**29/11/2021**

**Abstract**

Building on Nemeth (2014) "The Effect of Competition on Terrorist Group Operations," we reconsider the paper's central finding that competition among terrorist organisations reduces violent attacks, and that terror groups are prone to free ride when faced with intra-ideological competition. The author's initial specification uses a standard measure of competition across countries. We assess model dependence through a different measure for the quantity of interest, the relative change in competition levels within-country. Under this specification, we find that an increase in competition has a significant positive effect on violent attacks. Further, we consider how country-level unobserved variables may bias the initial specification, especially where terror hotspots are over-represented in the data. We implement country-level fixed effects in the author's initial specification and find the effect of competition on violent attacks disappears. We conclude that competition among terror groups is characterised by outbidding, even among intra-ideological markets.

## Introduction

Stephen Nemeth's 2014 paper "The Effect of Competition on Terrorist Group Operations," advances the claim that competition among terrorist organizations realigns group incentives to reduce the use of violence. This stands in contrast to theoretical literature (see ) which argues competition should cause terror groups to engage in outbidding and escalation. Nemeth's work finds a negative association between the number of violent attacks perpetrated by a terror group and an indexed measure of country-level intra-ideological group competition in the preceding year. Nemeth reports similarly negative associations when restricting the data to various ideological categories. Nemeth (2014) concludes that heightened competition may moderate violent attacks as groups seek to 'free ride' on the activities of ideological bed fellows. In the following, we examine model dependence in Nemeth's measure of competition and control for unobserved country-level variation.

[insert: brief recap of the debate in the literature: outbidding v moderation and competition.]

Nemeth (2014) constructs an index of competitive terrorist activity in a given country one year prior to observed terrorist attacks. The author's specification assumes that decisions made by groups to engage in violence occurs at least partly in response to the activity of rival organisations, and that this is the only channel through which this measure of lagged competition relates to the number of present terrorist attacks. However, as a consequence of how this measure is constructed, it is possible that lower values on the competition index indicate markets in which hegemonic organisations operate and undertake a large number of attacks. It is similarly possible that larger values on the competition index indicate markets in which many small terrorist organisations are operating and each carrying out a small number of attacks. Where this is the case, the competition index is inverse to the number of group-level number of attacks.

We can account for this possibility and further test model dependence by adjusting how we measure the quantity of interest, group competition. In theory, if terrorist groups consider the level of competition among rivals when deciding whether to undertake a violent attack, their decisions should be similarly sensitive the change in the level of competition. Therefore, we would expect to find an association between the change in competition and the number of attacks comparable to negative relationship reported in Nemeth (2014). We construct such a measure for change in competition between lag period two and lag period one. Importantly, differences in competition in the lagged period will also identify the association of competition and attacks, relative to the existing market. Our measure effectively standardises changes in the level of competition, irrespective of the size of the competition index value. Mostly small year-to-year movements are not likely to represent fundamental changes in the nature of the market (for example, from hegemonic to fractious), but the changes in the level of activity.

The nature of terrorist attacks globally and the tendency of violence to geographically cluster, leads to an unbalanced underlying dataset in Nemeth (2014). According to the author's data collection, there was one violent attack in Australia in 1986, committed by the Greek Bulgarian Armenian Front,

whereas in the same year in El Salvador, the Farabundo Marti National Liberation Front undertook 171 attacks. While this is the only observation for Australia in the dataset, groups in El Salvador consistently perpetrated heightened levels of violence throughout the 1980s. We highlight these extreme variations for illustrative purposes; however, they are common in the dataset. Imbalance in the data, when unaccounted for, may bias estimations. Terror groups may respond to competition in a country with a large number of observations in a manner which is idiosyncratic to that context. Without accounting for unbalanced data and country-level contexts, such out an outlier may bias our overall estimations. We respond to this challenge by implementing time-invariant country fixed effects in addition to the author's population, GDP and civil war controls.

In the following, we will argue that the measure of competition in the original paper does not accurately capture the quantity of interest and induces model dependence with important implications for Nemeth (2014)'s reported findings.

**Replication**

**I. Replicating the initial specification**

**a. Convergence errors.**

**II. Measuring Competition**

a. Problems with existing measure.
    i. The author's specification relies on the inverse Herfindahl-Hirschman Index (HHI) (Herfindahl 1950; Hirschman 1945) measure of firm concentration in a given market. The HHI is invariant to the number of firms in the market. It can be thought of as a measure of competitive activity.
    ii. More activity -> more observations -> better spread of observations so biased downwards (any the busy actor max attacker is an outlier)
    iii. Low competition -> one group hegemon -> high number of attacks
b. Theory and construction of the new measure.

**III. Country Fixed Effects**

a. Problems of existing specification
    i. Outliers, unbalanced
b. Role of country FE
    i. Provide a unique intercept for each country.

**IV. Results**

a. New model
b. Results

**Conclusion**

# Replication

\begin{document}

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.1 --
## v ggplot2 3.3.5     v purrr   0.3.4
## v tibble  3.1.6     v dplyr   1.0.7
## v tidyr   1.1.4     v stringr 1.4.0
## v readr   2.1.0     v forcats 0.5.1
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
##
## Attaching package: 'MASS'
## The following object is masked from 'package:dplyr':
##
##     select
## Loading required package: zoo
##
## Attaching package: 'zoo'
## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric
##
## 'drc' has been loaded.
## Please cite R and 'drc' if used for a publication,
## for references type 'citation()' and 'citation('drc')'.
##
## Attaching package: 'drc'
## The following objects are masked from 'package:stats':
##
##     gaussian, getInitial
##
## Attaching package: 'plm'
## The following objects are masked from 'package:dplyr':
##
##     between, lag, lead
##
## Please cite as:
##  Hlavac, Marek (2018). stargazer: Well-Formatted Regression and Summary Statistics Tables.
```

```
##  R package version 5.2.2. https://CRAN.R-project.org/package=stargazer
#Loading in the data
data = read_dta('FINALDATASET.dta')
data = data.frame(data)
#data = group_by(data,gname,country)
```

```
#Summary Statistics
data1 = drop_na(data, attack2, lagcompetition2,  lagfactor,  lagcompfactint2, laganocyn, lagdemyn, lagg

stargazer(as.data.frame(data1[c('attack2', 'lagcompetition2',  'lagfactor',  'lagcompfactint2', 'laganoc
```

% Table created by stargazer v.5.2.2 by Marek Hlavac, Harvard University. E-mail: hlavac at fas.harvard.edu
% Date and time: Mon, Nov 29, 2021 - 23:58:28

Table 1: Summary Statistics

| Statistic | N | Mean | St. Dev. | Min | Pctl(25) | Pctl(75) | Max |
|---|---|---|---|---|---|---|---|
| attack2 | 3,031 | 8.110 | 35.947 | 0 | 0 | 2 | 509 |
| lagcompetition2 | 3,031 | 1.683 | 0.963 | 1 | 1 | 2 | 7 |
| lagfactor | 3,031 | 0.559 | 1.078 | −1.121 | −0.373 | 1.506 | 3.177 |
| lagcompfactint2 | 3,031 | 1.114 | 2.406 | −5.218 | −0.565 | 2.073 | 14.714 |
| laganocyn | 3,031 | 0.197 | 0.398 | 0 | 0 | 0 | 1 |
| lagdemyn | 3,031 | 0.559 | 0.497 | 0 | 0 | 1 | 1 |
| laggdppc | 3,031 | 5,085.247 | 5,367.000 | 136.760 | 1,442.000 | 6,884.760 | 28,484.400 |
| lagrpc2 | 3,031 | 1.009 | 0.533 | 0.020 | 0.662 | 1.245 | 3.522 |
| lagcivwar | 3,031 | 0.530 | 0.499 | 0 | 0 | 1 | 1 |
| laglogpop | 3,031 | 10.332 | 1.576 | 6.477 | 9.055 | 10.967 | 13.752 |

