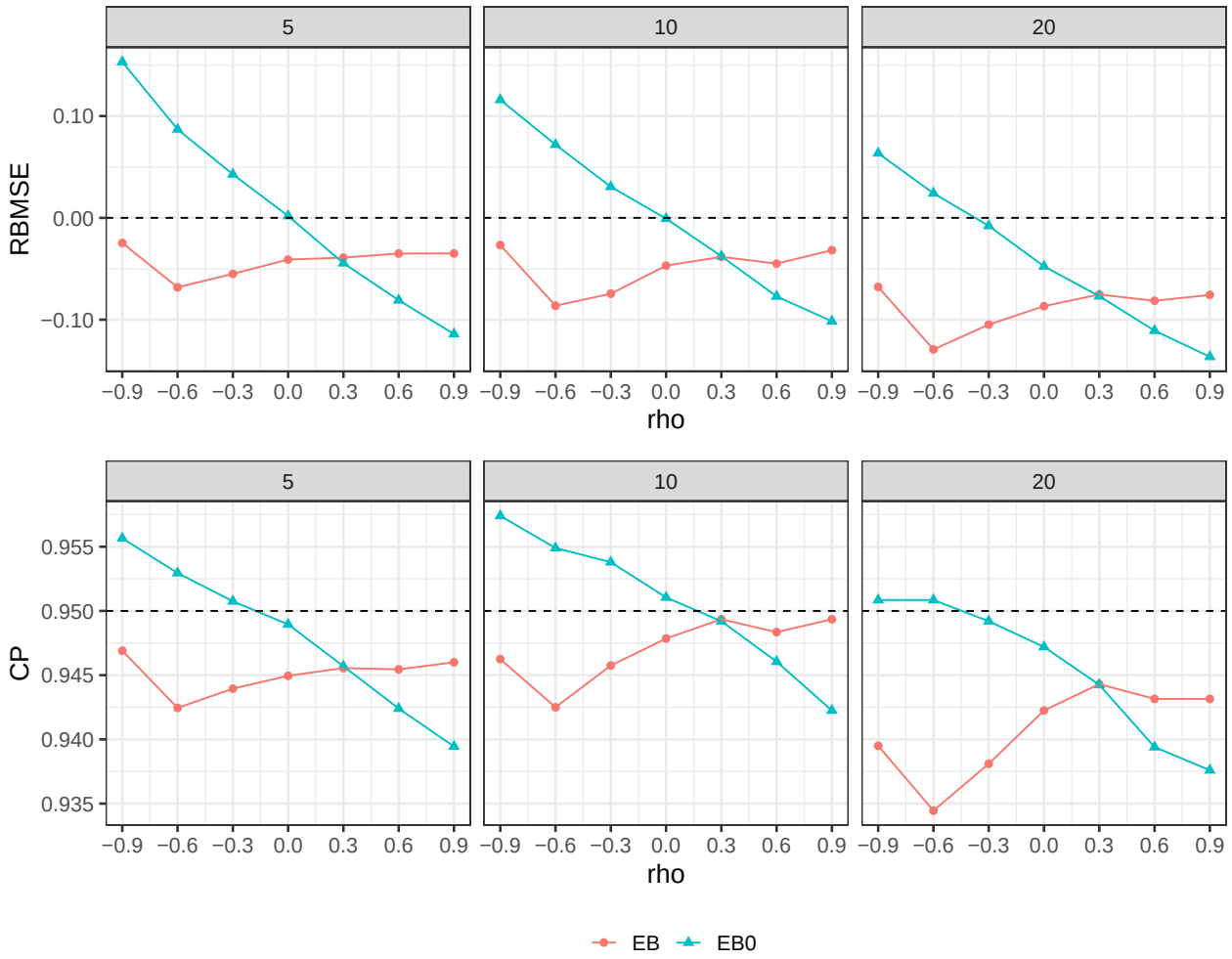
Table S2

```
bootres <- do.call("cbind", lapply(
  list(m2boot/mseboot, m1biasboot/mseboot, m12boot/mseboot), colMeans))
bootres <- apply(bootres, 2, tapply, nis, mean)
round(bootres*100, 2)
```

```
##    [,1]  [,2]  [,3]
## 5  4.81 -3.52 -0.01
## 10 5.42 -4.48 -0.04
## 20 5.86 -4.31 -0.11
```

Figure S2

```
library(dplyr)
library(ggplot2)
library(patchwork)
ebeb0.store <- c()
for (rho in rhos){
  load(sprintf("intermediate_results/Cor%s_D60_nsim1000_Result.RData", rho))
  mcmse.eb <- colMeans((pred.eb.store-YbarNis.store)^2)
  mcmse.eb0 <- colMeans((pred.eb0.store-YbarNis.store)^2)
  rbmse <- colMeans(mse.eb.store)/mcmse.eb-1
  rbmse0 <- colMeans(mse.eb0.store)/mcmse.eb0-1
  cp <- colMeans(abs(pred.eb.store - YbarNis.store) <= 1.96*sqrt(mse.eb.store))
  cp0 <- colMeans(abs(pred.eb0.store - YbarNis.store) <= 1.96*sqrt(mse.eb0.store))
  ebeb0.store <- rbind(ebeb0.store, cbind(rho = rho, nis, rbmse, rbmse0, cp, cp0))
}
tb <- ebeb0.store %>% as_tibble() %>%
  tidyr::gather(metric, value, rbmse:cp0) %>%
  group_by(rho, nis, metric) %>% summarise(value = mean(value)) %>%
  ungroup() %>% mutate(nis = forcats::fct_relevel(factor(nis), "5"))
g1 <- tb %>% filter(grepl("rbmse", metric)) %>%
  rename(RBMSE = value) %>%
  ggplot(aes(x = rho, y = RBMSE, color = metric)) +
  geom_point(aes(shape = metric), size = rel(2)) + geom_line() +
  geom_hline(yintercept = 0, linetype = "dashed") +
  scale_y_continuous(labels = function(x) sprintf("%.2f", x)) +
  scale_x_continuous(breaks = rhos) +
  guides(color = FALSE, shape = FALSE) +
  theme_bw(base_size = 15) +
  facet_grid(~nis)
g2 <- tb %>% filter(grepl("cp", metric)) %>%
  rename(CP = value) %>%
  mutate(metric = recode_factor(metric, "cp" = "EB", "cp0" = "EB0")) %>%
  ggplot(aes(x = rho, y = CP, color = metric)) +
  geom_point(aes(shape = metric), size = rel(2)) + geom_line() +
  geom_hline(yintercept = 0.95, linetype = "dashed") +
  scale_x_continuous(breaks = rhos) +
  theme_bw(base_size = 15) + labs(color = "", shape = "") +
  facet_grid(~nis) + theme(legend.position = "bottom")
g1 / g2
```


5
10
20
RBMSE
0.10
0.00
−0.10
−0.9 −0.6 −0.3 0.0 0.3 0.6 0.9
rho
CP
0.955
0.950
0.945
0.940
0.935
EB
EB0