Simulating Ideal Points for Shotts (2003)

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Introduction

Kenneth Shotts (2003) presents an intriguing account of the electoral implications of racial gerrymandering in his *Journal of Politics* article. He presents evidence that the number of Southern liberal representatives in the US House increased in the 1980s and 1990s even as Southern state legislatures attempted racial gerrymandering.

He proceeds to explain this finding using a simple formal model. I explain the basic tenets of the formal model below with R code. I then proceed to relax the assumption that all legislators are required to have a unique ideal point to test whether his results hold with this change. Finally, I relax the assumption that the ideal points of the Southern state are fixed, though I keep the medians set at the original specification.

Original Formal Model

Shotts (2003) proposes a 100 member legislature in which each legislator has a unique integer ideal point from 1 to 100. These decisions are coded below. The median ideal point of this group of representatives is 50.5. This ideal point represents a nationwide legislature that is, in terms of ideal point preferences, moderate.

```
### 100 MC legislature (without state in question)
# Create data for 100 legislators
# Create a randomized list of unique ideal points without replacement from 1-100
dat <- data.frame(Member = 1:100,
                  Ideal_Point = sample(1:100, 100, replace = FALSE))


#median(dat$Ideal_Point) # 50.5
#plot(density(dat$Ideal_Point), main = "Density of 100 Legislator Ideal Points")
```

Non-gerrymander Distribution

Shotts (2003) then proposes two cases for a state not included in the original 100 member chamber: a *non-gerrymander* district plan and a *gerrymander* district plan in a state with 3 legislators. I discuss the *non-gerrymander* plan first.

In this plan, the preferences of liberal minority voters, who make up 1/3 of the state population, are combined with the preferences of the conservative White voters, who make up 2/3 of the state population. (This is just an assumption as to the preferences of different groups and could, in my opinion, be relaxed to group liberals and conservatives regardless of race within a lopsided state.) The median ideal point of the liberal voters is set at 20, whereas the ideal point of the conservative voters is set at 70. Given there is no gerrymandering in this specific context, the three representatives have ideal points located at 61.5 (which is based on the assumed ideal points of each group of voter and the population of each group).

When this state's members are added to the original 100 member legislature, the median shifts from 50.5 to 52 – a rightward, conservative shift in policy preferences. This makes sense since the Southern state is assumed to have more conservative policy preferences than the (original) median state delegation.

```
### First District Plan: Non-Gerrymander
# Create data for 3 legislators in outside state
# Use ideal points from Shotts's article
non_gerrymander <- data.frame(Member = c(101,102,103),
                              Ideal_Point = c(61.5,61.5,61.5))
# We need median at 61.5

# Combine original data with non-gerrymandered legislators
combined <- rbind(dat, non_gerrymander)

#median(combined$Ideal_Point) # 52 -- correct!
```

Gerrymander Distribution

However, the interesting and central finding from Shotts's formal model arises when we consider the nationwide outcome if a state engages in racial gerrymandering. The state still consists of three districts; however, the minority voters in the state are grouped together. This guarantees a liberal legislator is elected with an ideal point of 20. The conservative voters, on the other hand, elect two representatives with ideal points located at 70.

When this gerrymandered state delegation is added to the original 100 member legislature, the median of the national chamber shifts from 52 in the non-gerrymander case to 51. The national legislature shifts in a leftward/liberal direction! Though, one should note that this is still on the conservative side of the spectrum since ideal points are assumed to be held from 1 to 100.

```
### Second District Plan: Gerrymander
# Create data for 3 legislators
# Use ideal points from Shott's article
gerrymander <- data.frame(Member = c(101,102,103),
                          Ideal_Point = c(20,70,70))
# Use ideal points from Shotts's article
# We need median at 70

# Combine original data with gerrymandered legislators
gerry_combined <- rbind(dat, gerrymander)
#median(gerry_combined$Ideal_Point) # 51 -- correct!
```

