813 Final Project

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Abstract

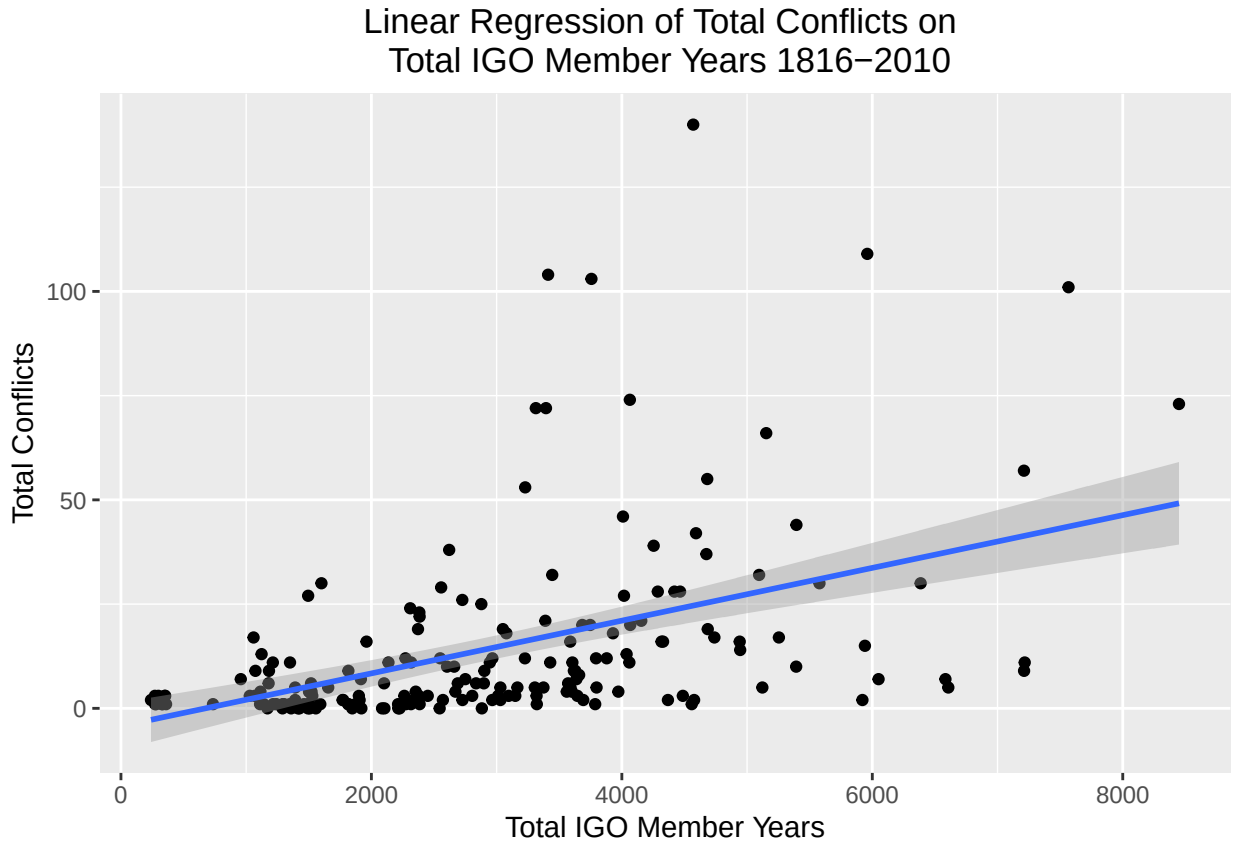
This project compares the relationship between International Governmental Organization (IGO) membership and engagement in interstate conflict. It uses data from the Correlates of War Project to assess if higher membership in IGOs (measured by the number of member years a state has total for the period 1814-2010) is correlated with the state being involved in fewer conflicts (measured as the number of times a state either used force or engaged in war during the same timespan). After running a robust linear regression, there is tentative evidence for a correlation between IGO membership and less violent conflict.

