Chapter 2 - Political Stability Around the World Since the End of the Cold War: Descriptive Statistics and Exploratory Data Analysis

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Outline:

2.1 - Descriptive Statistics

2.2 - Exploratory Data Analysis

## 2.1 - Descriptive Statistics

**General Stability of the World Since the End of the Cold War**

Following Kaufman et al.’s methodology (see World Bank 2016; and Kaufmann, Kraay, and Mastruzzi 2011), the political stability estimate of a given country for a given year is based on the aggregation of the perceptions (or assessments) from several survey respondents, including the following so-called five representative sources: Economist Intelligence Unit Riskwire & Democracy Index (EIU), World Economic Forum Global Competitiveness Report (GCS), Cingranelli Richards Human Rights Database and Political Terror Scale (HUM), Institutional Profiles Database (IPD), Political Risk Services International Country Risk Guide (PRS), and Global Insight Business Conditions and Risk Indicators (WMO). The annual political stability estimate ranges from approximately -2.5 to 2.5, with some extreme values less than -2.5. Using the dataset on the political stability estimate of all countries in the world for the period of 1996 to 2016, we can compute the stability of the world for the entire period and the annual stability trend from 1996 to 2016. Furthemore, we can compare the stability of the different regions in the world.

Thus, based on the dataset on the political stability estimate of all countries in the world, we can state that the whole world was not stable since the end of the Cold War. Indeed, as shown in Table 1 and Figure 1 below, the summary statistics of political stability during the time period of 1996-2016 around the world produces an average of -0.0199 with standard deviation of 1.00, which seems to indicate that the whole world has been slightly unstable during this time period. One can also notice that whereas the maximum value of political stability is 1.96, the minimum value is -3.31.

Furthermore, Figure 2 shows that the data on political stability is not normally distributed, but skweed to the left, which indicates the existence of outliers with negative values. Figure 2 also shows that the mode is between 0.5 and 1.

#Table 1 - Political Stability Around the World: Summary statistics  
summary(WGIdevRegimeType$stability, na.rm = TRUE)

## Min. 1st Qu. Median Mean 3rd Qu. Max.   
## -3.31494 -0.63062 0.15040 0.02312 0.90009 1.96506

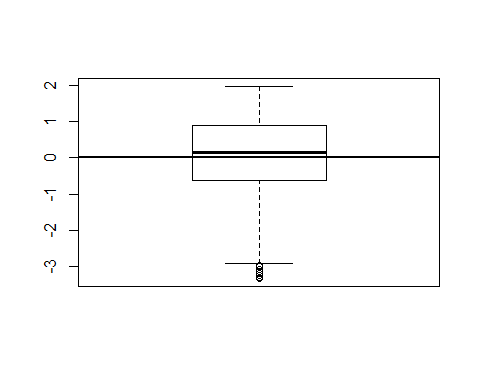


Fig. 1 - Political Stability Around the World: Summary Statistics

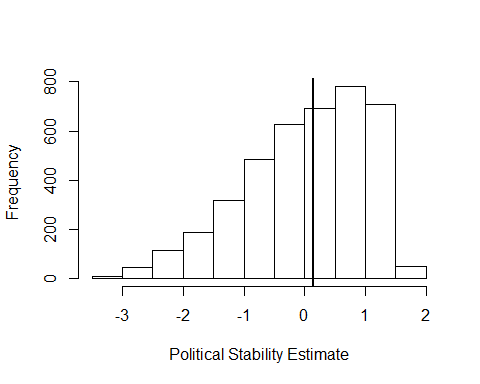


Figure 2 - Political Stability Around the World: Frequency Distribution

**Political Stability Trend: Annual Average Around the World**

As shown in Table 2 and Figure 3, the annual average of politial stability has remained below zero during the time period of 1996-2016 throughout the world. There was no time it had a positive value.

