QRM

2023-05-15

DESCRIPTIVE STATISTICS

```
library(tinytex)
df <- read.csv('C:/Users/Alkan/QRMDATA2.csv')
df = subset(df, select = -c(X,Country.Code) )
str(df)
```
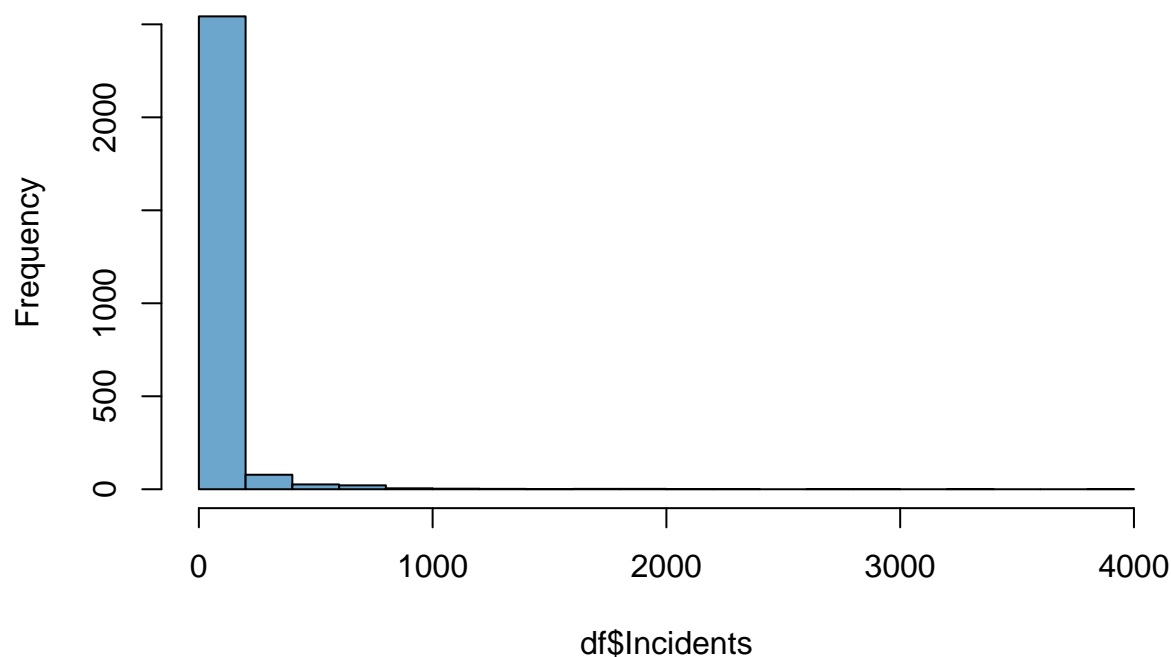
```
## 'data.frame':    2689 obs. of  8 variables:
##  $ year       : int  1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 ...
##  $ country    : chr  "Argentina" "Argentina" "Argentina" "Argentina" ...
##  $ Incidents  : int  21 7 15 60 71 38 54 17 25 16 ...
##  $ polity2    : num  -9 -9 -9 6 6 6 -9 -9 -9 -9 ...
##  $ GDP        : num  3.16e+10 3.33e+10 3.47e+10 5.25e+10 7.24e+10 ...
##  $ Religion   : chr  "Christians" "Christians" "Christians" "Christians" ...
##  $ Region     : chr  "Latin America-Caribbean" "Latin America-Caribbean" "Latin America-Caribbean" "La
##  $ Population : num  23842803 24223379 24612794 25020588 25449754 ...
```

```
summary(df)
```

```
##       year          country            Incidents          polity2
##  Min.   :1970   Length:2689        Min.   :   1.00   Min.   :-10.000
##  1st Qu.:1986   Class :character   1st Qu.:   2.00   1st Qu.: -3.000
##  Median :1996   Mode  :character   Median :   5.00   Median :  6.000
##  Mean   :1996                      Mean   :  49.02   Mean   :  3.357
##  3rd Qu.:2007                      3rd Qu.:  21.00   3rd Qu.:  9.000
##  Max.   :2016                      Max.   :3926.00   Max.   : 10.000
##       GDP               Religion            Region            Population
##  Min.   :1.347e+08   Length:2689        Length:2689        Min.   :3.126e+05
##  1st Qu.:6.599e+09   Class :character   Class :character   1st Qu.:5.712e+06
##  Median :3.293e+10   Mode  :character   Mode  :character   Median :1.323e+07
##  Mean   :2.757e+11                                         Mean   :5.656e+07
##  3rd Qu.:1.808e+11                                         3rd Qu.:4.152e+07
##  Max.   :1.123e+13                                         Max.   :1.388e+09
```

```
hist(df$Incidents,col="skyblue3",breaks=20)
```

Histogram of df$Incidents


```
mean(df$Incidents)
```

```
## [1] 49.02529
```

```
var(df$Incidents)
```

```
## [1] 35933.5
```

```
#The dependent variable is event count, so we can use either poisson distribution or negative binomial.
```

GLM NEGATIVE BINOMIAL

```
library(fastDummies)
library(MASS)
library(lme4)
```

```
## Zorunlu paket yükleniyor: Matrix
```

```
df1=dummy_columns(df,remove_first_dummy = TRUE,select_columns = c("Religion","Region"))
#added dummy variables for categorical values
mod1=glm.nb(Incidents~polity2+GDP+Region+Religion+Population,data=df1)
summary(mod1)
```

```
##
## Call:
## glm.nb(formula = Incidents ~ polity2 + GDP + Region + Religion +
##     Population, data = df1, init.theta = 0.3994476025, link = log)
##
```