```
# Table 2 -- no ideological sub-setting
model = glm.nb(attack2 ~ lagcompetition2 + lagfactor + lagcompfactint2 + laganocyn + lagdemyn + laggdpp

# Now adding clustered standard errors by groupcode
model_clustered = coeftest(model, vcov = vcovCL, cluster = ~groupcode)

stargazer(model_clustered, type = 'latex', title = "Replication Results for All Groups", covariate.labe
```

% Table created by stargazer v.5.2.2 by Marek Hlavac, Harvard University. E-mail: hlavac at fas.harvard.edu
% Date and time: Mon, Nov 29, 2021 - 23:58:29

```
#---------First Differences for Table 2-----------------

#LAGCOMPETITION2
a =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

#Every covariate set to its mean or median, except lagcompetition2 = mean + 1sd.
b =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE) + sd(data$lagcompetition2,

diffs = tibble(exp(predict(model, newdata=b)) - exp(predict(model, newdata=a)))

#LAGFACTOR
a =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

b =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la
```

Table 2: Replication Results for All Groups

| | *Dependent variable:* |
|---|---|
| Competition | $-0.693^{***}$ |
| | (0.150) |
| Acceptability of Violence | 0.422 |
| | (0.350) |
| Competition x Acceptability | 0.010 |
| | (0.105) |
| Anocracy | 0.174 |
| | (0.473) |
| Democracy | $1.589^{***}$ |
| | (0.436) |
| GDP | $0.0001^{***}$ |
| | (0.00002) |
| RPC | $-0.427$ |
| | (0.375) |
| Civil War | $0.692^{*}$ |
| | (0.411) |
| Logged Population | $-0.362^{***}$ |
| | (0.102) |
| Constant | $5.047^{***}$ |
| | (1.437) |
| *Note:* | $^{*}$p<0.1; $^{**}$p<0.05; $^{***}$p<0.01 |

```
diffs = rbind(diffs, exp(predict(model, newdata=b)) - exp(predict(model, newdata=a)))


#LAGCOMPFACTINT2
a =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

b =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

diffs = rbind(diffs, exp(predict(model, newdata=b)) - exp(predict(model, newdata=a)))


#LAGANOCYN
a =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

b =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

diffs = rbind(diffs, exp(predict(model, newdata=b)) - exp(predict(model, newdata=a)))


#LAGDEMYN
a =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

b =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

diffs = rbind(diffs, exp(predict(model, newdata=b)) - exp(predict(model, newdata=a)))



#LAGGDPPC
a =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

b =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

diffs = rbind(diffs, exp(predict(model, newdata=b)) - exp(predict(model, newdata=a)))


#LAGRPC2
a =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

b =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

diffs = rbind(diffs, exp(predict(model, newdata=b)) - exp(predict(model, newdata=a)))



#LAGCIVWAR
a =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

b =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

diffs = rbind(diffs, exp(predict(model, newdata=b)) - exp(predict(model, newdata=a)))
```

```
#LAGLOGPOP
a =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

b =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

diffs = rbind(diffs, exp(predict(model, newdata=b)) - exp(predict(model, newdata=a)))
```

```
diffs = cbind(diffs, Variable = c('Competition', "Acceptability of Violence", "Competition x Acceptabili
colnames(diffs) = c('All Groups', 'Variable')
rownames(diffs) = diffs$Variable
diffs = diffs[1]
stargazer(diffs, type = 'latex', summary = FALSE, title = 'First Differences for All Groups')
```

% Table created by stargazer v.5.2.2 by Marek Hlavac, Harvard University. E-mail: hlavac at fas.harvard.edu
% Date and time: Mon, Nov 29, 2021 - 23:58:29

Table 3: First Differences for All Groups

| | All Groups |
|---|---|
| Competition | -7.055 |
| Acceptability of Violence | 7.558 |
| Competition x Acceptability | 0.322 |
| Anocracy | 2.478 |
| Democracy | 10.357 |
| GDP | 5.904 |
| RPC | -2.621 |
| Civil War | 12.404 |
| Logged Population | -5.664 |

```
diffs_later = diffs
first_diffs = diffs
```

```
# Table 3, Model 1 -- religious groups
data_religious = data[data$RANDrel==1, ]

model1 = glm.nb(attack2 ~ lagcompetition2 + lagfactor + lagcompfactint2 + laganocyn + lagdemyn + laggdp
```

```
## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge
```

```
## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge
```

```
model1_clustered = coeftest(model1, vcov = vcovCL, cluster = ~groupcode)
```

```
#Checking the proportion of zeros in the religious data
#sum(data_religious$attack2 == 0, na.rm=TRUE)/length(data_religious$attack2)
```

```
# Table 3, Model 2 -- nationalist groups
data_nationalist = data[data$RANDnat==1, ]

model2 = glm.nb(attack2 ~ lagcompetition2 + lagfactor + lagcompfactint2 + laganocyn + lagdemyn + laggdp

model2_clustered = coeftest(model2, vcov = vcovCL, cluster = ~groupcode)
```

```
# Table 3, Model 3 -- left-wing groups
data_left = data[data$RANDlw==1, ]

model3 = glm.nb(attack2 ~ lagcompetition2 + lagfactor + lagcompfactint2 + laganocyn + lagdemyn + laggdp

model3_clustered = coeftest(model3, vcov = vcovCL, cluster = ~groupcode)
```

```
# Table 3, Model 4 -- right-wing groups
data_right = data[data$RANDrw==1, ]

model4 = glm.nb(attack2 ~ lagcompetition2 + lagfactor + lagcompfactint2 + laganocyn + lagdemyn + laggdp