Table 2 - Political Stability Trend: Annual Average Around the World

|  |  |
| --- | --- |
| date | AnnualAverage |
| 1996 | 0.1121926 |
| 1998 | 0.1021657 |
| 2000 | 0.1020844 |
| 2002 | 0.0864790 |
| 2003 | 0.0629503 |
| 2004 | 0.0250343 |
| 2005 | 0.0144723 |
| 2006 | 0.0028243 |
| 2007 | 0.0061752 |
| 2008 | 0.0106481 |
| 2009 | -0.0001735 |
| 2010 | -0.0024865 |
| 2011 | -0.0356176 |
| 2012 | -0.0230241 |
| 2013 | -0.0196692 |
| 2014 | -0.0008040 |
| 2015 | -0.0014467 |
| 2016 | -0.0007414 |
| 2017 | -0.0014795 |

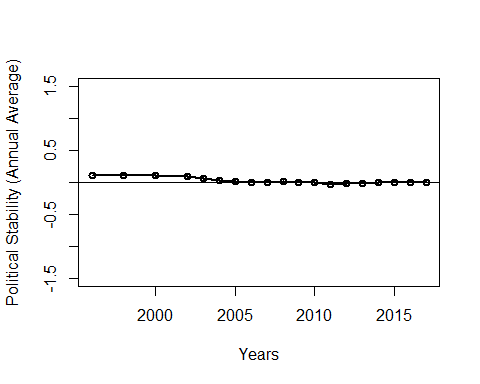


Fig. 3 - Political Stability Trend: Annual Average Around the World

**Political Stability: Average by Region**

Table 3 and Figure 4 clearly show that the regions of Africa and Asia, with respectively an average of -0.575 and -0.388, were the two most unstable regions in the world during the time period of 1996-2016. On the contrary, the regions of Oceania and Europe, with respectively an average of 0.820 and 0.651, were the two most unstable regions in the world

Table 3 - Political Stability: Average by Region

|  |  |  |
| --- | --- | --- |
| region | mean | sd |
| Africa | -0.5497792 | 0.9311490 |
| Americas | 0.2566603 | 0.7448222 |
| Asia | -0.3943205 | 1.0412316 |
| Europe | 0.6495288 | 0.6839273 |
| Oceania | 0.8092280 | 0.5672276 |

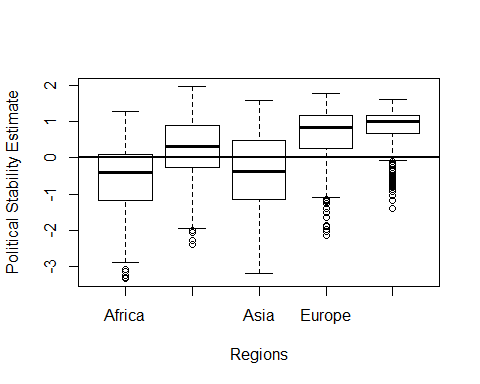


Fig. 3 - Political Stability: Average by Region

**Identifying the Most Stable and Most Unstable Countries in Africa**

# subsetting the African countries  
WGIdevRegimeTypeAf <- filter(WGIdevRegimeType, region == "Africa")  
  
# calculating the average stability by country in Africa  
  
politicalStabilityByCountry <- summarise(group\_by(WGIdevRegimeTypeAf, country),  
 mean=mean(stability, na.rm = TRUE), sd=sd(stability, na.rm = TRUE))  
  
mostStable <- arrange(politicalStabilityByCountry, desc(mean))  
mostStable

## # A tibble: 56 x 3  
## country mean sd  
## <chr> <dbl> <dbl>  
## 1 Botswana 1.02 0.0633  
## 2 Mauritius 0.915 0.140   
## 3 Cabo Verde 0.865 0.181   
## 4 Seychelles 0.812 0.204   
## 5 Namibia 0.770 0.241   
## 6 Benin 0.411 0.301   
## 7 "S\xe3o Tom\xe9 and Principe" 0.334 0.277   
## 8 Zambia 0.251 0.246   
## 9 Gabon 0.249 0.179   
## 10 Gambia, The 0.144 0.316   
## # ... with 46 more rows