Introduction

Liberalism, as one of the key paradigms of International Relations, relies on the concept that cooperation in the international arena is possible through the use of international institutions. This cooperation due to International Governmental Organizations (IGOs) will, in turn, decrease violent conflict between states. To test this theory, this project compares the relationship between IGO membership and interstate conflict during the years 1816-2010, hypothesizing that more IGO membership will be correlated with a state being involved in fewer violent conflicts. It uses data from the Correlates of War project to assess this relationship. Membership in IGOs is measured by the total number of member years across all 534 IGOs included in the 3rd version of the Intergovernmental Organizations data set (Pevehouse et al. 2020). More specifically, the data are grouped by each state, which collapses the timespan into one grouping, and then the number of associate memberships (2's) and full memberships (1's) are summed by state. For example, during the period 1816-2010, the United States had 66 member years (values of 1 or 2) in the United Nations. This contributed to its total of 5960 member years across all IGOs. Level of interstate conflict is measured by the number of times a state reached a hostility level in an interstate conflict in which it used force or engaged in all out war (Palmer et al., n.d.). This data is pulled from version 4.3B of the Militarized Interstate Disputes data set. Lastly, a control variable for the power of a state is added to the regression. The measure of this is each state's mean Composite Index of National Capacity (CINC) over the 1816-2010 time period, drawn from version 5 of the National Material Capabilities data set (Singer, Bremer, and Stuckey 1975, @Singer:1987:power–update). A state's CINC score for a given year is an aggregation of the six individual components (iron and steel production, military expenditures, military personnel, energy consumption, total population, and urban population) that measure material capabilities into a single value. This value is an average of that state's share of the system total of each of these components that year with each component being weighted equally.

Model and Descriptive Statistics

Regressing the total number of conflicts on the total number of member years with a control variable for power provides initial results. This is depicted in the plot below and displays tentative initial evidence for a positive correlation between the number of years a state is a member of an IGO and the number of violent conflicts it engages in.




```
glance(model)
```

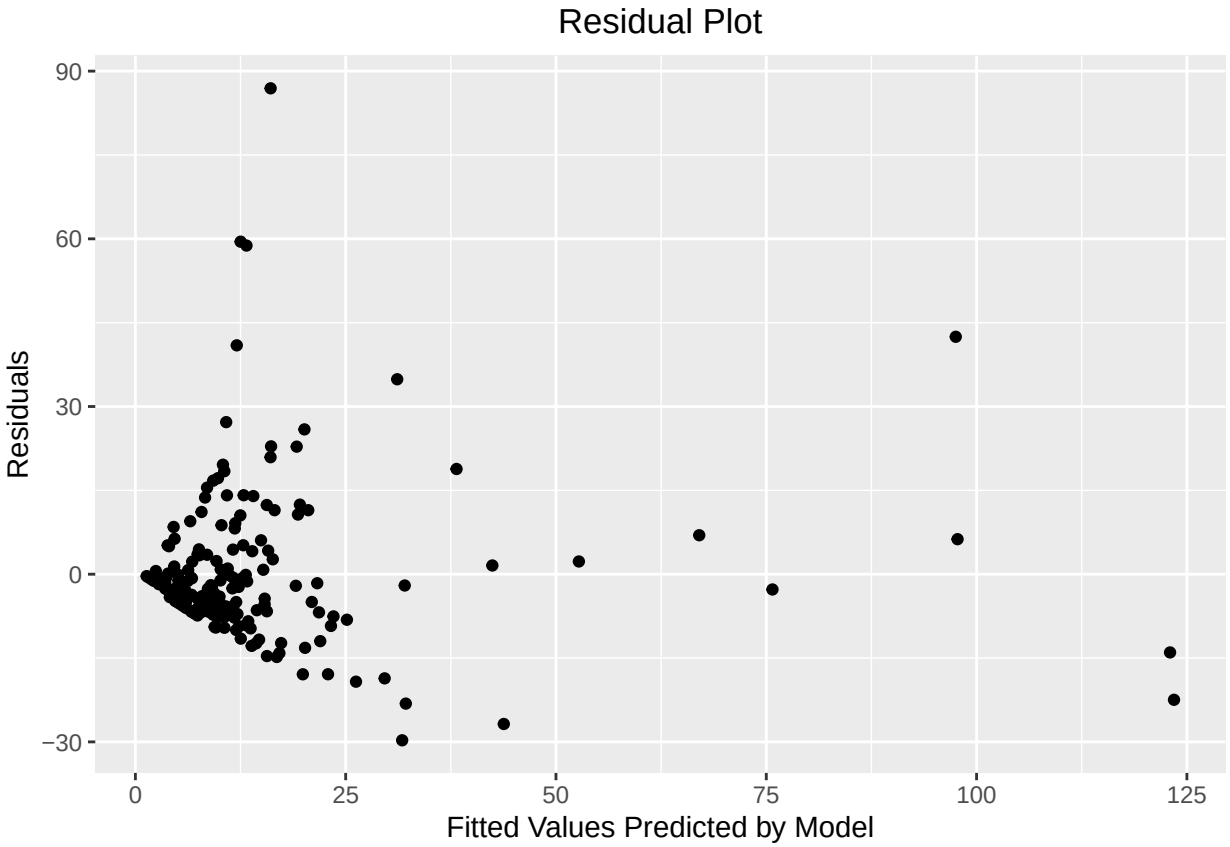
```
## # A tibble: 1 x 11
##   r.squared adj.r.squared sigma statistic  p.value    df logLik   AIC   BIC
##       <dbl>         <dbl> <dbl>     <dbl>    <dbl> <int>  <dbl> <dbl> <dbl>
## 1     0.619         0.615  13.7      154. 2.38e-40     3  -773. 1554. 1567.
## # ... with 2 more variables: deviance <dbl>, df.residual <int>
```

```
tidy(model)
```