Relaxing Assumptions: Simulating Ideal Points of the Other Legislators

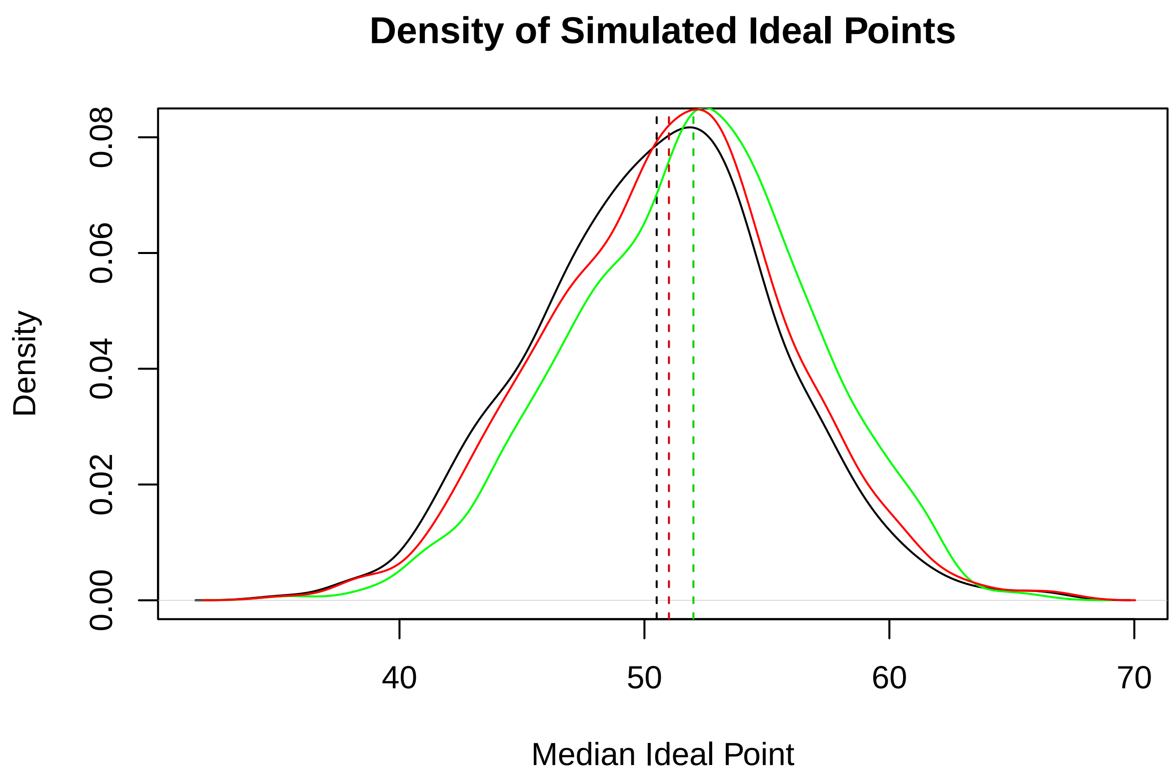
I find the results from the formal model above intriguing. What happens if we relax the assumption that all representatives in the legislature, outside of the state in question, are required to have a unique ideal point? I simulate ideal points by randomly sampling numbers from 1 to 100 *with* replacement to allow for the possibility representatives are assigned the same ideal point.

This decision is then iterated 1000 times. I take the median values from each run and store them. I then plot the density of each median (1000 total) in the figure below. The plots allow us to consider how often the racial gerrymander results in a leftward shift in median ideal point when compared to the non-gerrymander.

```
### Simulations

# Create a list of 100 members
dat <- data.frame(Member = 1:100,
                  Ideal_Point = NA)

# Non-gerrymander
```

```
non_gerrymander <- data.frame(Member = c(101,102,103),
                              Ideal_Point = c(61.5,61.5,61.5))
# Use ideal points from Shotts's article
# We need median at 61.5



# Gerrymander
gerrymander <- data.frame(Member = c(101,102,103),
                          Ideal_Point = c(20,70,70))
# Use ideal points from Shotts's article
# We need median at 70

## For Loop
# Number of iterations
n <- 1000

# Empty matrices for storage
outstate_median <- matrix(NA,n,1)
nongerry_median <- matrix(NA,n,1)
gerry_median <- matrix(NA,n,1)

for(i in 1:n){

  {
  # Remove "#" before "cat" below to see iterations
  #cat(paste("Running iteration",i,"of",n,"\n"))

  # Create a randomized list of ideal points WITH replacement from 1-100
  dat$Ideal_Point <- sample(1:100, 100, replace = TRUE)

  # Combine original data with non-gerrymandered legislators
  combined1 <- rbind(dat, non_gerrymander)
```

```
  # Combine original data with gerrymandered legislators
  combined2 <- rbind(dat, gerrymander)

  }

  outstate_median[i] <- median(dat$Ideal_Point)
  nongerry_median[i] <- median(combined1$Ideal_Point)
  gerry_median[i] <- median(combined2$Ideal_Point)
}

# Combine the sample of medians in a dataframe
final_dat <- as.data.frame(cbind(outstate_median, nongerry_median, gerry_median))
names(final_dat)[names(final_dat) == "V1"] <- "Median"
names(final_dat)[names(final_dat) == "V2"] <- "Non_Gerry_Median"
names(final_dat)[names(final_dat) == "V3"] <- "Gerry_Median"

plot(density(final_dat$Median), main = "Density of Simulated Ideal Points",
     xlab = "Median Ideal Point")
abline(v=50.5, lty =2 ) # Median without state in question (100 legislators)
lines(density(final_dat$Non_Gerry_Median), col = "green")
abline(v=52, col = "green3", lty =2 ) # Median with non-gerrymander (rightward shift)
lines(density(final_dat$Gerry_Median), col = "red")
abline(v=51, col = "red3", lty =2 ) # Median with gerrymander (leftward shift)
```




```
median(final_dat$Median)
```

```
## [1] 50.5
```

```
median(final_dat$Non_Gerry_Median)
```

```
## [1] 52
```

```
median(final_dat$Gerry_Median)
```

```
## [1] 51
```