mostUnstable <- arrange(politicalStabilityByCountry, mean)  
mostUnstable

## # A tibble: 56 x 3  
## country mean sd  
## <chr> <dbl> <dbl>  
## 1 Somalia -2.69 0.395  
## 2 Sudan -2.25 0.281  
## 3 Congo, Dem. Rep. -2.24 0.227  
## 4 Burundi -1.78 0.434  
## 5 Nigeria -1.78 0.398  
## 6 Central African Republic -1.75 0.378  
## 7 Ethiopia -1.44 0.307  
## 8 Chad -1.42 0.297  
## 9 "C\xf4te d'Ivoire" -1.34 0.691  
## 10 Algeria -1.31 0.277  
## # ... with 46 more rows

## 2.2 - Exploratory Data Analysis

*Correlation Between Political Stability and the other World Governance Indicators (WGI)*

In this section, we plot political stability against the other world governance indicators (corruption control, government effectiveness, regulatory quality, rule of law, and voice and accountability), and find that political stability is strongly and significantly correlated with these other world governance indicators. The correlation coefficients range from 0.63 to 0.77, with a p-value close to zero.

This result allows us to include all world governance indicators in our prediction models.

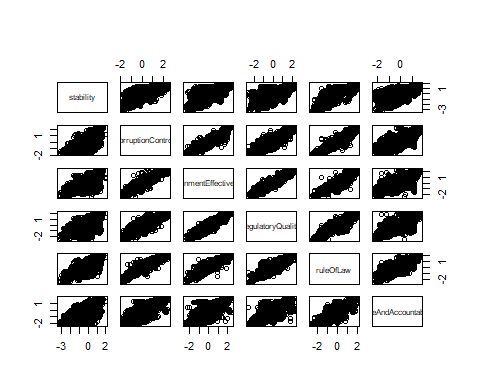


Fig. 5 - Correlation between Political Stability and the other World Governance Indicators (WGI)

#Table 4 - Correlation Matrix between Political Stability and the other World Governance Indicators (WGI)  
  
correlationWGI

## stability corruptionControl  
## stability 1.00 0.75  
## corruptionControl 0.75 1.00  
## governmentEffectiveness 0.71 0.92  
## regulatoryQuality 0.67 0.88  
## ruleOfLaw 0.78 0.94  
## voiceAndAccountability 0.68 0.78  
## governmentEffectiveness regulatoryQuality  
## stability 0.71 0.67  
## corruptionControl 0.92 0.88  
## governmentEffectiveness 1.00 0.94  
## regulatoryQuality 0.94 1.00  
## ruleOfLaw 0.92 0.90  
## voiceAndAccountability 0.76 0.78  
## ruleOfLaw voiceAndAccountability  
## stability 0.78 0.68  
## corruptionControl 0.94 0.78  
## governmentEffectiveness 0.92 0.76  
## regulatoryQuality 0.90 0.78  
## ruleOfLaw 1.00 0.83  
## voiceAndAccountability 0.83 1.00  
##   
## n= 4010   
##   
##   
## P  
## stability corruptionControl  
## stability 0   
## corruptionControl 0   
## governmentEffectiveness 0 0   
## regulatoryQuality 0 0   
## ruleOfLaw 0 0   
## voiceAndAccountability 0 0   
## governmentEffectiveness regulatoryQuality  
## stability 0 0   
## corruptionControl 0 0   
## governmentEffectiveness 0   
## regulatoryQuality 0   
## ruleOfLaw 0 0   
## voiceAndAccountability 0 0   
## ruleOfLaw voiceAndAccountability  
## stability 0 0   
## corruptionControl 0 0   
## governmentEffectiveness 0 0   
## regulatoryQuality 0 0   
## ruleOfLaw 0   
## voiceAndAccountability 0

### *Correlation Between Political Stability, Development, and Social Inequality*

In this section, we plot political stability against the indicators of socioeconomic development (GNI per capita and Human Development Index (HDI)) and social inequality (GINI index), and find that while the correlation between political stability and GNI per capita is relatively strong (0.61), those between political stability, on the one hand, and HID and GNI, on the other hand, are moderate (respectively 0.48 and -0.34).

