Triming the design weights in the Horvitz-Thompson Estimator

Even though the HT estimator is always design unbiased if the weights vary a lot it can have quite a large variance. In practice very small weights can be increased and very large weights can be decreased. The following code allows one to make such an adjustment by specifying "lowbd" and "upbd". Every weight below lowbd is raised to that value and every weight above upbd is lowered to that value. It then computes the error and squared error for each estimate. You can then draw K samples and compare the results for the two methods. The code includes a simple example where popy and the design have been specified.

```
> httottrim<-function(smp,popy,designwts,lowbd,upbd)
+ {
+    truetot<-sum(popy)
+    wts<-designwts[smp]
+    estHT<-sum(wts*popy[smp])
+    biasHT<-estHT - truetot
+    sqerrHT<-(estHT-truetot)^2
+    dum<-wts
+    dum[dum < lowbd]<-lowbd
+    dum[dum > upbd]<-upbd
+    trimwts<-dum
+    esttrim<-sum(trimwts*popy[smp])
+    biastrim<-esttrim - truetot
+    sqerrtrim<-(esttrim - truetot)^2
+    ans<-c(biasHT,sqerrHT,biastrim,sqerrtrim)
+    return(ans)
+ }
> httottrimlp<-function(popy,n,design,lowbd,upbd,K)
+    {
+      designwts<-sum(design)/(n*design)
+      ans<-rep(0,4)
+      for(i in 1:K){
+         smp<-sample(1:length(popy),n,replace=FALSE,prob=design)
+         ans<-ans + httottrim(smp,popy,designwts,lowbd,upbd)
+      }
+    ans<-round(ans/K,digits=2)
+    return(ans)
+ }
> set.seed(6875)
> popx<-sort(rgamma(200,5))
> popy<-rnorm(200,10 + 5*popx,8)
> range(popy)

[1]  4.997116 64.069214

> n<-10
> design<-popx
```

```
> lowbd<-12.9
> upbd<-48.8
> K<-500
> out<-httottrimlp(popy,n,design,lowbd,upbd,K)
> out<-round(out,digits=2)
> cat("Ave bias and sqerror for HTest=", out[1:2], "\n")

Ave bias and sqerror for HTest= 16.08 400012.4

> cat("Ave bias and sqerror for adjHTest=", out[3:4], "\n")

Ave bias and sqerror for adjHTest= 185.21 394094.2
```