The plot supports the findings in Shotts's article. Racial gerrymandering shifts the median of the national legislature further left – even when allowing representatives to have repeated ideal points. The horizontal lines depict the original medians from the formal model – 50.5 (black), 52 (green), and 51 (red) for the baseline, non-gerrymander, and gerrymander, respectively.

As the output shows, the median of the national legislature, when including the gerrymander case, is further to the left compared to the non-gerrymander context.

Relaxing Assumptions: Simulating Ideal Points of In-State Legislators Too

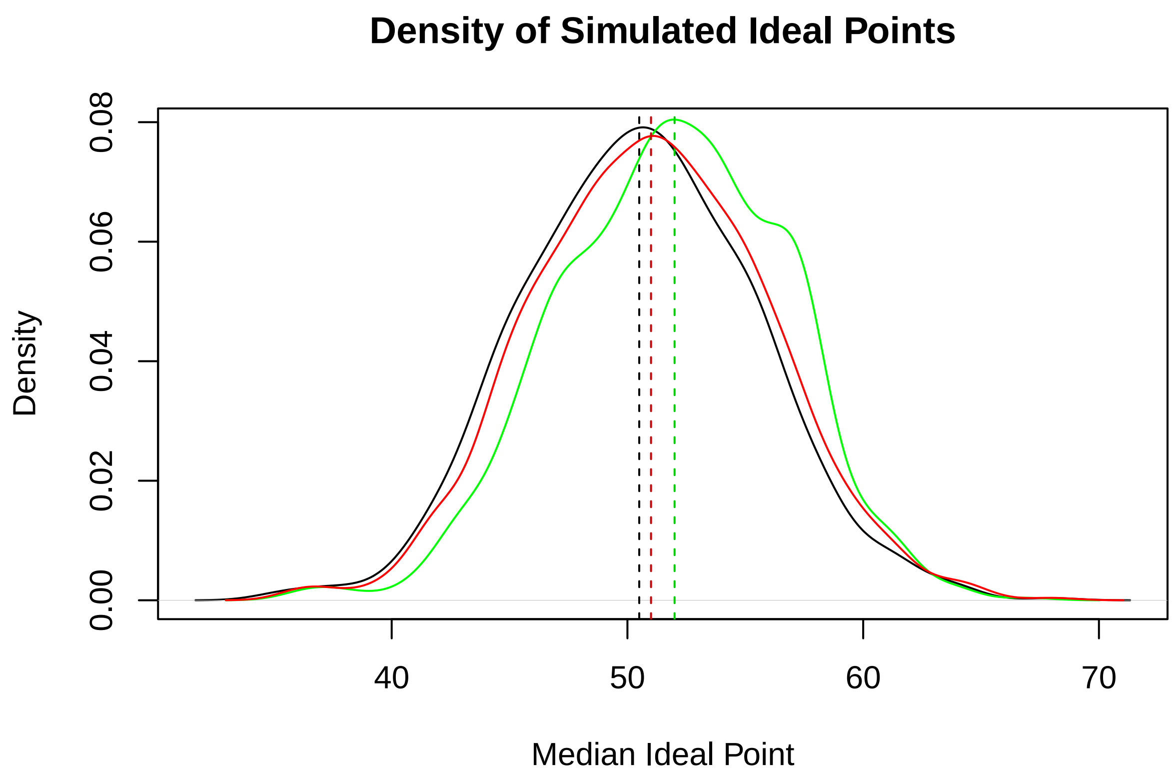
The next step I take is to relax the assumption that the ideal points of the legislators in the racial gerrymander state are fixed at 61.5, 61.5, and 61.5 in the non-gerrymander case and 20, 70, and 70 in the gerrymander case. The code below allows for flexibility in these ideal points. For example, in the non-gerrymander situation, two legislators' ideal points may fluctuate between 56.5-61 and 62-66.5. The median member remains at 61.5.