Nevertheless, since all of these correlations are statistically significant (with p-values close to zero), we can still include these indicators of socioeconomic developmentin and social inequality in our prediction models.

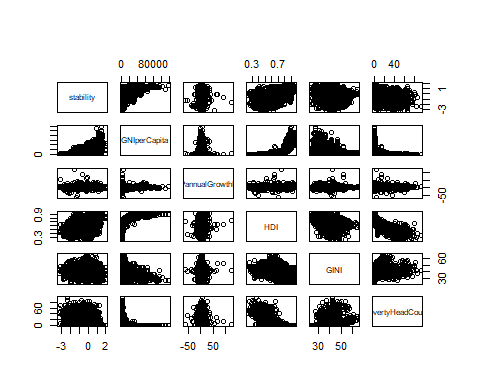


Fig. 6 - Correlation between Political Stability, Development, and Social Inequality

#Table 5 - Correlation Matrix between Political Stability and the Indicators of Development and Social Inequality  
  
correlation.devStability

## stability GNIperCapita GDPannualGrowthRate HDI GINI  
## stability 1.00 0.52 -0.11 0.59 -0.22  
## GNIperCapita 0.52 1.00 -0.12 0.71 -0.48  
## GDPannualGrowthRate -0.11 -0.12 1.00 -0.14 0.05  
## HDI 0.59 0.71 -0.14 1.00 -0.38  
## GINI -0.22 -0.48 0.05 -0.38 1.00  
## povertyHeadCount -0.47 -0.45 0.11 -0.84 0.28  
## povertyHeadCount  
## stability -0.47  
## GNIperCapita -0.45  
## GDPannualGrowthRate 0.11  
## HDI -0.84  
## GINI 0.28  
## povertyHeadCount 1.00  
##   
## n= 4010   
##   
##   
## P  
## stability GNIperCapita GDPannualGrowthRate HDI   
## stability 0.0000 0.0000 0.0000  
## GNIperCapita 0.0000 0.0000 0.0000  
## GDPannualGrowthRate 0.0000 0.0000 0.0000  
## HDI 0.0000 0.0000 0.0000   
## GINI 0.0000 0.0000 0.0026 0.0000  
## povertyHeadCount 0.0000 0.0000 0.0000 0.0000  
## GINI povertyHeadCount  
## stability 0.0000 0.0000   
## GNIperCapita 0.0000 0.0000   
## GDPannualGrowthRate 0.0026 0.0000   
## HDI 0.0000 0.0000   
## GINI 0.0000   
## povertyHeadCount 0.0000

### *Correlation Between Political Instability and Regime Type Indicators*

In this section, we plot political stability against the indicators of regime type (Polity IV revised combined polity score, Polity IV score on institutionalized democracy, Polity IV score on institutionalized autocracy, Freedom House inversed score on political rights, Freedom House inversed score on civil liberties, Freedom House combined score), and find that while the correlation between political stability and GNI per capita is relatively strong (0.61), those between political stability, on the one hand, and HID and GNI, on the other hand, are moderate (respectively 0.48 and -0.34).

Nevertheless, since all of these correlations are statistically significant (with p-values close to zero), we can still include these indicators of socioeconomic developmentin and social inequality in our prediction models.