```
## Coefficients:
##                                 Estimate Std. Error z value Pr(>|z|)
## (Intercept)                    3.855e+00  1.602e-01  24.062  < 2e-16 ***
## polity2                        8.206e-02  6.026e-03  13.617  < 2e-16 ***
## GDP                            1.455e-13  5.195e-14   2.802 0.005084 **
## RegionEurope                  -1.173e+00  1.229e-01  -9.537  < 2e-16 ***
## RegionLatin America-Caribbean  4.246e-02  1.233e-01   0.344 0.730589
## RegionMiddle East-North Africa 3.377e-01  1.478e-01   2.284 0.022351 *
## RegionNorth America           -3.453e+00  3.434e-01 -10.058  < 2e-16 ***
## RegionSub-Saharan Africa      -8.801e-01  1.165e-01  -7.554 4.23e-14 ***
## ReligionChristians            -2.899e-01  1.903e-01  -1.523 0.127680
## ReligionFolk Religions        -2.951e+00  7.393e-01  -3.991 6.58e-05 ***
## ReligionHindus                -1.048e+00  2.934e-01  -3.572 0.000354 ***
## ReligionJews                  -7.328e-01  4.038e-01  -1.815 0.069516 .
## ReligionMuslims                8.840e-02  1.877e-01   0.471 0.637681
## ReligionUnaffiliated          -3.299e+00  3.102e-01 -10.633  < 2e-16 ***
## Population                     2.338e-09  2.633e-10   8.877  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for Negative Binomial(0.3994) family taken to be 1)
##
##     Null deviance: 4059.1  on 2688  degrees of freedom
## Residual deviance: 3318.0  on 2674  degrees of freedom
## AIC: 22576
##
## Number of Fisher Scoring iterations: 1
##
##
##              Theta:  0.39945
##          Std. Err.:  0.00915
##
##  2 x log-likelihood:  -22543.68100
```

#NULL MODEL

```
mod1null=glm.nb(Incidents~GDP+Region+Population,data=df1)
summary(mod1null)
```

```
##
## Call:
## glm.nb(formula = Incidents ~ GDP + Region + Population, data = df1,
##     init.theta = 0.3720408502, link = log)
##
## Coefficients:
##                                 Estimate Std. Error z value Pr(>|z|)
## (Intercept)                    3.939e+00  7.786e-02  50.591  < 2e-16 ***
## GDP                            4.676e-15  4.687e-14   0.100    0.921
## RegionEurope                  -7.740e-01  1.001e-01  -7.731 1.07e-14 ***
## RegionLatin America-Caribbean -1.019e-01  1.010e-01  -1.009    0.313
## RegionMiddle East-North Africa 5.026e-01  1.254e-01   4.007 6.16e-05 ***
## RegionNorth America           -2.880e+00  3.437e-01  -8.380  < 2e-16 ***
## RegionSub-Saharan Africa      -9.882e-01  1.037e-01  -9.531  < 2e-16 ***
## Population                     2.372e-09  2.188e-10  10.842  < 2e-16 ***
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for Negative Binomial(0.372) family taken to be 1)
##
##     Null deviance: 3788.8  on 2688  degrees of freedom
## Residual deviance: 3365.5  on 2681  degrees of freedom
## AIC: 22839
##
## Number of Fisher Scoring iterations: 1
##
##
##               Theta:  0.37204
##           Std. Err.:  0.00843
##
##  2 x log-likelihood:  -22820.81100
```

#COMPARISON WITH ANOVA

```
anova(mod1,mod1null,test='Chisq')
```

```
## Likelihood ratio tests of Negative Binomial Models
##
## Response: Incidents
##                                         Model     theta Resid. df
## 1                   GDP + Region + Population 0.3720409      2681
## 2 polity2 + GDP + Region + Religion + Population 0.3994476      2674
##      2 x log-lik.   Test    df LR stat. Pr(Chi)
## 1         -22820.81
## 2         -22543.68 1 vs 2     7 277.1307        0
```

#Comparison with the null model using Chi Square test shows that the explanatory variable highly signif

One Way Fixed Effect (country)

```
library(lme4)
mod2=glm.nb(Incidents~polity2+GDP+Region+Religion+Population+as.factor(country),data=df1)
summary(mod2)
```

```
##
## Call:
## glm.nb(formula = Incidents ~ polity2 + GDP + Region + Religion +
##     Population + as.factor(country), data = df1, init.theta = 0.8425688402,
##     link = log)
##
## Coefficients: (11 not defined because of singularities)
##                                    Estimate Std. Error z value
## (Intercept)                        3.855e+00  1.787e-01  21.578
## polity2                            3.880e-02  5.679e-03   6.831
## GDP                               -2.100e-13  4.697e-14  -4.470
## RegionEurope                       6.196e-01  6.913e-01   0.896
## RegionLatin America-Caribbean     -2.107e+00  7.317e-01  -2.879
## RegionMiddle East-North Africa    -5.384e+00  6.123e-01  -8.793
## RegionNorth America               -2.716e+00  7.114e-01  -3.818
## RegionSub-Saharan Africa          -2.088e+00  6.238e-01  -3.347
## ReligionChristians                -4.909e-01  6.899e-01  -0.712
```

```
## ReligionFolk Religions                              -3.804e+00  5.771e-01  -6.591
## ReligionHindus                                       -5.243e-01  2.846e-01  -1.842
## ReligionJews                                          5.273e+00  6.782e-01   7.775
## ReligionMuslims                                       3.061e+00  5.731e-01   5.342
## ReligionUnaffiliated                                 -2.337e+00  2.862e-01  -8.166
## Population                                            9.736e-09  7.533e-10  12.925
## as.factor(country)Albania                            -6.179e+00  5.147e-01 -12.007
## as.factor(country)Algeria                             2.781e+00  3.433e-01   8.100
## as.factor(country)Angola                              1.829e+00  3.286e-01   5.566
## as.factor(country)Argentina                           1.425e+00  3.478e-01   4.097
## as.factor(country)Armenia                            -3.028e+00  7.573e-01  -3.999
## as.factor(country)Australia                          -2.527e+00  7.072e-01  -3.573
## as.factor(country)Austria                            -3.186e+00  2.747e-01 -11.598
## as.factor(country)Azerbaijan                         -5.619e+00  6.362e-01  -8.832
## as.factor(country)Bahrain                             1.284e+00  3.987e-01   3.220
## as.factor(country)Bangladesh                         -4.554e+00  5.786e-01  -7.871
## as.factor(country)Belarus                            -3.479e+00  4.936e-01  -7.047
## as.factor(country)Belgium                            -2.924e+00  2.680e-01 -10.914
## as.factor(country)Benin                              -1.106e+00  6.483e-01  -1.706
## as.factor(country)Bhutan                             -3.525e+00  7.051e-01  -4.998
## as.factor(country)Bolivia                             8.784e-01  3.634e-01   2.417
## as.factor(country)Botswana                           -1.194e+00  5.730e-01  -2.083
## as.factor(country)Brazil                             -7.364e-01  3.688e-01  -1.997
## as.factor(country)Bulgaria                           -3.425e+00  3.254e-01 -10.524
## as.factor(country)Burkina Faso                       -3.716e+00  6.229e-01  -5.965
## as.factor(country)Burundi                             1.872e+00  3.280e-01   5.707
## as.factor(country)Cambodia                           -1.398e+00  3.487e-01  -4.010
## as.factor(country)Cameroon                            1.492e+00  3.816e-01   3.911
## as.factor(country)Canada                                     NA         NA       NA
## as.factor(country)Central African Republic  1.176e+00  3.510e-01   3.351
## as.factor(country)Chad                               -3.447e+00  4.008e-01  -8.600
## as.factor(country)Chile                               2.811e+00  3.446e-01   8.157
## as.factor(country)China                              -1.048e+01  9.244e-01 -11.334
## as.factor(country)Colombia                            3.348e+00  3.390e-01   9.877
## as.factor(country)Comoros                            -4.478e+00  8.303e-01  -5.393
## as.factor(country)Costa Rica                         -5.569e-01  3.954e-01  -1.408
## as.factor(country)Croatia                            -3.147e+00  4.500e-01  -6.993
## as.factor(country)Cuba                                5.226e-01  5.705e-01   0.916
## as.factor(country)Cyprus                             -2.333e+00  7.041e-01  -3.313
## as.factor(country)Denmark                            -3.567e+00  3.460e-01 -10.311
## as.factor(country)Djibouti                           -4.074e+00  5.012e-01  -8.129
## as.factor(country)Dominican Republic                  5.007e-02  4.022e-01   0.124
## as.factor(country)Ecuador                             1.597e-01  3.525e-01   0.453
## as.factor(country)El Salvador                         3.956e+00  3.687e-01  10.729
## as.factor(country)Equatorial Guinea                  -1.030e+00  1.073e+00  -0.961
## as.factor(country)Eritrea                            -6.867e-01  5.714e-01  -1.202
## as.factor(country)Estonia                            -2.157e+00  9.328e-01  -2.313
## as.factor(country)Ethiopia                           -3.827e-01  3.229e-01  -1.185
## as.factor(country)Fiji                               -2.634e+00  8.216e-01  -3.206
## as.factor(country)Finland                            -3.570e+00  4.827e-01  -7.397
## as.factor(country)France                             -5.805e-01  2.311e-01  -2.512
## as.factor(country)Gabon                              -1.082e+00  7.767e-01  -1.393
## as.factor(country)Georgia                            -1.975e+00  2.906e-01  -6.798
## as.factor(country)Germany                            -1.291e+00  2.805e-01  -4.604
```

```
## as.factor(country)Ghana               -5.964e-01  5.054e-01   -1.180
## as.factor(country)Greece              -1.121e+00  2.365e-01   -4.740
## as.factor(country)Guatemala            2.913e+00  3.534e-01    8.244
## as.factor(country)Guinea              -3.834e+00  5.324e-01   -7.202
## as.factor(country)Guinea-Bissau       -4.602e+00  6.361e-01   -7.234
## as.factor(country)Guyana              -7.160e-01  4.590e-01   -1.560
## as.factor(country)Haiti                8.254e-01  3.786e-01    2.180
## as.factor(country)Honduras            1.006e+00  3.691e-01    2.725
## as.factor(country)Hungary             -3.137e+00  3.883e-01   -8.078
## as.factor(country)India               -7.523e+00  7.607e-01   -9.890
## as.factor(country)Indonesia           -5.984e+00  5.934e-01  -10.085
## as.factor(country)Iraq                 4.357e+00  3.457e-01   12.603
## as.factor(country)Ireland             -2.400e+00  2.505e-01   -9.580
## as.factor(country)Israel                     NA         NA         NA
## as.factor(country)Italy               -1.261e+00  2.308e-01   -5.461
## as.factor(country)Jamaica             -7.640e-01  4.490e-01   -1.701
## as.factor(country)Japan                      NA         NA         NA
## as.factor(country)Jordan              -1.905e-01  3.554e-01   -0.536
## as.factor(country)Kazakhstan          -5.849e+00  6.731e-01   -8.690
## as.factor(country)Kenya                1.133e+00  3.187e-01    3.555
## as.factor(country)Kosovo              -6.422e+00  5.799e-01  -11.075
## as.factor(country)Kuwait              -1.125e-01  3.739e-01   -0.301
## as.factor(country)Latvia              -3.622e+00  5.578e-01   -6.493
## as.factor(country)Lebanon              2.344e+00  4.062e-01    5.770
## as.factor(country)Lesotho             -6.815e-02  4.549e-01   -0.150
## as.factor(country)Liberia             -8.461e-01  5.545e-01   -1.526
## as.factor(country)Libya                3.647e+00  4.316e-01    8.449
## as.factor(country)Lithuania           -3.712e+00  7.696e-01   -4.823
## as.factor(country)Luxembourg          -2.988e+00  6.240e-01   -4.788
## as.factor(country)Madagascar          -9.618e-01  4.325e-01   -2.224
## as.factor(country)Malawi              -4.884e-01  9.372e-01   -0.521
## as.factor(country)Malaysia            -5.733e+00  6.072e-01   -9.441
## as.factor(country)Mali                -1.970e+00  4.076e-01   -4.835
## as.factor(country)Mauritania          -3.882e+00  5.444e-01   -7.131
## as.factor(country)Mauritius           -1.641e+00  1.239e+00   -1.325
## as.factor(country)Mexico               3.622e-01  3.486e-01    1.039
## as.factor(country)Moldova             -4.190e+00  5.694e-01   -7.359
## as.factor(country)Montenegro          -4.051e+00  8.220e-01   -4.928
## as.factor(country)Morocco             -6.848e-01  4.257e-01   -1.609
## as.factor(country)Mozambique           1.231e+00  4.011e-01    3.069
## as.factor(country)Namibia              1.484e-01  5.360e-01    0.277
## as.factor(country)Nepal                      NA         NA         NA
## as.factor(country)Netherlands         -3.282e+00  2.566e-01  -12.793
## as.factor(country)New Zealand         -3.261e+00  7.737e-01   -4.215
## as.factor(country)Nicaragua            3.105e+00  3.677e-01    8.444
## as.factor(country)Niger               -3.147e+00  4.043e-01   -7.784
## as.factor(country)Nigeria              1.765e+00  3.271e-01    5.397
## as.factor(country)Norway              -3.965e+00  4.284e-01   -9.255
## as.factor(country)Pakistan            -3.141e+00  5.760e-01   -5.452
## as.factor(country)Panama               3.498e-01  3.884e-01    0.901
## as.factor(country)Papua New Guinea    -1.468e+00  7.598e-01   -1.932
## as.factor(country)Paraguay             1.589e-01  4.021e-01    0.395
## as.factor(country)Peru                 3.339e+00  3.432e-01    9.729
## as.factor(country)Philippines          5.520e-01  6.876e-01    0.803
```