model4_clustered = coeftest(model4, vcov = vcovCL, cluster = ~groupcode)
```

```
#Table with the results
stargazer(model1_clustered, model2_clustered, model3_clustered, model4_clustered, type = 'latex', title
```

Table 4: Replication Results by Group Ideology

| | Religious | Nationalist | Left-Wing | Right-Wing |
|---|---|---|---|---|
| Competition | $-1.261^{***}$ | $-0.733^{***}$ | $-0.406$ | $-0.321$ |
| | (0.439) | (0.168) | (0.257) | (0.370) |
| Acceptability of Violence | $-1.525^{***}$ | $-0.253$ | $0.769^{**}$ | $1.200^{**}$ |
| | (0.473) | (0.430) | (0.366) | (0.551) |
| Competition x Acceptability | $0.725^{***}$ | 0.094 | $-0.084$ | $-0.429$ |
| | (0.243) | (0.126) | (0.172) | (0.404) |
| Anocracy | 0.153 | $2.440^{***}$ | $-0.711$ | $-2.982^{***}$ |
| | (1.094) | (0.478) | (0.455) | (0.746) |
| Democracy | 0.497 | $2.442^{***}$ | $1.113^{*}$ | 0.096 |
| | (1.684) | (0.429) | (0.568) | (0.318) |
| GDP | $-0.0001^{*}$ | $0.0001^{***}$ | 0.00001 | 0.00001 |
| | (0.00005) | (0.00003) | (0.00003) | (0.00005) |
| RPC | $-0.462$ | $-0.484$ | $-0.797$ | $0.486^{*}$ |
| | (0.905) | (0.477) | (0.517) | (0.276) |
| Civil War | 1.323 | $0.716^{**}$ | 0.474 | $0.949^{**}$ |
| | (1.379) | (0.327) | (0.416) | (0.386) |
| Logged Population | $-0.260$ | $0.290^{**}$ | $-0.631^{***}$ | $-0.391^{*}$ |
| | (0.370) | (0.118) | (0.117) | (0.230) |
| Constant | 4.984 | $-2.673$ | $8.483^{***}$ | 3.735 |
| | (4.424) | (1.796) | (1.323) | (2.375) |

*Note:* $^{*}$p<0.1; $^{**}$p<0.05; $^{***}$p<0.01

```
#---------First Differences for Table 3-----------------

models = list(model1, model2, model3, model4)

for(model in models) {

#LAGCOMPETITION2
a =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

#Every covariate set to its mean or median, except lagcompetition2 = mean + 1sd.
b =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE) + sd(data$lagcompetition2,

diffs = tibble(exp(predict(model, newdata=b)) - exp(predict(model, newdata=a)))

#LAGFACTOR
a =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

b =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

diffs = rbind(diffs, exp(predict(model, newdata=b)) - exp(predict(model, newdata=a)))


#LAGCOMPFACTINT2
a =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

b =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

diffs = rbind(diffs, exp(predict(model, newdata=b)) - exp(predict(model, newdata=a)))


#LAGANOCYN
a =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

b =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

diffs = rbind(diffs, exp(predict(model, newdata=b)) - exp(predict(model, newdata=a)))


#LAGDEMYN
a =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

b =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

diffs = rbind(diffs, exp(predict(model, newdata=b)) - exp(predict(model, newdata=a)))



#LAGGDPPC
a =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

b =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

diffs = rbind(diffs, exp(predict(model, newdata=b)) - exp(predict(model, newdata=a)))
```

```
#LAGRPC2
a =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

b =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

diffs = rbind(diffs, exp(predict(model, newdata=b)) - exp(predict(model, newdata=a)))



#LAGCIVWAR
a =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

b =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

diffs = rbind(diffs, exp(predict(model, newdata=b)) - exp(predict(model, newdata=a)))



#LAGLOGPOP
a =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

b =  data.frame('lagcompetition2' = mean(data$lagcompetition2, na.rm = TRUE), 'lagfactor' = mean(data$la

diffs = rbind(diffs, exp(predict(model, newdata=b)) - exp(predict(model, newdata=a)))
first_diffs = cbind(first_diffs, diffs)
}
colnames(first_diffs) = c('All Groups', 'Religious', 'Nationalist', 'Left-Wing', 'Right-Wing')
```

```
stargazer(first_diffs, type = 'latex', summary = FALSE, title = "First Differences by Group Ideology",
```

Table 5: First Differences by Group Ideology

| | All Groups | Religious | Nationalist | Left-Wing | Right-Wing |
|---|---|---|---|---|---|
| Competition | -7.055 | -1.969 | -4.639 | -4.253 | -0.796 |
| Acceptability of Violence | 7.558 | -2.099 | -1.981 | 15.119 | 7.035 |
| Competition x Acceptability | 0.322 | 12.268 | 2.087 | -2.128 | -1.690 |
| Anocracy | 2.478 | 0.430 | 86.316 | -5.892 | -2.491 |
| Democracy | 10.357 | 1.015 | 7.528 | 7.774 | 0.239 |
| GDP | 5.904 | -0.973 | 4.775 | 0.535 | 0.215 |
| RPC | -2.621 | -0.561 | -1.858 | -3.972 | 0.765 |
| Civil War | 12.404 | 0.930 | 8.992 | 4.909 | 1.824 |
| Logged Population | -5.664 | -0.873 | 4.778 | -7.296 | -1.206 |

```
#Table with the results
stargazer(model1_clustered, model2_clustered, model3_clustered, model4_clustered, type = 'latex', title
```

## Intervention 1 Table 2, a new competition variable // competition_delta for lagcompetition2

```
# Intervention 1 Table 2, a new competition variable // competition_delta for lagcompetition2
data_dplyr <- data %>%
  group_by(groupcode,country) %>%
  dplyr::mutate(lag2 = dplyr::lag(lagcompetition2, n = 1, default = NA)) %>%
  as.data.frame()

data <- data_dplyr %>%
  group_by(groupcode,country) %>%
  dplyr::mutate(lag3 = dplyr::lag(lag2, n = 1, default = NA)) %>%
  as.data.frame()

data$competition_delta = data$lagcompetition2 - data$lag2
data$lagcompfactor_delta = data$competition_delta * data$lagfactor

model_int = glm.nb(attack2 ~ competition_delta + lagfactor  + laganocyn + lagdemyn + laggdppc + lagrpc2

# Now adding clustered standard errors by groupcode
model_int_clustered = coeftest(model_int, vcov = vcovCL, cluster = ~groupcode)

#results table
stargazer(model_clustered, model_int_clustered, type = 'text', title = "Intervention 1, All Groups", co
```

## Intervention 1, All Groups

### (1) (2)

Nameth Competition -0.693***
(0.150)

Intervention Revised Competition 0.161***
(0.025)

Acceptability of Violence 0.422 0.275
(0.350) (0.243)

Nameth x Acceptability 0.010
(0.105)

Anocracy 0.174 0.143
(0.473) (0.463)

Democracy 1.589*** 1.250***
(0.436) (0.453)

GDP 0.0001*** 0.0001***
(0.00002) (0.00002)

RPC -0.427 -0.395
(0.375) (0.404)

Civil War 0.692* 0.790*
(0.411) (0.423)

Logged Population -0.362*** -0.432***
(0.102) (0.117)

Constant 5.047*** 5.047***
(1.437) (1.566)

==========

Note: *p<0.1;* ***p<0.05;*** p<0.01

```
#---------First Differences for I1, Table 2-----------------



#COMPETITION_DELTA
a =  data.frame('competition_delta' = mean(data$competition_delta, na.rm = TRUE), 'lagfactor' = mean(da

#Every covariate set to its mean or median, except competition_delta = mean + 1sd.
b =  data.frame('competition_delta' = mean(data$competition_delta, na.rm = TRUE) + sd(data$competition_

diffs_int = tibble(exp(predict(model_int, newdata=b) - exp(predict(model_int, newdata=a))))


#LAGFACTOR
a =  data.frame('competition_delta' = mean(data$competition_delta, na.rm = TRUE), 'lagfactor' = mean(da

b =  data.frame('competition_delta' = mean(data$competition_delta, na.rm = TRUE), 'lagfactor' = mean(da

diffs_int = rbind(diffs_int, exp(predict(model_int, newdata=b)) - exp(predict(model_int, newdata=a)))