In the gerrymander situation, I allow for even greater flexibility. The liberal legislator may have an ideal point from 1 to 69. I set the limit such that it is just below the median of White voters; however, this ideal point is unlikely given the preferences of the liberal district. The median legislator is kept at 70. The more conservative legislator may have an ideal point from 71 to 100.

```
### Simulations
# Create a list of 100 members
dat <- data.frame(Member = 1:100,
                  Ideal_Point = NA)

# Non-gerrymander
# Remove median voter assumption - within a +/-5 point range (nothing crazy)
non_gerrymander1 <- data.frame(Member = c(101),
                               Ideal_Point = sample(56.5:61, 1))
non_gerrymander2 <- data.frame(Member = c(102),
                               Ideal_Point = c(61.5))
non_gerrymander3 <- data.frame(Member = c(103),
                               Ideal_Point = sample(62:66.5, 1))
non_gerrymander <- rbind(non_gerrymander1, non_gerrymander2, non_gerrymander3)




# Gerrymander
# Create data for 3 legislators but sample outside of Shotts's model
gerrymander1 <- data.frame(Member = c(101),
                           Ideal_Point = sample(1:61.5, 1))
gerrymander2 <- data.frame(Member = c(102),
```

```
                           Ideal_Point = c(70))
gerrymander3 <- data.frame(Member = c(103),
                           Ideal_Point = sample(71:100, 1))

gerrymander <- rbind(gerrymander1, gerrymander2, gerrymander3)


## For Loop
# Number of iterations
n <- 1000

# Empty matrices for storage
outstate_median <- matrix(NA,n,1)
nongerry_median <- matrix(NA,n,1)
gerry_median <- matrix(NA,n,1)

for(i in 1:n){

  {
  # Remove "#" before "cat" below to see iterations
  #cat(paste("Running iteration",i,"of",n,"\n"))

  # Create a randomized list of ideal points WITH replacement from 1-100
  dat$Ideal_Point <- sample(1:100, 100, replace = TRUE)

  # Combine original data with non-gerrymandered legislators
  combined1 <- rbind(dat, non_gerrymander)

  # Combine original data with gerrymandered legislators
  combined2 <- rbind(dat, gerrymander)

  }
```

```r
  outstate_median[i] <- median(dat$Ideal_Point)
  nongerry_median[i] <- median(combined1$Ideal_Point)
  gerry_median[i] <- median(combined2$Ideal_Point)
}

# Combine the sample of medians in a dataframe
final_dat <- as.data.frame(cbind(outstate_median, nongerry_median, gerry_median))
names(final_dat)[names(final_dat) == "V1"] <- "Median"
names(final_dat)[names(final_dat) == "V2"] <- "Non_Gerry_Median"
names(final_dat)[names(final_dat) == "V3"] <- "Gerry_Median"

plot(density(final_dat$Median), main = "Density of Simulated Ideal Points",
     xlab = "Median Ideal Point")
abline(v=50.5, lty =2 ) # Median without state in question (100 legislators)
lines(density(final_dat$Non_Gerry_Median), col = "green")
abline(v=52, col = "green3", lty =2 ) # Median with non-gerrymander (rightward shift)
lines(density(final_dat$Gerry_Median), col = "red")
abline(v=51, col = "red3", lty =2 ) # Median with gerrymander (leftward shift)
```




```
median(final_dat$Median)
```

```
## [1] 50.5
```

```
median(final_dat$Non_Gerry_Median)
```

```
## [1] 52
```

```
median(final_dat$Gerry_Median)
```

```
## [1] 51
```

Again, Shotts's results hold even when allowing both the 100 baseline legislators and the three Southern state legislators to be randomly sampled. The nationwide median in the racial gerrymander case is to the left when compared to the median in the non-gerrymander context. However, after examining the iterated data, it is possible that the medians are the exact same. In other words, the gerrymander leads to a no more conservative outcome compared to the non-gerrymander.

Conclusion

This short blog post explores the formal model and relaxes a number of the built-in assumptions. The purpose of relaxing a few of the assumptions is to understand how flexible they are to ideal points outside of the author's original model.

Importantly, Shotts's argument that racial gerrymandering could lead to more liberal outcomes (compared to no gerrymandering) is limited to examining conservative states. On the flip side, if a liberal state engaged in gerrymandering, the nationwide median would shift to the right.

There are numerous ways this model can be explored in more detail. I have code to add a fourth (or even more) legislators to the Southern state. This blog post is a first step. My aim is to code the model and adjust various assumptions to see how the nationwide median shifts. Based on my decisions above, the original formal model is robust to repeated sampling of the original legislators and to the Southern legislators in both contexts.

References

Shotts, Kenneth W. 2003. “Does Racial Redistricting Cause Conservative Policy Outcomes? Policy Preferences of Southern Representatives in the 1980s and 1990s.” *Journal of Politics* 65(1): 216–226.