```
## as.factor(country)Poland                        -3.309e+00  4.357e-01  -7.595
## as.factor(country)Portugal                      -2.431e+00  3.156e-01  -7.702
## as.factor(country)Qatar                         -1.145e+00  6.266e-01  -1.827
## as.factor(country)Romania                       -4.417e+00  7.591e-01  -5.819
## as.factor(country)Rwanda                         1.033e+00  3.583e-01   2.882
## as.factor(country)Saudi Arabia                   1.180e+00  3.598e-01   3.280
## as.factor(country)Senegal                       -3.371e+00  3.914e-01  -8.612
## as.factor(country)Serbia                        -3.344e+00  6.460e-01  -5.176
## as.factor(country)Sierra Leone                  -2.463e+00  4.695e-01  -5.245
## as.factor(country)Singapore                     -3.567e+00  6.113e-01  -5.835
## as.factor(country)Slovenia                      -3.876e+00  7.910e-01  -4.900
## as.factor(country)Solomon Islands               -3.471e+00  1.084e+00  -3.202
## as.factor(country)Somalia                               NA         NA       NA
## as.factor(country)South Africa                   2.264e+00  3.081e-01   7.349
## as.factor(country)South Sudan                    1.950e+00  6.016e-01   3.241
## as.factor(country)Spain                         -3.176e-01  2.323e-01  -1.367
## as.factor(country)Sri Lanka                      1.907e-01  2.533e-01   0.753
## as.factor(country)Sudan                          6.631e-01  3.525e-01   1.881
## as.factor(country)Suriname                       4.752e-01  4.509e-01   1.054
## as.factor(country)Sweden                        -2.907e+00  2.846e-01 -10.214
## as.factor(country)Switzerland                   -3.150e+00  3.051e-01 -10.324
## as.factor(country)Tajikistan                    -4.404e+00  6.100e-01  -7.220
## as.factor(country)Tanzania                      -4.365e-01  4.038e-01  -1.081
## as.factor(country)Thailand                              NA         NA       NA
## as.factor(country)Togo                           7.709e-01  4.964e-01   1.553
## as.factor(country)Trinidad and Tobago           -1.138e+00  4.671e-01  -2.437
## as.factor(country)Tunisia                               NA         NA       NA
## as.factor(country)Turkmenistan                  -6.632e+00  1.180e+00  -5.622
## as.factor(country)Uganda                         1.082e+00  3.099e-01   3.493
## as.factor(country)Ukraine                       -1.475e-01  2.993e-01  -0.493
## as.factor(country)United Kingdom                        NA         NA       NA
## as.factor(country)Uruguay                               NA         NA       NA
## as.factor(country)Uzbekistan                    -5.710e+00  7.179e-01  -7.955
## as.factor(country)Vietnam                               NA         NA       NA
## as.factor(country)Zambia                         6.854e-02  3.731e-01   0.184
## as.factor(country)Zimbabwe                              NA         NA       NA
##                                                 Pr(>|z|)
## (Intercept)                                      < 2e-16 ***
## polity2                                         8.41e-12 ***
## GDP                                             7.84e-06 ***
## RegionEurope                                    0.370062
## RegionLatin America-Caribbean                   0.003988 **
## RegionMiddle East-North Africa                   < 2e-16 ***
## RegionNorth America                             0.000135 ***
## RegionSub-Saharan Africa                        0.000817 ***
## ReligionChristians                              0.476765
## ReligionFolk Religions                          4.36e-11 ***
## ReligionHindus                                  0.065422 .
## ReligionJews                                    7.54e-15 ***
## ReligionMuslims                                 9.19e-08 ***
## ReligionUnaffiliated                            3.18e-16 ***
## Population                                       < 2e-16 ***
## as.factor(country)Albania                        < 2e-16 ***
## as.factor(country)Algeria                       5.51e-16 ***
```

```
## as.factor(country)Angola                    2.61e-08 ***
## as.factor(country)Argentina                 4.18e-05 ***
## as.factor(country)Armenia                   6.37e-05 ***
## as.factor(country)Australia                 0.000353 ***
## as.factor(country)Austria                    < 2e-16 ***
## as.factor(country)Azerbaijan                 < 2e-16 ***
## as.factor(country)Bahrain                   0.001284 **
## as.factor(country)Bangladesh                3.53e-15 ***
## as.factor(country)Belarus                   1.82e-12 ***
## as.factor(country)Belgium                    < 2e-16 ***
## as.factor(country)Benin                     0.087931 .
## as.factor(country)Bhutan                    5.78e-07 ***
## as.factor(country)Bolivia                   0.015644 *
## as.factor(country)Botswana                  0.037239 *
## as.factor(country)Brazil                    0.045835 *
## as.factor(country)Bulgaria                   < 2e-16 ***
## as.factor(country)Burkina Faso              2.44e-09 ***
## as.factor(country)Burundi                   1.15e-08 ***
## as.factor(country)Cambodia                  6.07e-05 ***
## as.factor(country)Cameroon                  9.21e-05 ***
## as.factor(country)Canada                          NA
## as.factor(country)Central African Republic 0.000806 ***
## as.factor(country)Chad                       < 2e-16 ***
## as.factor(country)Chile                     3.44e-16 ***
## as.factor(country)China                      < 2e-16 ***
## as.factor(country)Colombia                   < 2e-16 ***
## as.factor(country)Comoros                   6.94e-08 ***
## as.factor(country)Costa Rica                0.159005
## as.factor(country)Croatia                   2.68e-12 ***
## as.factor(country)Cuba                      0.359647
## as.factor(country)Cyprus                    0.000922 ***
## as.factor(country)Denmark                    < 2e-16 ***
## as.factor(country)Djibouti                  4.34e-16 ***
## as.factor(country)Dominican Republic        0.900931
## as.factor(country)Ecuador                   0.650466
## as.factor(country)El Salvador                < 2e-16 ***
## as.factor(country)Equatorial Guinea         0.336766
## as.factor(country)Eritrea                   0.229456
## as.factor(country)Estonia                   0.020744 *
## as.factor(country)Ethiopia                  0.235941
## as.factor(country)Fiji                      0.001346 **
## as.factor(country)Finland                   1.39e-13 ***
## as.factor(country)France                    0.011991 *
## as.factor(country)Gabon                     0.163701
## as.factor(country)Georgia                   1.06e-11 ***
## as.factor(country)Germany                   4.14e-06 ***
## as.factor(country)Ghana                     0.237980
## as.factor(country)Greece                    2.13e-06 ***
## as.factor(country)Guatemala                  < 2e-16 ***
## as.factor(country)Guinea                    5.95e-13 ***
## as.factor(country)Guinea-Bissau             4.67e-13 ***
## as.factor(country)Guyana                    0.118789
## as.factor(country)Haiti                     0.029259 *
## as.factor(country)Honduras                  0.006433 **
```

```
## as.factor(country)Hungary             6.61e-16 ***
## as.factor(country)India               < 2e-16 ***
## as.factor(country)Indonesia           < 2e-16 ***
## as.factor(country)Iraq                < 2e-16 ***
## as.factor(country)Ireland             < 2e-16 ***
## as.factor(country)Israel                   NA
## as.factor(country)Italy               4.73e-08 ***
## as.factor(country)Jamaica             0.088890 .
## as.factor(country)Japan                    NA
## as.factor(country)Jordan              0.591924
## as.factor(country)Kazakhstan          < 2e-16 ***
## as.factor(country)Kenya               0.000378 ***
## as.factor(country)Kosovo              < 2e-16 ***
## as.factor(country)Kuwait              0.763602
## as.factor(country)Latvia              8.39e-11 ***
## as.factor(country)Lebanon             7.92e-09 ***
## as.factor(country)Lesotho             0.880907
## as.factor(country)Liberia             0.127026
## as.factor(country)Libya               < 2e-16 ***
## as.factor(country)Lithuania           1.41e-06 ***
## as.factor(country)Luxembourg          1.69e-06 ***
## as.factor(country)Madagascar          0.026160 *
## as.factor(country)Malawi              0.602265
## as.factor(country)Malaysia            < 2e-16 ***
## as.factor(country)Mali                1.33e-06 ***
## as.factor(country)Mauritania          9.94e-13 ***
## as.factor(country)Mauritius           0.185333
## as.factor(country)Mexico              0.298779
## as.factor(country)Moldova             1.85e-13 ***
## as.factor(country)Montenegro          8.33e-07 ***
## as.factor(country)Morocco             0.107706
## as.factor(country)Mozambique          0.002148 **
## as.factor(country)Namibia             0.781898
## as.factor(country)Nepal                    NA
## as.factor(country)Netherlands         < 2e-16 ***
## as.factor(country)New Zealand         2.50e-05 ***
## as.factor(country)Nicaragua           < 2e-16 ***
## as.factor(country)Niger               7.05e-15 ***
## as.factor(country)Nigeria             6.78e-08 ***
## as.factor(country)Norway              < 2e-16 ***
## as.factor(country)Pakistan            4.98e-08 ***
## as.factor(country)Panama              0.367762
## as.factor(country)Papua New Guinea    0.053343 .
## as.factor(country)Paraguay            0.692689
## as.factor(country)Peru                < 2e-16 ***
## as.factor(country)Philippines         0.422083
## as.factor(country)Poland              3.07e-14 ***
## as.factor(country)Portugal            1.34e-14 ***
## as.factor(country)Qatar               0.067654 .
## as.factor(country)Romania             5.93e-09 ***
## as.factor(country)Rwanda              0.003952 **
## as.factor(country)Saudi Arabia        0.001037 **
## as.factor(country)Senegal             < 2e-16 ***
## as.factor(country)Serbia              2.26e-07 ***
```