#LAGCOMPFACTOR_DELTA
a =  data.frame('competition_delta' = mean(data$competition_delta, na.rm = TRUE), 'lagfactor' = mean(da

b =  data.frame('competition_delta' = mean(data$competition_delta, na.rm = TRUE), 'lagfactor' = mean(da

diffs_int = rbind(diffs, exp(predict(model_int, newdata=b)) - exp(predict(model_int, newdata=a)))


#LAGANOCYN
a =  data.frame('competition_delta' = mean(data$competition_delta, na.rm = TRUE), 'lagfactor' = mean(da

b =  data.frame('competition_delta' = mean(data$competition_delta, na.rm = TRUE), 'lagfactor' = mean(da

diffs_int = rbind(diffs, exp(predict(model_int, newdata=b)) - exp(predict(model_int, newdata=a)))


#LAGDEMYN
a =  data.frame('competition_delta' = mean(data$competition_delta, na.rm = TRUE), 'lagfactor' = mean(da

b =  data.frame('competition_delta' = mean(data$competition_delta, na.rm = TRUE), 'lagfactor' = mean(da
```

```
diffs_int = rbind(diffs, exp(predict(model_int, newdata=b)) - exp(predict(model_int, newdata=a)))



#LAGGDPPC
a =  data.frame('competition_delta' = mean(data$competition_delta, na.rm = TRUE), 'lagfactor' = mean(da

b =  data.frame('competition_delta' = mean(data$competition_delta, na.rm = TRUE), 'lagfactor' = mean(da

diffs_int = rbind(diffs, exp(predict(model_int, newdata=b)) - exp(predict(model_int, newdata=a)))


#LAGRPC2
a =  data.frame('competition_delta' = mean(data$competition_delta, na.rm = TRUE), 'lagfactor' = mean(da

b =  data.frame('competition_delta' = mean(data$competition_delta, na.rm = TRUE), 'lagfactor' = mean(da

diffs_int = rbind(diffs, exp(predict(model_int, newdata=b)) - exp(predict(model_int, newdata=a)))



#LAGCIVWAR
a =  data.frame('competition_delta' = mean(data$competition_delta, na.rm = TRUE), 'lagfactor' = mean(da

b =  data.frame('competition_delta' = mean(data$competition_delta, na.rm = TRUE), 'lagfactor' = mean(da

diffs_int = rbind(diffs, exp(predict(model_int, newdata=b)) - exp(predict(model_int, newdata=a)))



#LAGLOGPOP
a =  data.frame('competition_delta' = mean(data$competition_delta, na.rm = TRUE), 'lagfactor' = mean(da

b =  data.frame('competition_delta' = mean(data$competition_delta, na.rm = TRUE), 'lagfactor' = mean(da

diffs_int = rbind(diffs, exp(predict(model_int, newdata=b)) - exp(predict(model_int, newdata=a)))
```

```
diffs_int = cbind(diffs, Variable = c('Competition ', "Acceptability of Violence", "Intervention x Accep
colnames(diffs_int) = c('All Groups', 'Variable')
rownames(diffs_int) = diffs_int$Variable
diffs_int = diffs_int[1]

diffs_int = cbind(diffs_later, diffs_int)
colnames(diffs_int) = c('Nameth Competition', 'Intervention Competition')
stargazer(diffs_int, type = 'latex', summary = FALSE, title = 'Competition Measure Intervention, All Gr
```

% Table created by stargazer v.5.2.2 by Marek Hlavac, Harvard University. E-mail: hlavac at fas.harvard.edu
% Date and time: Mon, Nov 29, 2021 - 23:58:37

```
# I1 Table 3, Model 1
data_religious = data[data$RANDrel==1, ]

model1_int = glm.nb(attack2 ~ competition_delta + lagfactor + laganocyn + lagdemyn + laggdppc + lagrpc2
```

```
## Warning: glm.fit: algorithm did not converge
```

Table 6: Competition Measure Intervention, All Groups

| | Nameth Competition | Intervention Competition |
|---|---|---|
| Competition | -7.055 | -0.796 |
| Acceptability of Violence | 7.558 | 7.035 |
| Competition x Acceptability | 0.322 | -1.690 |
| Anocracy | 2.478 | -2.491 |
| Democracy | 10.357 | 0.239 |
| GDP | 5.904 | 0.215 |
| RPC | -2.621 | 0.765 |
| Civil War | 12.404 | 1.824 |
| Logged Population | -5.664 | -1.206 |

```
## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge

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## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge
```

```
model1_clustered_int = coeftest(model1_int, vcov = vcovCL, cluster = ~groupcode)
```

```
# I1 Table 3, Model 2 -- nationalist groups
data_nationalist = data[data$RANDnat==1, ]

model2_int = glm.nb(attack2 ~ competition_delta + lagfactor + laganocyn + lagdemyn + laggdppc + lagrpc2

model2_clustered_int = coeftest(model2_int, vcov = vcovCL, cluster = ~groupcode)
```

```
# I1 Table 3, Model 3 -- left-wing groups
data_left = data[data$RANDlw==1, ]

model3_int = glm.nb(attack2 ~ competition_delta + lagfactor + laganocyn + lagdemyn + laggdppc + lagrpc2

model3_clustered_int = coeftest(model3_int, vcov = vcovCL, cluster = ~groupcode)
```

```r
# I1 Table 3, Model 4 -- right-wing groups
data_right = data[data$RANDrw==1, ]

model4_int = glm.nb(attack2 ~ competition_delta + lagfactor  + laganocyn + lagdemyn + laggdppc + lagrpc

model4_clustered_int = coeftest(model4_int, vcov = vcovCL, cluster = ~groupcode)
```