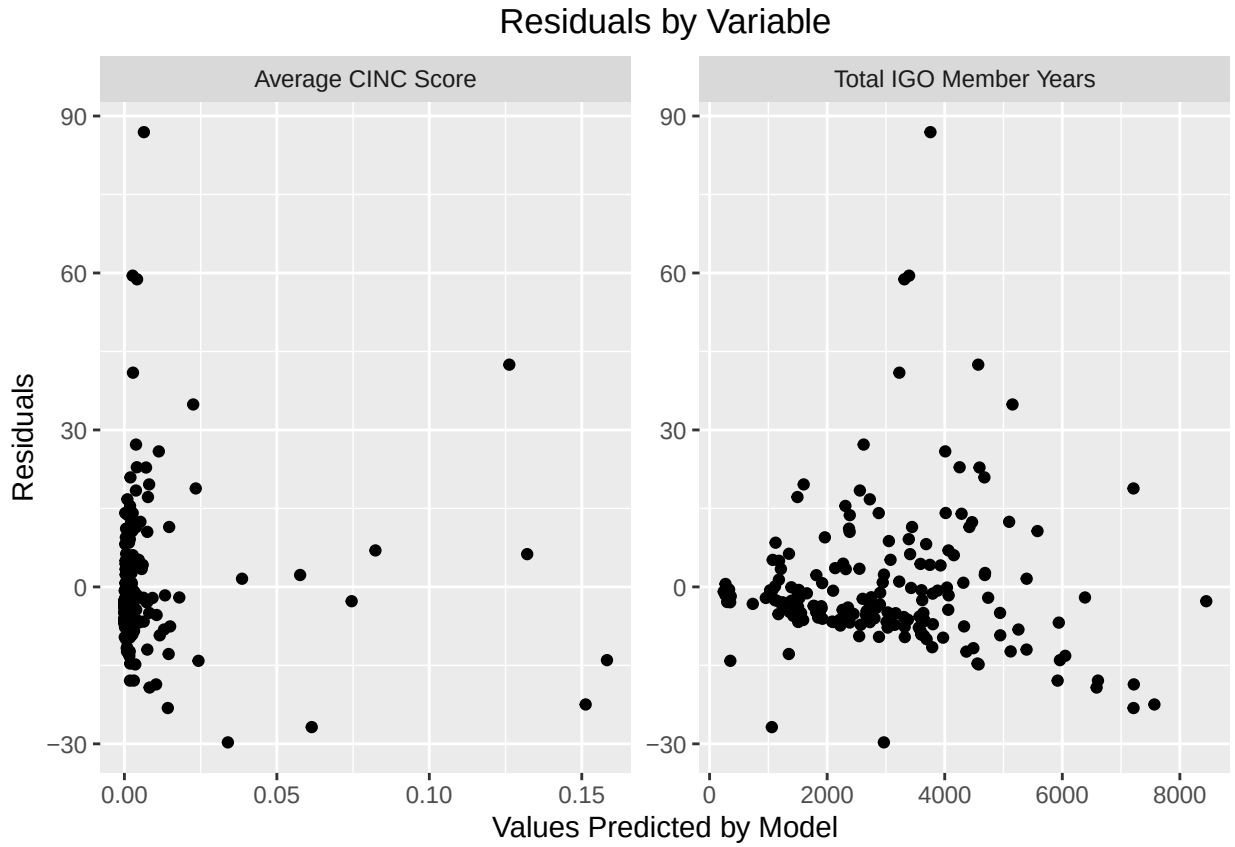
```
## # A tibble: 3 x 5
##   term                estimate std.error statistic  p.value
##   <chr>                  <dbl>     <dbl>     <dbl>    <dbl>
## 1 (Intercept)          0.0189   2.04       0.00924 9.93e- 1
## 2 total_member_years   0.00316  0.000647   4.87    2.30e- 6
## 3 cinc               658.      46.7       14.1     2.61e-31
```

The variable- and model-level statistics are listed above. The r-squared for the model is high at 0.619, which indicates that the model fits the data well with about 62% of the variance being explained. The coefficient for the primary variable of interest, total number of member years, is 0.00316. This indicates that, for an increase one member year per state, there is an average of 0.00316 more conflicts per state. There is a wide range in the standard errors of the two variables: total member years has a rather low standard error of 0.000647, while the average CINC score has a standard error of 46.7.