```
## as.factor(country)Sierra Leone       1.56e-07 ***
## as.factor(country)Singapore          5.39e-09 ***
## as.factor(country)Slovenia           9.57e-07 ***
## as.factor(country)Solomon Islands     0.001366 **
## as.factor(country)Somalia                  NA
## as.factor(country)South Africa        2.00e-13 ***
## as.factor(country)South Sudan         0.001190 **
## as.factor(country)Spain               0.171628
## as.factor(country)Sri Lanka           0.451587
## as.factor(country)Sudan               0.059963 .
## as.factor(country)Suriname            0.291900
## as.factor(country)Sweden               < 2e-16 ***
## as.factor(country)Switzerland          < 2e-16 ***
## as.factor(country)Tajikistan          5.22e-13 ***
## as.factor(country)Tanzania            0.279740
## as.factor(country)Thailand                 NA
## as.factor(country)Togo                0.120435
## as.factor(country)Trinidad and Tobago 0.014807 *
## as.factor(country)Tunisia                  NA
## as.factor(country)Turkmenistan        1.89e-08 ***
## as.factor(country)Uganda              0.000478 ***
## as.factor(country)Ukraine             0.622149
## as.factor(country)United Kingdom            NA
## as.factor(country)Uruguay                  NA
## as.factor(country)Uzbekistan          1.80e-15 ***
## as.factor(country)Vietnam                  NA
## as.factor(country)Zambia              0.854248
## as.factor(country)Zimbabwe                 NA
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for Negative Binomial(0.8426) family taken to be 1)
##
##     Null deviance: 8289.9  on 2688  degrees of freedom
## Residual deviance: 2847.4  on 2547  degrees of freedom
## AIC: 20198
##
## Number of Fisher Scoring iterations: 1
##
##
##              Theta:  0.8426
##          Std. Err.:  0.0219
##
##  2 x log-likelihood:  -19911.6020
```

One way fixed effect (year)

```
mod3=glm.nb(Incidents~polity2+GDP+Region+Religion+Population+as.factor(year),data=df1)
```

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

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

```
## Warning in glm.nb(Incidents ~ polity2 + GDP + Region + Religion + Population +
```

```
## : alternation limit reached
```

```
summary(mod3)
```

```
##
## Call:
## glm.nb(formula = Incidents ~ polity2 + GDP + Region + Religion +
##     Population + as.factor(year), data = df1, init.theta = 0.4458995044,
##     link = log)
##
## Coefficients:
##                                Estimate Std. Error z value Pr(>|z|)
## (Intercept)                    2.572e+00  3.640e-01   7.065 1.61e-12 ***
## polity2                        6.997e-02  6.056e-03  11.554  < 2e-16 ***
## GDP                            1.734e-13  5.130e-14   3.379 0.000727 ***
## RegionEurope                  -1.084e+00  1.178e-01  -9.203  < 2e-16 ***
## RegionLatin America-Caribbean -9.039e-02  1.177e-01  -0.768 0.442419
## RegionMiddle East-North Africa 4.170e-01  1.414e-01   2.950 0.003181 **
## RegionNorth America           -3.110e+00  3.294e-01  -9.444  < 2e-16 ***
## RegionSub-Saharan Africa      -9.700e-01  1.128e-01  -8.602  < 2e-16 ***
## ReligionChristians            -4.612e-01  1.810e-01  -2.548 0.010826 *
## ReligionFolk Religions        -2.767e+00  7.048e-01  -3.926 8.63e-05 ***
## ReligionHindus                -7.312e-01  2.790e-01  -2.621 0.008775 **
## ReligionJews                  -6.316e-01  3.834e-01  -1.647 0.099508 .
## ReligionMuslims               -3.898e-01  1.786e-01  -2.182 0.029099 *
## ReligionUnaffiliated          -3.447e+00  3.014e-01 -11.435  < 2e-16 ***
## Population                     2.343e-09  2.513e-10   9.323  < 2e-16 ***
## as.factor(year)1971           4.843e-01  4.824e-01   1.004 0.315419
## as.factor(year)1972           9.919e-01  4.449e-01   2.229 0.025783 *
## as.factor(year)1973           8.084e-01  4.349e-01   1.859 0.063077 .
## as.factor(year)1974           7.669e-01  4.291e-01   1.787 0.073922 .
## as.factor(year)1975           1.382e+00  4.333e-01   3.189 0.001426 **
## as.factor(year)1976           1.222e+00  4.172e-01   2.929 0.003403 **
## as.factor(year)1977           1.508e+00  4.191e-01   3.599 0.000319 ***
## as.factor(year)1978           1.724e+00  4.083e-01   4.222 2.42e-05 ***
## as.factor(year)1979           1.805e+00  3.924e-01   4.601 4.21e-06 ***
## as.factor(year)1980           1.844e+00  3.936e-01   4.685 2.80e-06 ***
## as.factor(year)1981           1.779e+00  3.893e-01   4.570 4.88e-06 ***
## as.factor(year)1982           1.855e+00  3.962e-01   4.683 2.83e-06 ***
## as.factor(year)1983           1.907e+00  3.926e-01   4.857 1.19e-06 ***
## as.factor(year)1984           2.006e+00  3.893e-01   5.153 2.57e-07 ***
## as.factor(year)1985           1.821e+00  3.897e-01   4.672 2.99e-06 ***
## as.factor(year)1986           1.668e+00  3.868e-01   4.313 1.61e-05 ***
## as.factor(year)1987           1.747e+00  3.887e-01   4.494 6.98e-06 ***
## as.factor(year)1988           1.791e+00  3.864e-01   4.633 3.60e-06 ***
## as.factor(year)1989           1.713e+00  3.820e-01   4.486 7.27e-06 ***
## as.factor(year)1990           1.910e+00  3.828e-01   4.990 6.05e-07 ***
## as.factor(year)1991           1.423e+00  3.669e-01   3.879 0.000105 ***
## as.factor(year)1992           1.568e+00  3.632e-01   4.317 1.58e-05 ***
## as.factor(year)1994           1.081e+00  3.639e-01   2.971 0.002973 **
## as.factor(year)1995           9.799e-01  3.661e-01   2.677 0.007439 **
## as.factor(year)1996           1.050e+00  3.665e-01   2.866 0.004162 **
## as.factor(year)1997           1.227e+00  3.673e-01   3.342 0.000831 ***
## as.factor(year)1998           4.979e-01  3.909e-01   1.274 0.202796
## as.factor(year)1999           5.845e-01  3.808e-01   1.535 0.124812
```