```r
#Results

stargazer(model1_clustered, model1_clustered_int, model2_clustered, model2_clustered_int, model3_cluste
```

Table 7: Intervention 1, by Ideology

| | Religious (N) | Religious (I) | Nationalist (N) | Nationalist (I) | Left-Wing (N) | Left-Wing (I) | Right-Wing (N) | Right-Wing (I) |
|---|---|---|---|---|---|---|---|---|
| Nameth Competition | $-1.261^{***}$ | | $-0.733^{***}$ | | $-0.406$ | | $-0.321$ | |
| | (0.439) | | (0.168) | | (0.257) | | (0.370) | |
| Intervention Revised Competition | | $-0.204^{***}$ | | 0.019 | | $0.222^{***}$ | | 0.102 |
| | | (0.057) | | (0.025) | | (0.052) | | (0.231) |
| Acceptability of Violence | $-1.525^{***}$ | $-1.028^{***}$ | $-0.253$ | $-0.307$ | $0.769^{**}$ | $0.492^{***}$ | $1.200^{**}$ | $0.720^{***}$ |
| | (0.473) | (0.337) | (0.430) | (0.289) | (0.366) | (0.174) | (0.551) | (0.267) |
| Nameth x Acceptability | $0.725^{***}$ | | 0.094 | | $-0.084$ | | $-0.429$ | |
| | (0.243) | | (0.126) | | (0.172) | | (0.404) | |
| Anocracy | 0.153 | $-0.160$ | $2.440^{***}$ | $2.340^{***}$ | $-0.711$ | $-0.670^{*}$ | $-2.982^{***}$ | $-2.897^{***}$ |
| | (1.094) | (1.183) | (0.478) | (0.625) | (0.455) | (0.403) | (0.746) | (0.747) |
| Democracy | 0.497 | 0.315 | $2.442^{***}$ | $2.243^{***}$ | $1.113^{*}$ | 0.828 | 0.096 | $-0.077$ |
| | (1.684) | (1.681) | (0.429) | (0.492) | (0.568) | (0.526) | (0.318) | (0.358) |
| GDP | $-0.0001^{*}$ | $-0.0001^{**}$ | $0.0001^{***}$ | $0.0001^{**}$ | 0.00001 | $-0.00000$ | 0.00001 | 0.00001 |
| | (0.00005) | (0.00005) | (0.00003) | (0.00003) | (0.00003) | (0.00003) | (0.00005) | (0.0001) |
| RPC | $-0.462$ | $-0.514$ | $-0.484$ | $-0.538$ | $-0.797$ | $-0.753$ | $0.486^{*}$ | 0.432 |
| | (0.905) | (1.023) | (0.477) | (0.518) | (0.517) | (0.509) | (0.276) | (0.288) |
| Civil War | 1.323 | 1.349 | $0.716^{**}$ | $0.755^{*}$ | 0.474 | 0.660 | $0.949^{**}$ | $1.185^{***}$ |
| | (1.379) | (1.303) | (0.327) | (0.416) | (0.416) | (0.424) | (0.386) | (0.409) |
| Logged Population | $-0.260$ | $-0.409$ | $0.290^{**}$ | $0.512^{***}$ | $-0.631^{***}$ | $-0.711^{***}$ | $-0.391^{*}$ | $-0.297$ |
| | (0.370) | (0.372) | (0.118) | (0.139) | (0.117) | (0.126) | (0.230) | (0.331) |
| Constant | 4.984 | 5.827 | $-2.673$ | $-5.692^{***}$ | $8.483^{***}$ | $8.915^{***}$ | 3.735 | 2.495 |
| | (4.424) | (4.801) | (1.796) | (2.105) | (1.323) | (1.427) | (2.375) | (3.312) |

*Note:* $^{*}$p<0.1; $^{**}$p<0.05; $^{***}$p<0.01

The original models are represented with an I, our results are represented with an N

## Intervention 2, introducing country fixed effects

```
# Intervention 2, introducing country fixed effects
model = glm.nb(attack2 ~ lagcompetition2 + lagfactor + lagcompfactint2 + laganocyn + lagdemyn + laggdpp

fe.model <- feglm(attack2 ~ lagcompetition2 + lagfactor + lagcompfactint2 + laganocyn + lagdemyn + lagg
```

```
## NOTE: 916 observations removed because of NA values (LHS: 162, RHS: 770).
```

```
# Now adding clustered standard errors by groupcode AND calculating variance-covariance matrix for fegl
fe.vcovCL = vcov(fe.model)
model_clustered = coeftest(fe.model, vcov = fe.vcovCL, cluster = ~groupcode)

stargazer(model, model_clustered, type = 'latex', title = "Fixed Effects Intervention, All Groups", dep
```

% Table created by stargazer v.5.2.2 by Marek Hlavac, Harvard University. E-mail: hlavac at fas.harvard.edu
% Date and time: Mon, Nov 29, 2021 - 23:58:42

```
# I3 Table 3, Model 1 -- religious groups
data_religious = data[data$RANDrel==1, ]

model1 = glm.nb(attack2 ~ lagcompetition2 + lagfactor + lagcompfactint2 + laganocyn + lagdemyn + laggdp
```

```
## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: algorithm did not converge
```

```
model1_clustered = coeftest(model1, vcov = vcovCL, cluster = ~groupcode)

fe.model1 <- feglm(attack2 ~ lagcompetition2 + lagfactor + lagcompfactint2 + laganocyn + lagdemyn + lag
```

```
## NOTE: 171 observations removed because of NA values (LHS: 41, RHS: 135).

## Warning: Absence of convergence: Maximum number of iterations reached (25).
## Final deviance: 108.3.
```

Table 8: Fixed Effects Intervention, All Groups

| | Original Model | FE Model |
|---|---|---|
| Competition | $-0.693^{***}$ | $-0.127$ |
| | (0.074) | (0.082) |
| Acceptability of Violence | $0.422^{***}$ | $0.235^{*}$ |
| | (0.117) | (0.142) |
| Competition x Acceptability | 0.010 | $-0.026$ |
| | (0.051) | (0.068) |
| Anocracy | 0.174 | 0.011 |
| | (0.161) | (0.274) |
| Democracy | $1.589^{***}$ | $0.932^{***}$ |
| | (0.151) | (0.346) |
| GDP | $0.0001^{***}$ | $-0.0001^{**}$ |
| | (0.00001) | (0.00003) |
| RPC | $-0.427^{***}$ | $-0.087$ |
| | (0.115) | (0.293) |
| Civil War | $0.692^{***}$ | $0.955^{***}$ |
| | (0.138) | (0.222) |
| Logged Population | $-0.362^{***}$ | $2.311^{***}$ |
| | (0.039) | (0.787) |
| Constant | $5.047^{***}$ | |
| | (0.464) | |
| Observations | 3,031 | |
| Log Likelihood | $-5,818.653$ | |
| $\theta$ | $0.132^{***}$ (0.005) | |
| Akaike Inf. Crit. | 11,657.310 | |
| *Note:* | $^{*}$p<0.1; $^{**}$p<0.05; $^{***}$p<0.01 | |

```
# Now adding clustered standard errors by groupcode AND calculating variance-covariance matrix for fegl
fe.vcovCL1 = vcov(fe.model1)
model1_clustered_int = coeftest(fe.model1, vcov = fe.vcovCL1, cluster = ~groupcode)
```

```
# I3 Table 3, Model 2 -- nationalist groups
data_nationalist = data[data$RANDnat==1, ]

model2 = glm.nb(attack2 ~ lagcompetition2 + lagfactor + lagcompfactint2 + laganocyn + lagdemyn + laggdp

model2_clustered = coeftest(model2, vcov = vcovCL, cluster = ~groupcode)

fe.model2 <- feglm(attack2 ~ lagcompetition2 + lagfactor + lagcompfactint2 + laganocyn + lagdemyn + lag
```

```
## NOTE: 358 observations removed because of NA values (LHS: 63, RHS: 303).
```

```
# Now adding clustered standard errors by groupcode AND calculating variance-covariance matrix for fegl
fe.vcovCL2 = vcov(fe.model2)
model2_clustered_int = coeftest(fe.model2, vcov = fe.vcovCL2, cluster = ~groupcode)
```

```
# I3 Table 3, Model 3 -- left-wing groups
data_left = data[data$RANDlw==1, ]

model3 = glm.nb(attack2 ~ lagcompetition2 + lagfactor + lagcompfactint2 + laganocyn + lagdemyn + laggdp

model3_clustered = coeftest(model3, vcov = vcovCL, cluster = ~groupcode)

fe.model3 <- feglm(attack2 ~ lagcompetition2 + lagfactor + lagcompfactint2 + laganocyn + lagdemyn + lag
```

```
## NOTE: 348 observations removed because of NA values (LHS: 52, RHS: 299).
```

```
## Warning: Absence of convergence: Maximum number of iterations reached (25).
## Final deviance: 634.3.
```

```
# Now adding clustered standard errors by groupcode AND calculating variance-covariance matrix for fegl
fe.vcovCL3 = vcov(fe.model3)
model3_clustered_int = coeftest(fe.model3, vcov = fe.vcovCL3, cluster = ~groupcode)
```