These metrics, at first glance, indicate that the data fit the model relatively well. To confirm this, I plot the residuals of the model in the next section.



The plot above does not have a random spread to it; if there was a random pattern to the residuals, this would indicate that the model fits the data well. Instead, it has a cone shope, which is a sign of heteroskedasticity. To determine which variable is potentially causing the heteroskedasticity, I plot the residuals for each variable alone.

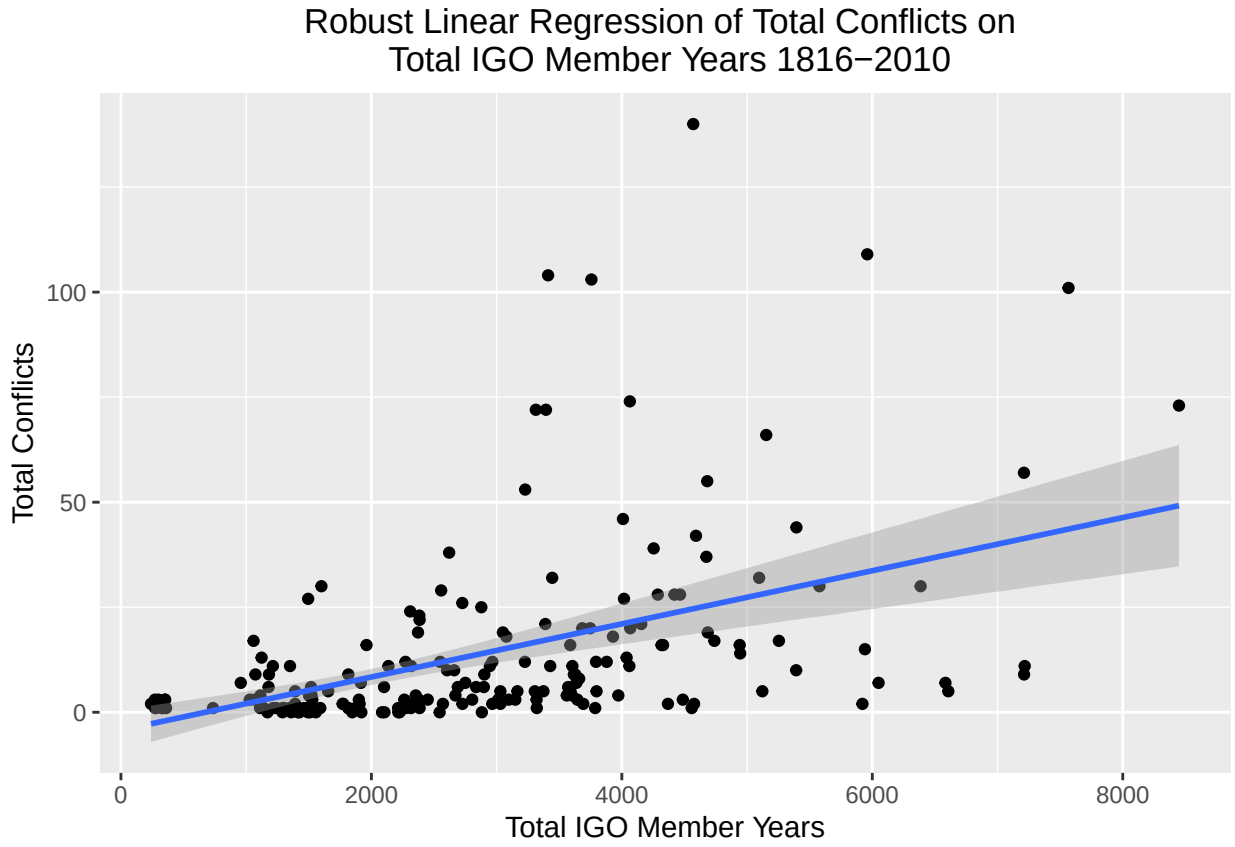


Neither variable has particularly random residuals, although the Average CINC Score seems to be appears to be more random outside of the cluster around 0. The Total IGO Member Years variable, however, has that heteroskedastic cone shape in its residuals. Therefore, I ran a Breusch-Pagan-Godfrey test on this variable to further examine its heteroskedasticity.

```
##
##  studentized Breusch-Pagan test
##
## data:  model$terms
## BP = 4.241, df = 1, p-value = 0.03946
```

The Breusch-Pagan-Godfrey test essentially regresses standardized residuals on the independent variables. A small resulting p-value indicates a large χ^2, and the homoskedasticity assumption is rejected for large values of χ^2. When I ran the test on the IGO variable, it returned a p-value of 0.039, which is relatively small. Therefore, this appears to be the variable for which I can reject the null of homoskedasticity.