```
## as.factor(year)2000                   7.297e-01  3.755e-01   1.943 0.051988 .
## as.factor(year)2001                   7.478e-01  3.774e-01   1.981 0.047544 *
## as.factor(year)2002                   5.783e-01  3.888e-01   1.487 0.136954
## as.factor(year)2003                   3.632e-01  3.950e-01   0.919 0.357840
## as.factor(year)2004                   4.058e-01  4.149e-01   0.978 0.328018
## as.factor(year)2005                   4.967e-01  3.995e-01   1.243 0.213727
## as.factor(year)2006                   8.277e-01  3.975e-01   2.082 0.037324 *
## as.factor(year)2007                   6.145e-01  3.885e-01   1.582 0.113713
## as.factor(year)2008                   9.484e-01  3.795e-01   2.499 0.012448 *
## as.factor(year)2009                   8.233e-01  3.816e-01   2.158 0.030943 *
## as.factor(year)2010                   1.262e+00  3.885e-01   3.249 0.001157 **
## as.factor(year)2011                   1.285e+00  3.869e-01   3.322 0.000892 ***
## as.factor(year)2012                   1.721e+00  3.827e-01   4.497 6.90e-06 ***
## as.factor(year)2013                   2.084e+00  3.784e-01   5.508 3.63e-08 ***
## as.factor(year)2014                   2.817e+00  3.758e-01   7.497 6.54e-14 ***
## as.factor(year)2015                   2.636e+00  3.751e-01   7.027 2.11e-12 ***
## as.factor(year)2016                   2.301e+00  3.712e-01   6.200 5.63e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for Negative Binomial(0.4459) family taken to be 1)
##
##     Null deviance: 4514.9  on 2688  degrees of freedom
## Residual deviance: 3246.8  on 2629  degrees of freedom
## AIC: 22247
##
## Number of Fisher Scoring iterations: 1
##
##
##              Theta:  0.4459
##          Std. Err.:  0.0104
## Warning while fitting theta: alternation limit reached
##
##  2 x log-likelihood:  -22125.4280
```

Two way fixed effect

```
mod4=glm.nb(Incidents~polity2+GDP+Region+Religion+Population+as.factor(year)+as.factor(country),data=df
summary(mod4)
```

```
##
## Call:
## glm.nb(formula = Incidents ~ polity2 + GDP + Region + Religion +
##     Population + as.factor(year) + as.factor(country), data = df1,
##     init.theta = 0.9733272518, link = log)
##
## Coefficients: (11 not defined because of singularities)
##                                    Estimate Std. Error z value
## (Intercept)                       3.397e+00  2.877e-01  11.808
## polity2                           2.898e-02  6.245e-03   4.641
## GDP                              -3.219e-13  4.746e-14  -6.783
## RegionEurope                      1.163e+00  6.549e-01   1.776
## RegionLatin America-Caribbean    -1.574e+00  6.890e-01  -2.284
## RegionMiddle East-North Africa   -4.850e+00  5.798e-01  -8.365
```

```
## RegionNorth America               -2.247e+00  6.724e-01  -3.341
## RegionSub-Saharan Africa          -1.929e+00  5.859e-01  -3.293
## ReligionChristians                -7.810e-01  6.494e-01  -1.203
## ReligionFolk Religions            -3.986e+00  5.442e-01  -7.324
## ReligionHindus                    -1.764e-01  2.669e-01  -0.661
## ReligionJews                       4.879e+00  6.416e-01   7.604
## ReligionMuslims                    2.082e+00  5.403e-01   3.853
## ReligionUnaffiliated              -2.145e+00  2.821e-01  -7.604
## Population                         1.005e-08  7.296e-10  13.781
## as.factor(year)1971              -3.495e-01  3.560e-01  -0.982
## as.factor(year)1972              -4.612e-01  3.271e-01  -1.410
## as.factor(year)1973              -3.529e-01  3.192e-01  -1.106
## as.factor(year)1974              -2.053e-01  3.111e-01  -0.660
## as.factor(year)1975              -2.113e-01  3.115e-01  -0.678
## as.factor(year)1976               3.257e-01  2.987e-01   1.090
## as.factor(year)1977               4.095e-01  2.982e-01   1.373
## as.factor(year)1978               5.159e-01  2.911e-01   1.772
## as.factor(year)1979               6.337e-01  2.810e-01   2.255
## as.factor(year)1980               7.310e-01  2.804e-01   2.607
## as.factor(year)1981               6.515e-01  2.782e-01   2.342
## as.factor(year)1982               6.164e-01  2.823e-01   2.183
## as.factor(year)1983               7.795e-01  2.797e-01   2.787
## as.factor(year)1984               8.744e-01  2.770e-01   3.157
## as.factor(year)1985               7.626e-01  2.781e-01   2.742
## as.factor(year)1986               6.693e-01  2.767e-01   2.419
## as.factor(year)1987               9.334e-01  2.781e-01   3.357
## as.factor(year)1988               8.586e-01  2.761e-01   3.110
## as.factor(year)1989               9.390e-01  2.729e-01   3.441
## as.factor(year)1990               1.002e+00  2.732e-01   3.668
## as.factor(year)1991               7.628e-01  2.638e-01   2.892
## as.factor(year)1992               1.115e+00  2.613e-01   4.267
## as.factor(year)1994               6.191e-01  2.628e-01   2.356
## as.factor(year)1995               6.486e-01  2.642e-01   2.456
## as.factor(year)1996               7.235e-01  2.647e-01   2.733
## as.factor(year)1997               7.931e-01  2.650e-01   2.993
## as.factor(year)1998              -2.366e-01  2.837e-01  -0.834
## as.factor(year)1999              -2.032e-01  2.770e-01  -0.734
## as.factor(year)2000               1.750e-01  2.728e-01   0.641
## as.factor(year)2001               8.696e-02  2.750e-01   0.316
## as.factor(year)2002              -1.778e-01  2.835e-01  -0.627
## as.factor(year)2003              -3.217e-01  2.872e-01  -1.120
## as.factor(year)2004              -5.308e-01  3.018e-01  -1.759
## as.factor(year)2005              -2.950e-01  2.912e-01  -1.013
## as.factor(year)2006               5.019e-02  2.899e-01   0.173
## as.factor(year)2007              -8.905e-02  2.843e-01  -0.313
## as.factor(year)2008               4.418e-01  2.772e-01   1.594
## as.factor(year)2009               5.741e-02  2.795e-01   0.205
## as.factor(year)2010               7.596e-02  2.843e-01   0.267
## as.factor(year)2011               1.782e-01  2.841e-01   0.627
## as.factor(year)2012               5.487e-01  2.786e-01   1.969
## as.factor(year)2013               1.040e+00  2.751e-01   3.781
## as.factor(year)2014               1.521e+00  2.727e-01   5.579
## as.factor(year)2015               1.585e+00  2.724e-01   5.818
## as.factor(year)2016               1.167e+00  2.698e-01   4.326
```

```