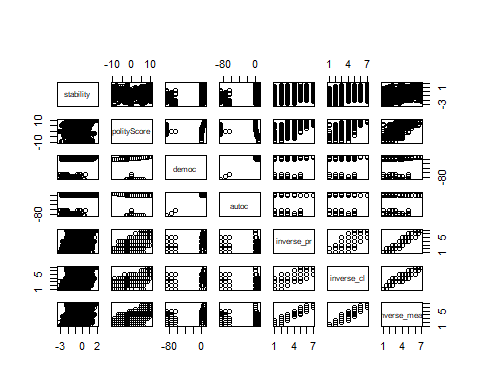


Fig. 7 - Political Instability and Regime Type Indicators

#Table 6 - Correlation Matrix between Political Stability and Regime Type Indicators  
  
Correlation.regimeTypeStability

## stability polityScore democ autoc inverse\_pr inverse\_cl  
## stability 1.00 0.40 0.41 0.25 0.58 0.64  
## polityScore 0.40 1.00 0.37 -0.09 0.90 0.85  
## democ 0.41 0.37 1.00 0.89 0.43 0.44  
## autoc 0.25 -0.09 0.89 1.00 0.03 0.06  
## inverse\_pr 0.58 0.90 0.43 0.03 1.00 0.94  
## inverse\_cl 0.64 0.85 0.44 0.06 0.94 1.00  
## inverse\_mean 0.62 0.89 0.44 0.04 0.99 0.98  
## inverse\_mean  
## stability 0.62  
## polityScore 0.89  
## democ 0.44  
## autoc 0.04  
## inverse\_pr 0.99  
## inverse\_cl 0.98  
## inverse\_mean 1.00  
##   
## n= 4010   
##   
##   
## P  
## stability polityScore democ autoc inverse\_pr inverse\_cl  
## stability 0.0000 0.0000 0.0000 0.0000 0.0000   
## polityScore 0.0000 0.0000 0.0000 0.0000 0.0000   
## democ 0.0000 0.0000 0.0000 0.0000 0.0000   
## autoc 0.0000 0.0000 0.0000 0.0686 0.0002   
## inverse\_pr 0.0000 0.0000 0.0000 0.0686 0.0000   
## inverse\_cl 0.0000 0.0000 0.0000 0.0002 0.0000   
## inverse\_mean 0.0000 0.0000 0.0000 0.0056 0.0000 0.0000   
## inverse\_mean  
## stability 0.0000   
## polityScore 0.0000   
## democ 0.0000   
## autoc 0.0056   
## inverse\_pr 0.0000   
## inverse\_cl 0.0000   
## inverse\_mean

### *Generalized Linear Regression Model to Identify the Most Significant Variables*

In this section, we include all variables in a single dataframe and run a step function in order to identify the most significant variables to be included in the prediction models.

# Selecting the variables to be included in the regression model. We need to remove the stability dummy (stabilityDummy) and stability category (stabilityCategory) from this dataset.  
  
WGIdevRegimeTypeReg <- select(WGIdevRegimeType, stability, corruptionControl, governmentEffectiveness, regulatoryQuality, ruleOfLaw, voiceAndAccountability, GNIperCapita, GDPannualGrowthRate, HDI, GINI, povertyHeadCount, polityScore, polityCategory, politicalChange, democ, autoc, durable, xrreg, xrcomp, xropen, xconst, parreg, parcomp, exrec, exconst, polcomp, status, inverse\_pr, inverse\_cl, inverse\_mean, politicalChangeFH, region, subregion)  
  
# Table 7 - Summary of the Generalized Linear Regression Model Using Step Function  
modelFit1 <- step(glm( data=WGIdevRegimeTypeReg, stability ~ .), trace=0,steps=10000)  
summary(modelFit1)