To deal with this heteroskedasticity, I ran a robust linear model and utilize Huber-White robust standard errors. The plot below shows the results of this model with a confidence interval based on the robust variance estimates. Aside from the confidence interval, this plot is identical to the plot of the original regression, as it should be given that the coefficients of the two models should be the same. The standard errors of these coefficients should change with those of the robust model being altered to account for the hetereoskedasticity in the simple linear model. The standard errors of both models are displayed underneath the plot.




```
##   r.squared adj.r.squared statistic      p.value df.residual   N se_type
## 1 0.6191945     0.6151648  71.80256 6.358512e-24         189 192     HC2
```

Original simple linear regression model:

```
tidy(model)
```

```
## # A tibble: 3 x 5
##   term                estimate std.error statistic  p.value
##   <chr>                  <dbl>     <dbl>     <dbl>    <dbl>
## 1 (Intercept)          0.0189   2.04       0.00924 9.93e- 1
## 2 total_member_years   0.00316  0.000647   4.87    2.30e- 6
## 3 cinc               658.      46.7       14.1     2.61e-31
```

Robust linear regression model:

```
tidy(robust_model)
```

```
##                term     estimate    std.error  statistic      p.value
## 1       (Intercept) 1.886194e-02 1.482045e+00 0.01272697 9.898590e-01
## 2 total_member_years 3.155524e-03 6.455182e-04 4.88835728 2.164839e-06
## 3              cinc 6.582240e+02 8.011270e+01 8.21622529 3.256325e-14
##        conf.low    conf.high  df         outcome
## 1  -2.904612978   2.94233687 189 total_conflicts
## 2   0.001882178   0.00442887 189 total_conflicts
## 3 500.194077088 816.25391458 189 total_conflicts
```

It appears that the robust model successfully altered the standard errors as they are much smaller with this model.

Conclusion

The results of the robust model indicate that there is a positive correlation between the presence of a state in IGOS, as measured by the number of member years they had associate or full membership in IGOs, and that state's engagement in violent conflict, either using material force or going to war. In other words, this provides initial tentative evidence that participating in IGOs for longer periods of time decreases the amount of violent conflict a state partakes in. This is not a causal claim by any means, and there are many things about this initial analysis that could be improved upon.

First, this is not a great way to handle panel data. In all honesty, I was not sure how to do a fixed or random effects model and accurately deal with changes over time, so I simplified by totalling the member years. This is also an extremely simple model with only one control; there are others that would have been good to include, like GDP and regime type. But, again, including variables like this (and many of the other elements of the National Material Capabilities data) are difficult to handle when purposefully avoiding times series analyses. Lastly, it would be interesting to further investigate different methods within R for running a robust linear regression and calculating these standard errors. I played around with a few different robust estimator packages and got different results from all three of them, but I am still not really sure why that happened. I ended up using the method that Mike provided in a problem set that corresponded with doing a Bruesch-Pagan-Godfrey test, deciding that he probably knew what he was doing when he chose lm_robust() over the other options.

References

Palmer, Glenn, Vito D'Orazio, Michael R. Kenwick, and Rose C. McManus. n.d. "Updating the Militarized Interstate Dispute Data: A Response to Gibler, Miller, and Little." *International Studies Quarterly.*

Pevehouse, Jon C. W., Timothy Nordstron, Roseanne W. McManus, and Anne Spencer Jamison. 2020. "Tracking Organizations in the World: The Correlates of War Igo Version 3.0 Datasets." *Journal of Peace Research* 57 (3): 492–503.

Singer, David J. 1987. "Reconstructing the Correlates of War Dataset on Material Capabilities of States, 1816-1985." *International Interactions* 14: 115–32.

Singer, David J., Stuart Bremer, and John Stuckey. 1975. "Capability Distribution, Uncertainty, and Major Power War, 1820-1965." In *Peace, War, and Numbers*, edited by Bruce Russett, 19–48. Beverly Hills: Sage.