## as.factor(country)Albania                   -5.832e+00  4.905e-01 -11.891
## as.factor(country)Algeria                    3.409e+00  3.301e-01  10.325
## as.factor(country)Angola                     1.762e+00  3.104e-01   5.675
## as.factor(country)Argentina                  1.323e+00  3.249e-01   4.070
## as.factor(country)Armenia                   -2.731e+00  7.142e-01  -3.823
## as.factor(country)Australia                 -2.289e+00  6.694e-01  -3.419
## as.factor(country)Austria                   -3.404e+00  2.612e-01 -13.028
## as.factor(country)Azerbaijan                -4.847e+00  6.019e-01  -8.053
## as.factor(country)Bahrain                    1.157e+00  3.857e-01   3.000
## as.factor(country)Bangladesh                -3.974e+00  5.458e-01  -7.282
## as.factor(country)Belarus                   -3.644e+00  4.865e-01  -7.491
## as.factor(country)Belgium                   -3.136e+00  2.543e-01 -12.334
## as.factor(country)Benin                     -1.063e+00  6.224e-01  -1.707
## as.factor(country)Bhutan                    -3.530e+00  6.762e-01  -5.220
## as.factor(country)Bolivia                    4.222e-01  3.414e-01   1.237
## as.factor(country)Botswana                  -1.271e+00  5.540e-01  -2.294
## as.factor(country)Brazil                    -1.087e+00  3.471e-01  -3.133
## as.factor(country)Bulgaria                  -3.789e+00  3.150e-01 -12.029
## as.factor(country)Burkina Faso              -3.570e+00  5.932e-01  -6.019
## as.factor(country)Burundi                    1.888e+00  3.106e-01   6.078
## as.factor(country)Cambodia                  -1.399e+00  3.323e-01  -4.211
## as.factor(country)Cameroon                   8.345e-01  3.671e-01   2.273
## as.factor(country)Canada                           NA         NA        NA
## as.factor(country)Central African Republic  7.088e-01  3.362e-01   2.108
## as.factor(country)Chad                      -2.768e+00  3.808e-01  -7.269
## as.factor(country)Chile                      2.201e+00  3.232e-01   6.810
## as.factor(country)China                     -1.094e+01  8.822e-01 -12.407
## as.factor(country)Colombia                   3.029e+00  3.168e-01   9.559
## as.factor(country)Comoros                   -3.985e+00  7.924e-01  -5.029
## as.factor(country)Costa Rica                -8.532e-01  3.718e-01  -2.295
## as.factor(country)Croatia                   -3.425e+00  4.395e-01  -7.792
## as.factor(country)Cuba                      -4.541e-02  5.443e-01  -0.083
## as.factor(country)Cyprus                    -2.216e+00  6.654e-01  -3.331
## as.factor(country)Denmark                   -4.011e+00  3.317e-01 -12.095
## as.factor(country)Djibouti                  -3.702e+00  4.788e-01  -7.730
## as.factor(country)Dominican Republic        -3.391e-01  3.796e-01  -0.893
## as.factor(country)Ecuador                   -1.547e-01  3.320e-01  -0.466
## as.factor(country)El Salvador                3.459e+00  3.446e-01  10.037
## as.factor(country)Equatorial Guinea         -1.088e+00  1.036e+00  -1.051
## as.factor(country)Eritrea                   -4.532e-01  5.500e-01  -0.824
## as.factor(country)Estonia                   -2.913e+00  9.103e-01  -3.201
## as.factor(country)Ethiopia                  -3.991e-01  3.069e-01  -1.300
## as.factor(country)Fiji                      -2.321e+00  7.752e-01  -2.993
## as.factor(country)Finland                   -4.252e+00  4.795e-01  -8.867
## as.factor(country)France                    -6.983e-01  2.157e-01  -3.237
## as.factor(country)Gabon                     -1.236e+00  7.498e-01  -1.649
## as.factor(country)Georgia                   -2.091e+00  2.825e-01  -7.403
## as.factor(country)Germany                   -1.463e+00  2.641e-01  -5.540
## as.factor(country)Ghana                     -9.306e-01  4.823e-01  -1.930
## as.factor(country)Greece                    -1.246e+00  2.236e-01  -5.573
## as.factor(country)Guatemala                  2.404e+00  3.308e-01   7.268
## as.factor(country)Guinea                    -3.080e+00  4.982e-01  -6.182
## as.factor(country)Guinea-Bissau             -3.230e+00  6.030e-01  -5.357
## as.factor(country)Guyana                    -9.999e-01  4.400e-01  -2.273
```

```
## as.factor(country)Haiti                4.964e-01  3.591e-01   1.382
## as.factor(country)Honduras             5.426e-01  3.465e-01   1.566
## as.factor(country)Hungary             -3.509e+00  3.718e-01  -9.438
## as.factor(country)India               -8.299e+00  7.468e-01 -11.113
## as.factor(country)Indonesia           -4.865e+00  5.605e-01  -8.681
## as.factor(country)Iraq                 4.401e+00  3.322e-01  13.250
## as.factor(country)Ireland             -2.756e+00  2.385e-01 -11.556
## as.factor(country)Israel                      NA         NA        NA
## as.factor(country)Italy               -1.374e+00  2.157e-01  -6.369
## as.factor(country)Jamaica             -1.129e+00  4.269e-01  -2.645
## as.factor(country)Japan                       NA         NA        NA
## as.factor(country)Jordan               2.201e-01  3.438e-01   0.640
## as.factor(country)Kazakhstan          -5.103e+00  6.378e-01  -8.001
## as.factor(country)Kenya                9.987e-01  3.029e-01   3.297
## as.factor(country)Kosovo              -6.206e+00  5.554e-01 -11.172
## as.factor(country)Kuwait               1.028e-01  3.638e-01   0.283
## as.factor(country)Latvia              -3.455e+00  5.321e-01  -6.493
## as.factor(country)Lebanon              2.406e+00  3.885e-01   6.193
## as.factor(country)Lesotho             -2.048e-01  4.346e-01  -0.471
## as.factor(country)Liberia             -3.934e-01  5.237e-01  -0.751
## as.factor(country)Libya                3.233e+00  4.113e-01   7.860
## as.factor(country)Lithuania           -4.123e+00  7.348e-01  -5.612
## as.factor(country)Luxembourg          -3.411e+00  5.930e-01  -5.751
## as.factor(country)Madagascar          -9.148e-01  4.118e-01  -2.221
## as.factor(country)Malawi              -6.224e-01  9.289e-01  -0.670
## as.factor(country)Malaysia            -5.043e+00  5.738e-01  -8.789
## as.factor(country)Mali                -1.738e+00  3.847e-01  -4.518
## as.factor(country)Mauritania          -2.798e+00  5.215e-01  -5.365
## as.factor(country)Mauritius           -2.490e+00  1.188e+00  -2.097
## as.factor(country)Mexico               1.274e-01  3.268e-01   0.390
## as.factor(country)Moldova             -4.418e+00  5.528e-01  -7.992
## as.factor(country)Montenegro          -4.610e+00  7.984e-01  -5.774
## as.factor(country)Morocco             -2.489e-01  4.064e-01  -0.612
## as.factor(country)Mozambique           8.337e-01  3.812e-01   2.187
## as.factor(country)Namibia              5.660e-01  5.042e-01   1.123
## as.factor(country)Nepal                       NA         NA        NA
## as.factor(country)Netherlands         -3.475e+00  2.446e-01 -14.209
## as.factor(country)New Zealand         -2.890e+00  7.286e-01  -3.966
## as.factor(country)Nicaragua            2.547e+00  3.442e-01   7.398
## as.factor(country)Niger               -2.676e+00  3.830e-01  -6.987
## as.factor(country)Nigeria              1.588e+00  3.093e-01   5.133
## as.factor(country)Norway              -4.116e+00  4.132e-01  -9.961
## as.factor(country)Pakistan            -2.291e+00  5.438e-01  -4.214
## as.factor(country)Panama              -1.853e-01  3.670e-01  -0.505
## as.factor(country)Papua New Guinea    -1.495e+00  7.174e-01  -2.085
## as.factor(country)Paraguay            -4.453e-01  3.827e-01  -1.164
## as.factor(country)Peru                 2.792e+00  3.215e-01   8.686
## as.factor(country)Philippines          6.571e-01  6.476e-01   1.015
## as.factor(country)Poland              -3.738e+00  4.182e-01  -8.937
## as.factor(country)Portugal            -2.700e+00  2.978e-01  -9.066
## as.factor(country)Qatar               -8.764e-01  6.074e-01  -1.443
## as.factor(country)Romania             -4.894e+00  7.339e-01  -6.668
## as.factor(country)Rwanda               9.803e-01  3.414e-01   2.871
## as.factor(country)Saudi Arabia         1.181e+00  3.488e-01   3.387
```

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```