```
# I3 Table 3, Model 4 -- right-wing groups
data_right = data[data$RANDrw==1, ]

model4 = glm.nb(attack2 ~ lagcompetition2 + lagfactor + lagcompfactint2 + laganocyn + lagdemyn + laggdp

model4_clustered = coeftest(model4, vcov = vcovCL, cluster = ~groupcode)

fe.model4 <- feglm(attack2 ~ lagcompetition2 + lagfactor + lagcompfactint2 + laganocyn + lagdemyn + lag
```

```
## NOTE: 39 observations removed because of NA values (LHS: 6, RHS: 33).
```

```
# Now adding clustered standard errors by groupcode AND calculating variance-covariance matrix for fegl
fe.vcovCL4 = vcov(fe.model4)
model4_clustered_int = coeftest(fe.model4, vcov = fe.vcovCL4, cluster = ~groupcode)
```

```
#Table with the results
stargazer(model1_clustered, model1_clustered_int, model2_clustered, model2_clustered_int, model3_cluste
```

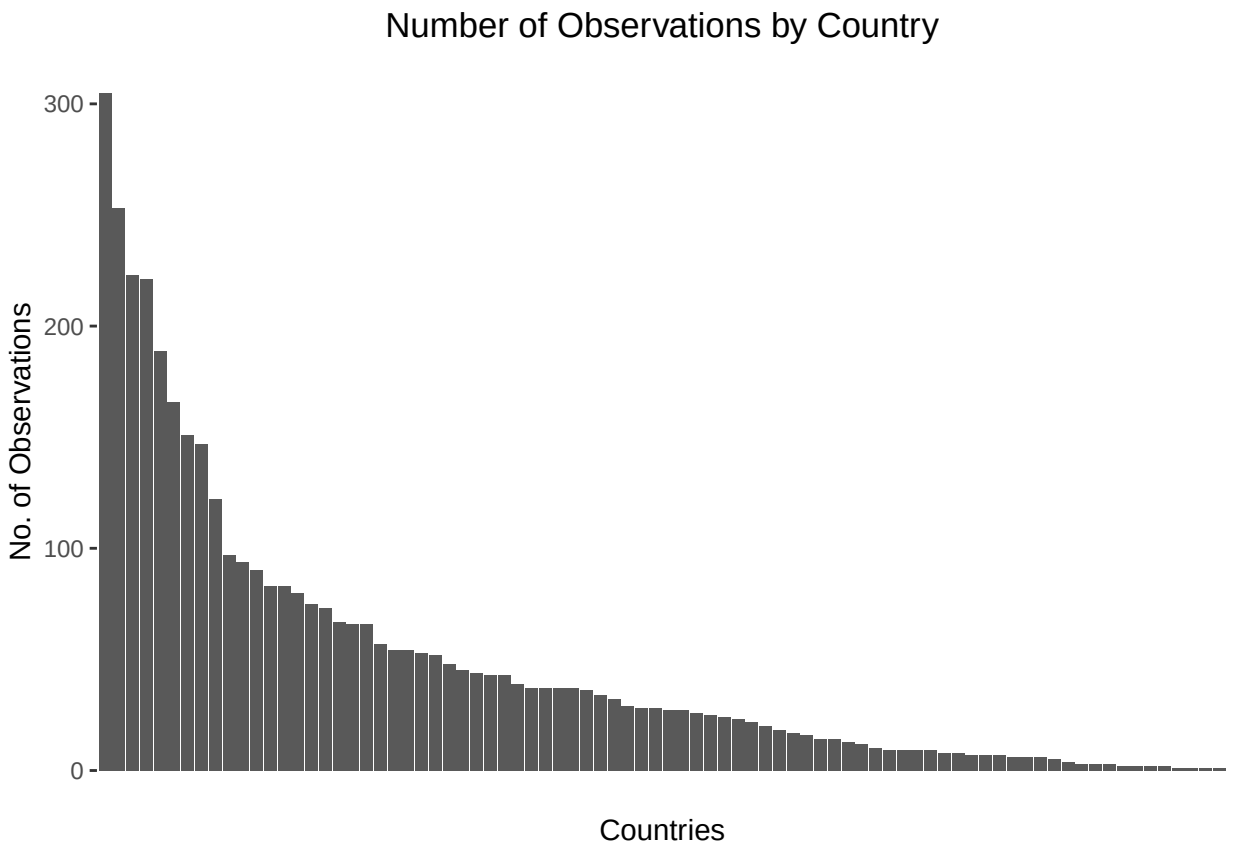
Table 9: Fixed Effects Intervention by Group Ideology

| | Religious (N) | Religious (I) | Nationalist (N) | Nationalist (I) | Left-Wing (N) | Left-Wing (I) | Right-Wing (N) | Right-Wing (I) |
|---|---|---|---|---|---|---|---|---|
| Competition | $-1.261^{***}$ | $-0.911$ | $-0.733^{***}$ | $-0.230^{***}$ | $-0.406$ | $-0.300$ | $-0.321$ | $-0.089$ |
| | (0.439) | (1.029) | (0.168) | (0.078) | (0.257) | (0.187) | (0.370) | (0.425) |
| Acceptability of Violence | $-1.525^{***}$ | $-0.640$ | $-0.253$ | 0.194 | $0.769^{**}$ | 0.453 | $1.200^{**}$ | 0.064 |
| | (0.473) | (0.904) | (0.430) | (0.197) | (0.366) | (0.289) | (0.551) | (0.654) |
| Competition x Acceptability | $0.725^{***}$ | 0.696 | 0.094 | $-0.012$ | $-0.084$ | $-0.084$ | $-0.429$ | $-0.165$ |
| | (0.243) | (0.608) | (0.126) | (0.065) | (0.172) | (0.151) | (0.404) | (0.519) |
| Anocracy | 0.153 | $-1.298^{***}$ | $2.440^{***}$ | $1.166^{***}$ | $-0.711$ | $-0.292$ | $-2.982^{***}$ | $-2.917^{***}$ |
| | (1.094) | (0.428) | (0.478) | (0.365) | (0.455) | (0.371) | (0.746) | (0.503) |
| Democracy | 0.497 | $-1.554^{***}$ | $2.442^{***}$ | $2.021^{***}$ | $1.113^{*}$ | $0.879^{*}$ | 0.096 | 0.544 |
| | (1.684) | (0.578) | (0.429) | (0.391) | (0.568) | (0.475) | (0.318) | (0.684) |
| GDP | $-0.0001^{*}$ | $-0.0002^{*}$ | $0.0001^{***}$ | $-0.0001^{**}$ | 0.00001 | $-0.0001^{**}$ | 0.00001 | $-0.0001$ |
| | (0.00005) | (0.0001) | (0.00003) | (0.00002) | (0.00003) | (0.0001) | (0.00005) | (0.0001) |
| RPC | $-0.462$ | $-1.259$ | $-0.484$ | $-0.338$ | $-0.797$ | $-1.087^{**}$ | $0.486^{*}$ | $0.628^{***}$ |
| | (0.905) | (0.773) | (0.477) | (0.339) | (0.517) | (0.480) | (0.276) | (0.036) |
| Civil War | 1.323 | $1.353^{*}$ | $0.716^{**}$ | $0.991^{***}$ | 0.474 | 0.586 | $0.949^{**}$ | $1.532^{*}$ |
| | (1.379) | (0.755) | (0.327) | (0.312) | (0.416) | (0.361) | (0.386) | (0.874) |
| Logged Population | $-0.260$ | $7.818^{***}$ | $0.290^{**}$ | $2.829^{***}$ | $-0.631^{***}$ | 1.056 | $-0.391^{*}$ | $4.293^{*}$ |
| | (0.370) | (2.312) | (0.118) | (1.000) | (0.117) | (0.946) | (0.230) | (2.593) |
| Constant | 4.984 | | $-2.673$ | | $8.483^{***}$ | | 3.735 | |
| | (4.424) | | (1.796) | | (1.323) | | (2.375) | |

*Note:* $^{*}$p<0.1; $^{**}$p<0.05; $^{***}$p<0.01

## Figures

