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set.seed(3409)
library(sem)
N <- 5000
iter <- 1000

betaU <- log(1.7)
betaIV <- log(3)

betaE <- 2.0
betaU2 <- 1.5
betaC <- 1.4

betaC2 <- log(2.2)
betaE2 <- log(5)

bootstrap <- function(dat,x,bootiter=200) {
  res.linear <- rep(NA,bootiter)
  res.tsls <- rep(NA,bootiter)
  for(val in c(1:bootiter)){
    resample <- dat[sample(1:nrow(dat),replace = TRUE),]
    resample$ipsw <- 1/(glm(S~C+E,family=binomial,data=resample)$fitted.values)
    linearmodel <- summary(glm(Y~E,subset=S==1,weights=ipsw,data=reample))
    tslsmodel <- summary(tsls(Y~E,~IV,subset=S==1,weights=ipsw,data=resample))
    res.linear[val] <- linearmodel$coef[2,1]
    res.tsls[val] <- tslsmodel$coef[2,1]
  }

  model1 <- summary(glm(Y~E,data=dat))
  model1.beta <- model1$coef[2,1]
  model1.var <- model1$coef[2,2]

  model2 <- summary(tsls(Y~E,~IV,data=dat))
  model2.beta <- model2$coef[2,1]
  model2.var <- model2$coef[2,2]

  model3 <- summary(glm(Y~E,data=dat,subset=S==1))
  model3.beta <- model3$coef[2,1]
  model3.var <- model3$coef[2,2]

  model4 <- summary(tsls(Y~E,~IV,data=dat,subset=S==1))
  model4.beta <- model4$coef[2,1]
  model4.var <- model4$coef[2,2]

  dat$ipsw <- 1/(glm(S~C+E, family=binomial,data=dat)$fitted.values)

  model5 <- summary(glm(Y~E,data=dat,subset=S==1,weights=ipsw))

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model5.beta <- model5$coef[2,1]
model5.bootvar <- sd(res.linear)

model6 <- summary(tsls(Y~E,~IV,subset=S==1,weights=ipsw,data=dat))
model6.beta <- model5$coef[2,1]
model6.bootvar <- sd(res.tsls)

res.frame <-
data.frame(model1.beta,model1.var,model2.beta,model2.var,model3.beta,model3.var,model4.beta,model4.var,model5.beta,model5.var,model5.bootvar,model6.beta,model6.bootvar)
return(res.frame)
}

bootres <- as.data.frame(matrix(NA,nrow=iter,ncol=12))
names(bootres) <-
c("model1.beta","model1.var","model2.beta","model2.var","model3.beta","model3.var","model4.beta","model4.var","model5.beta","model5.bootvar","model6.beta","model6.bootvar")

for(i in c(1:iter)) {
  C <- rnorm(N)
  U <- rnorm(N)
  IV <- rbinom(N,1,0.4)

  E <- rbinom(N,1,1/(1+exp(-(log(.2/.8)+(U*betaU)+(IV*betaIV)))))

  error<-rnorm(N,0,1)
  Y <- 5 + U*betaU2 + E*betaE + C*betaC + error

  S <- rbinom(N,1,1/(1+exp(-(log(.4/.6)+(C*betaC2)+(E*betaE2)))))

  data <- data.frame(IV,E,C,U,S,Y)

  bootres[i,] <- bootstrap(data,sample(1:1000000,1))
}

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