##   
## Call:  
## glm(formula = stability ~ corruptionControl + governmentEffectiveness +   
## regulatoryQuality + ruleOfLaw + voiceAndAccountability +   
## GNIperCapita + GDPannualGrowthRate + HDI + GINI + povertyHeadCount +   
## polityScore + polityCategory + politicalChange + autoc +   
## durable + xrreg + xrcomp + xropen + parreg + parcomp + exrec +   
## exconst + inverse\_pr + inverse\_mean + politicalChangeFH +   
## region + subregion, data = WGIdevRegimeTypeReg)  
##   
## Deviance Residuals:   
## Min 1Q Median 3Q Max   
## -1.7647 -0.2849 0.0317 0.3137 2.1067   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) -1.063e+00 2.460e-01 -4.320 1.60e-05  
## corruptionControl 1.766e-01 2.799e-02 6.309 3.12e-10  
## governmentEffectiveness 8.486e-02 3.178e-02 2.670 0.007614  
## regulatoryQuality -2.150e-01 2.684e-02 -8.011 1.49e-15  
## ruleOfLaw 5.382e-01 3.216e-02 16.732 < 2e-16  
## voiceAndAccountability 9.902e-02 2.830e-02 3.499 0.000472  
## GNIperCapita -3.683e-06 1.017e-06 -3.621 0.000297  
## GDPannualGrowthRate 3.240e-03 1.439e-03 2.251 0.024449  
## HDI 3.477e-01 1.565e-01 2.221 0.026390  
## GINI 2.473e-03 1.525e-03 1.621 0.105033  
## povertyHeadCount -3.710e-03 8.850e-04 -4.192 2.83e-05  
## polityScore 2.978e-02 1.568e-02 1.900 0.057560  
## polityCategoryAutocracy 6.077e-01 5.895e-02 10.309 < 2e-16  
## polityCategoryDemocracy -1.072e-01 4.037e-02 -2.655 0.007963  
## politicalChangedemocratization 1.661e-01 7.550e-02 2.201 0.027829  
## politicalChangeno change 2.048e-01 6.252e-02 3.275 0.001065  
## autoc 3.435e-02 2.392e-02 1.436 0.151022  
## durable -1.725e-03 4.056e-04 -4.253 2.16e-05  
## xrreg 6.398e-02 4.388e-02 1.458 0.144876  
## xrcomp 1.252e-01 6.274e-02 1.995 0.046143  
## xropen -6.157e-02 1.977e-02 -3.115 0.001854  
## parreg -3.641e-02 1.195e-02 -3.048 0.002321  
## parcomp 5.121e-02 1.549e-02 3.306 0.000954  
## exrec -6.496e-02 1.604e-02 -4.049 5.23e-05  
## exconst -9.934e-02 1.687e-02 -5.890 4.19e-09  
## inverse\_pr -1.562e-01 2.632e-02 -5.935 3.19e-09  
## inverse\_mean 2.825e-01 3.072e-02 9.197 < 2e-16  
## politicalChangeFHdemocratization 9.147e-02 4.513e-02 2.027 0.042731  
## politicalChangeFHno change 6.059e-02 3.489e-02 1.737 0.082527  
## regionAmericas 3.192e-01 1.546e-01 2.065 0.039005  
## regionAsia 2.521e-02 1.593e-01 0.158 0.874245  
## regionEurope 1.457e-01 1.876e-01 0.776 0.437514  
## regionOceania 3.892e-01 1.410e-01 2.760 0.005803  
## subregionCaribbean 2.777e-01 1.695e-01 1.638 0.101487  
## subregionCentral America 3.177e-01 1.752e-01 1.813 0.069893  
## subregionCentral Asia 6.193e-01 2.091e-01 2.962 0.003077  
## subregionEastern Africa 5.939e-01 1.700e-01 3.494 0.000480  
## subregionEastern Asia 5.163e-01 2.033e-01 2.540 0.011121  
## subregionEastern Europe 5.259e-01 2.112e-01 2.490 0.012826  
## subregionMelanesia 5.718e-01 1.094e-01 5.228 1.81e-07  
## subregionMicronesia 4.663e-01 1.043e-01 4.473 7.93e-06  
## subregionMiddle Africa 6.217e-01 1.741e-01 3.572 0.000358  
## subregionNorthern Africa 1.448e-02 1.753e-01 0.083 0.934173  
## subregionNorthern America 1.613e-01 1.721e-01 0.937 0.348890  
## subregionNorthern Europe 2.540e-01 2.088e-01 1.217 0.223771  
## subregionPolynesia 3.612e-01 1.006e-01 3.590 0.000334  
## subregionSouth-Eastern Asia 5.237e-01 2.024e-01 2.587 0.009708  