```
#Figure 1, observations per country
no_obs = data %>%
  group_by(country) %>%
  summarise(n = n())
figure1 = ggplot(no_obs, aes(x=reorder(country, -n), y=n)) + geom_bar(stat="identity") +labs(title="Numb
        x ="Countries", y = "No. of Observations") + theme(plot.title = element_text(hjust = 0.5), axis
figure1
```

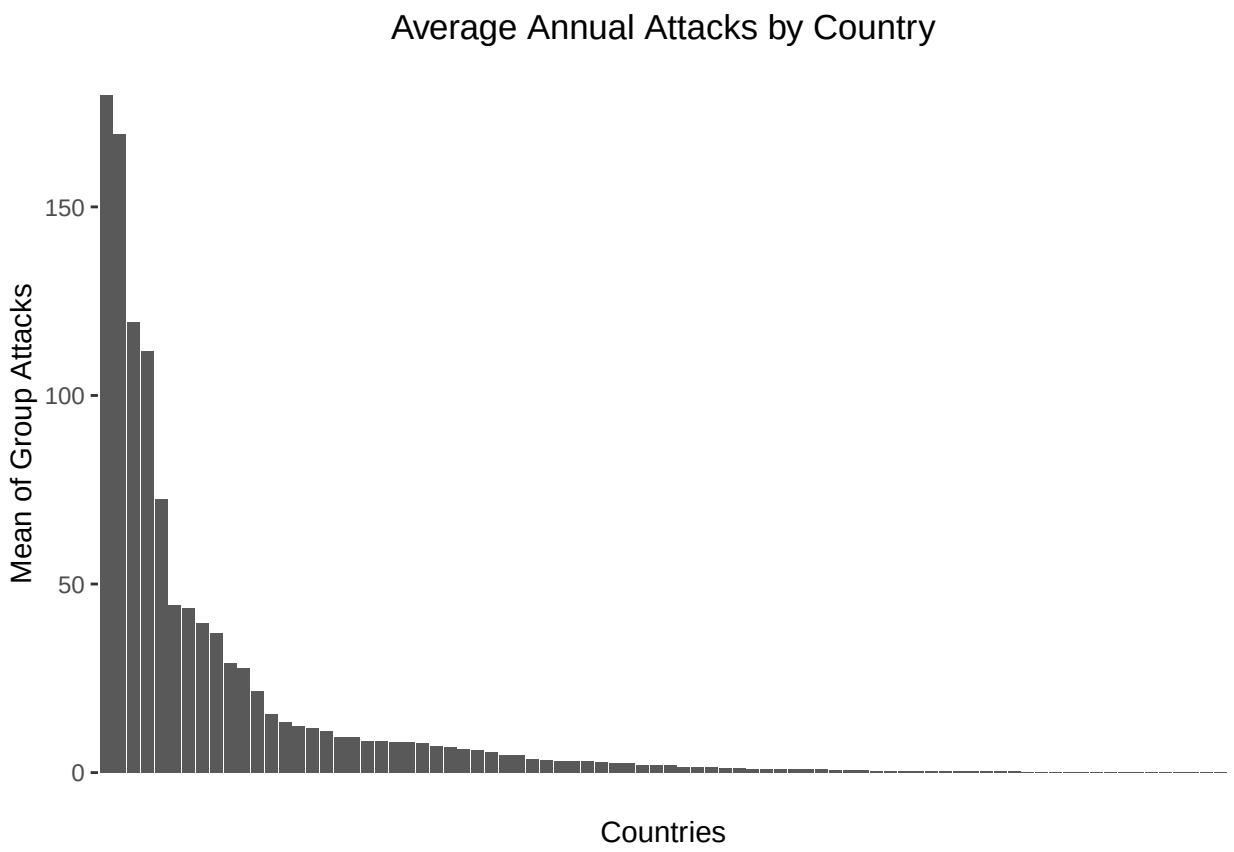



```
#Figure 2, average attacks per year per country
avg_attack = data %>%
  group_by(country,year) %>%
  summarise_at(vars(attack2), list(sum = sum), na.rm=TRUE)
avg_attack = avg_attack %>%
  group_by(country) %>%
  summarise_at(vars(sum), list(avg = mean), na.rm=TRUE)
avg_attack
```

```
## # A tibble: 82 x 2
##    country        avg
##    <chr>        <dbl>
##  1 Afghanistan  0.375
##  2 Algeria     29
##  3 Angola      11
##  4 Argentina    6.12
##  5 Australia    1
```

```
##  6 Austria      1
##  7 Bangladesh   0.667
##  8 Belgium      2.56
##  9 Bolivia      1.58
## 10 Brazil       0.714
## # ... with 72 more rows
```

```
figure2 = ggplot(avg_attack, aes(x=reorder(country, -avg), y=avg)) + geom_bar(stat="identity") +labs(ti
        x ="Countries", y = "Mean of Group Attacks") + theme(plot.title = element_text(hjust = 0.5), ax
figure2
```




```
#write.csv(avg_attack, file="avg_attack.csv")

#Figure 3, average competition index per year per country
avg_comp = data %>%
  group_by(country) %>%
  summarise_at(vars(lagcompetition2), list(avg = mean), na.rm=TRUE)
avg_comp
```

```
## # A tibble: 82 x 2
##    country        avg
##    <chr>        <dbl>
##  1 Afghanistan   1.53
##  2 Algeria       1.14
##  3 Angola        1.55
##  4 Argentina     1.20
##  5 Australia   NaN
##  6 Austria     NaN
```