## subregionSouth America -5.561e-02 1.741e-01 -0.319 0.749389  
## subregionSouthern Africa 5.535e-01 1.777e-01 3.115 0.001851  
## subregionSouthern Asia -1.657e-01 2.054e-01 -0.807 0.419779  
## subregionSouthern Europe 3.742e-01 2.087e-01 1.793 0.073100  
## subregionWestern Africa 6.330e-01 1.712e-01 3.698 0.000221  
## subregionWestern Asia -2.021e-01 2.019e-01 -1.001 0.316768  
## subregionWestern Europe 2.620e-01 2.095e-01 1.251 0.211079  
##   
## (Intercept) \*\*\*  
## corruptionControl \*\*\*  
## governmentEffectiveness \*\*   
## regulatoryQuality \*\*\*  
## ruleOfLaw \*\*\*  
## voiceAndAccountability \*\*\*  
## GNIperCapita \*\*\*  
## GDPannualGrowthRate \*   
## HDI \*   
## GINI   
## povertyHeadCount \*\*\*  
## polityScore .   
## polityCategoryAutocracy \*\*\*  
## polityCategoryDemocracy \*\*   
## politicalChangedemocratization \*   
## politicalChangeno change \*\*   
## autoc   
## durable \*\*\*  
## xrreg   
## xrcomp \*   
## xropen \*\*   
## parreg \*\*   
## parcomp \*\*\*  
## exrec \*\*\*  
## exconst \*\*\*  
## inverse\_pr \*\*\*  
## inverse\_mean \*\*\*  
## politicalChangeFHdemocratization \*   
## politicalChangeFHno change .   
## regionAmericas \*   
## regionAsia   
## regionEurope   
## regionOceania \*\*   
## subregionCaribbean   
## subregionCentral America .   
## subregionCentral Asia \*\*   
## subregionEastern Africa \*\*\*  
## subregionEastern Asia \*   
## subregionEastern Europe \*   
## subregionMelanesia \*\*\*  
## subregionMicronesia \*\*\*  
## subregionMiddle Africa \*\*\*  
## subregionNorthern Africa   
## subregionNorthern America   
## subregionNorthern Europe   
## subregionPolynesia \*\*\*  
## subregionSouth-Eastern Asia \*\*   
## subregionSouth America   
## subregionSouthern Africa \*\*   
## subregionSouthern Asia   
## subregionSouthern Europe .   
## subregionWestern Africa \*\*\*  
## subregionWestern Asia   
## subregionWestern Europe   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for gaussian family taken to be 0.2449769)  
##   
## Null deviance: 4005.79 on 4009 degrees of freedom  
## Residual deviance: 969.13 on 3956 degrees of freedom  
## AIC: 5795.1  
##   
## Number of Fisher Scoring iterations: 2

The above step function allows us the identify the following variables as the most significant predictors to be included in the prediction models:

corruptionControl, governmentEffectiveness, regulatoryQuality, ruleOfLaw, voiceAndAccountability, GNIperCapita, GDPannualGrowthRate, HDI, GINI, povertyHeadCount, polityCategory, politicalChange, durable, xrreg, xrcomp, xropen, xconst, parreg, parcomp, exrec, exconst, polcomp, status, inverse\_pr, inverse\_cl, inverse\_mean, politicalChangeFH, region, subregion

The following variables were dropped or appeared to be insignificant in this model:

polityScore, democ, autoc, polcomp, inverse\_pr

## III. Predicting Political Stability Using Machine Learning

See scriptForMachineLearningPrediction

Kaufmann, Daniel, Aart Kraay, and Massimo Mastruzzi. 2011. “The Worldwide Governance Indicators: Methodology and Analytical Issues.” 1876-4053. Washington, DC: The World Bank.

World Bank. 2016. “Worldwide Governance Indicators.” *The World Bank Databank*. http://databank.worldbank.org/data/reports.aspx?source=worldwide-governance-indicators.