```
##  7 Bangladesh    1
##  8 Belgium       1
##  9 Bolivia       1.25
## 10 Brazil        1
## # ... with 72 more rows
```

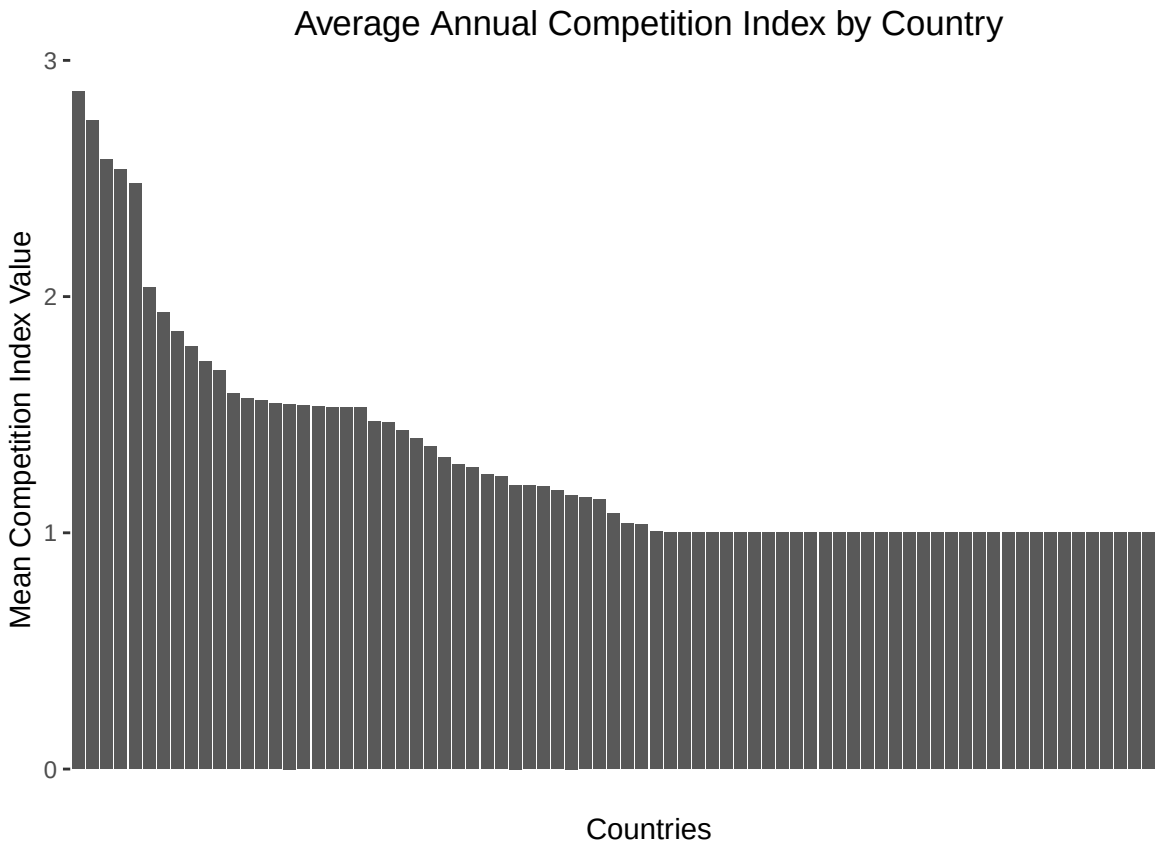
```
avg_comp = data %>%
  group_by(country) %>%
  summarise_at(vars(lagcompetition2), list(avg = mean), na.rm=TRUE)
avg_comp
```

```
## # A tibble: 82 x 2
##    country        avg
##    <chr>        <dbl>
##  1 Afghanistan   1.53
##  2 Algeria       1.14
##  3 Angola        1.55
##  4 Argentina     1.20
##  5 Australia   NaN
##  6 Austria     NaN
##  7 Bangladesh    1
##  8 Belgium       1
##  9 Bolivia       1.25
## 10 Brazil        1
## # ... with 72 more rows
```

```
#write.csv(avg_comp, file="avg_comp.csv")

figure3 = ggplot(avg_comp, aes(x=reorder(country, -avg), y=avg)) + geom_bar(stat="identity") +labs(titl
       x ="Countries", y = "Mean Competition Index Value") + theme(plot.title = element_text(hjust = 0
figure3
```

```
## Warning: Removed 5 rows containing missing values (position_stack).
```




```
#Figure 3, histogram of annual competition index by country
comp_hist = data[!is.na(data$lagcompetition2),]
comp_hist = data %>% distinct(country, year, .keep_all = TRUE)

figure4 = ggplot(comp_hist, aes(x=lagcompetition2)) + geom_histogram() +stat_bin(binwidth = 1) +labs(ti
        x ="Competition Index Values", y = "Observations") + theme(plot.title = element_text(hjust = 0.5
figure4
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

```
## Warning: Removed 139 rows containing non-finite values (stat_bin).
```

```
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```

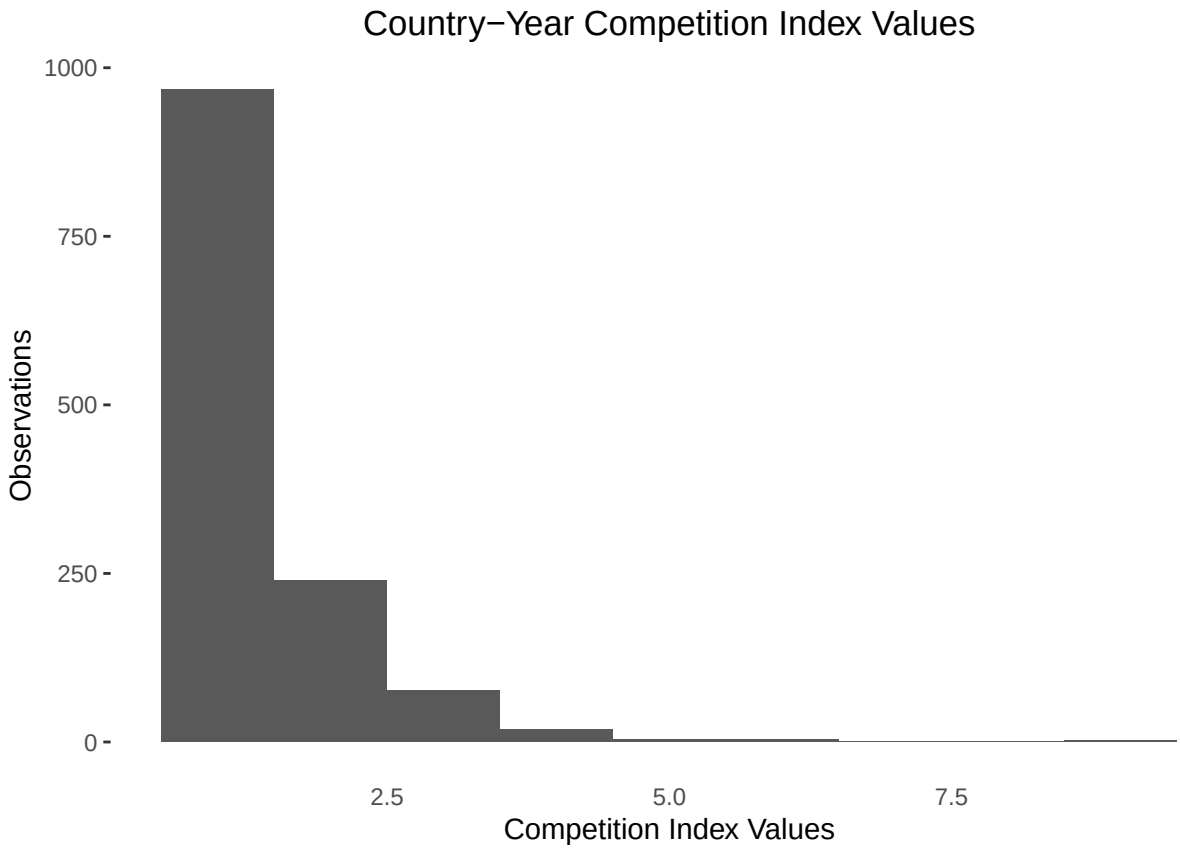


\end{document}