## as.factor(country)Senegal            -2.671e+00  3.706e-01  -7.207
## as.factor(country)Serbia             -3.367e+00  6.221e-01  -5.412
## as.factor(country)Sierra Leone       -1.615e+00  4.416e-01  -3.657
## as.factor(country)Singapore          -3.831e+00  5.909e-01  -6.483
## as.factor(country)Slovenia           -4.169e+00  7.638e-01  -5.458
## as.factor(country)Solomon Islands    -2.629e+00  1.037e+00  -2.535
## as.factor(country)Somalia                    NA         NA         NA
## as.factor(country)South Africa        2.106e+00  2.936e-01   7.173
## as.factor(country)South Sudan         1.134e+00  5.694e-01   1.992
## as.factor(country)Spain              -4.356e-01  2.178e-01  -2.001
## as.factor(country)Sri Lanka           1.856e-01  2.366e-01   0.784
## as.factor(country)Sudan               1.306e+00  3.389e-01   3.854
## as.factor(country)Suriname           -1.933e-01  4.253e-01  -0.454
## as.factor(country)Sweden             -3.364e+00  2.765e-01 -12.165
## as.factor(country)Switzerland        -3.400e+00  2.910e-01 -11.684
## as.factor(country)Tajikistan         -3.578e+00  5.743e-01  -6.230
## as.factor(country)Tanzania           -6.204e-01  3.949e-01  -1.571
## as.factor(country)Thailand                   NA         NA         NA
## as.factor(country)Togo                4.888e-01  4.760e-01   1.027
## as.factor(country)Trinidad and Tobago -1.499e+00 4.429e-01  -3.385
## as.factor(country)Tunisia                    NA         NA         NA
## as.factor(country)Turkmenistan       -5.943e+00  1.133e+00  -5.246
## as.factor(country)Uganda              1.336e+00  2.924e-01   4.569
## as.factor(country)Ukraine            -1.350e+00  2.881e-01  -4.686
## as.factor(country)United Kingdom             NA         NA         NA
## as.factor(country)Uruguay                    NA         NA         NA
## as.factor(country)Uzbekistan         -4.336e+00  6.720e-01  -6.452
## as.factor(country)Vietnam                    NA         NA         NA
## as.factor(country)Zambia              1.071e-01  3.574e-01   0.300
## as.factor(country)Zimbabwe                   NA         NA         NA
##                                      Pr(>|z|)
## (Intercept)                           < 2e-16 ***
## polity2                              3.46e-06 ***
## GDP                                  1.18e-11 ***
## RegionEurope                         0.075653 .
## RegionLatin America-Caribbean        0.022373 *
## RegionMiddle East-North Africa        < 2e-16 ***
## RegionNorth America                  0.000835 ***
## RegionSub-Saharan Africa             0.000991 ***
## ReligionChristians                   0.229094
## ReligionFolk Religions               2.41e-13 ***
## ReligionHindus                       0.508601
## ReligionJews                         2.87e-14 ***
## ReligionMuslims                      0.000117 ***
## ReligionUnaffiliated                 2.87e-14 ***
## Population                            < 2e-16 ***
## as.factor(year)1971                  0.326186
## as.factor(year)1972                  0.158557
## as.factor(year)1973                  0.268813
## as.factor(year)1974                  0.509311
## as.factor(year)1975                  0.497623
## as.factor(year)1976                  0.275534
## as.factor(year)1977                  0.169672
## as.factor(year)1978                  0.076334 .
```

```
## as.factor(year)1979                    0.024102 *
## as.factor(year)1980                    0.009141 **
## as.factor(year)1981                    0.019186 *
## as.factor(year)1982                    0.029034 *
## as.factor(year)1983                    0.005324 **
## as.factor(year)1984                    0.001594 **
## as.factor(year)1985                    0.006106 **
## as.factor(year)1986                    0.015569 *
## as.factor(year)1987                    0.000788 ***
## as.factor(year)1988                    0.001874 **
## as.factor(year)1989                    0.000579 ***
## as.factor(year)1990                    0.000244 ***
## as.factor(year)1991                    0.003826 **
## as.factor(year)1992                    1.98e-05 ***
## as.factor(year)1994                    0.018492 *
## as.factor(year)1995                    0.014069 *
## as.factor(year)1996                    0.006277 **
## as.factor(year)1997                    0.002764 **
## as.factor(year)1998                    0.404387
## as.factor(year)1999                    0.463174
## as.factor(year)2000                    0.521375
## as.factor(year)2001                    0.751812
## as.factor(year)2002                    0.530484
## as.factor(year)2003                    0.262708
## as.factor(year)2004                    0.078604 .
## as.factor(year)2005                    0.311004
## as.factor(year)2006                    0.862571
## as.factor(year)2007                    0.754110
## as.factor(year)2008                    0.110973
## as.factor(year)2009                    0.837247
## as.factor(year)2010                    0.789339
## as.factor(year)2011                    0.530459
## as.factor(year)2012                    0.048922 *
## as.factor(year)2013                    0.000156 ***
## as.factor(year)2014                    2.41e-08 ***
## as.factor(year)2015                    5.96e-09 ***
## as.factor(year)2016                    1.52e-05 ***
## as.factor(country)Albania               < 2e-16 ***
## as.factor(country)Algeria               < 2e-16 ***
## as.factor(country)Angola               1.38e-08 ***
## as.factor(country)Argentina            4.70e-05 ***
## as.factor(country)Armenia              0.000132 ***
## as.factor(country)Australia            0.000628 ***
## as.factor(country)Austria               < 2e-16 ***
## as.factor(country)Azerbaijan           8.09e-16 ***
## as.factor(country)Bahrain              0.002697 **
## as.factor(country)Bangladesh           3.29e-13 ***
## as.factor(country)Belarus              6.82e-14 ***
## as.factor(country)Belgium               < 2e-16 ***
## as.factor(country)Benin                0.087741 .
## as.factor(country)Bhutan               1.79e-07 ***
## as.factor(country)Bolivia              0.216197
## as.factor(country)Botswana             0.021799 *
## as.factor(country)Brazil               0.001733 **
```

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```
## as.factor(country)Bulgaria                   < 2e-16 ***
## as.factor(country)Burkina Faso              1.75e-09 ***
## as.factor(country)Burundi                   1.21e-09 ***
## as.factor(country)Cambodia                  2.54e-05 ***
## as.factor(country)Cameroon                  0.023007 *
## as.factor(country)Canada                          NA
## as.factor(country)Central African Republic 0.035035 *
## as.factor(country)Chad                      3.62e-13 ***
## as.factor(country)Chile                     9.78e-12 ***
## as.factor(country)China                      < 2e-16 ***
## as.factor(country)Colombia                   < 2e-16 ***
## as.factor(country)Comoros                   4.93e-07 ***
## as.factor(country)Costa Rica                0.021723 *
## as.factor(country)Croatia                   6.58e-15 ***
## as.factor(country)Cuba                      0.933512
## as.factor(country)Cyprus                    0.000866 ***
## as.factor(country)Denmark                    < 2e-16 ***
## as.factor(country)Djibouti                  1.07e-14 ***
## as.factor(country)Dominican Republic        0.371680
## as.factor(country)Ecuador                   0.641316
## as.factor(country)El Salvador                < 2e-16 ***
## as.factor(country)Equatorial Guinea         0.293475
## as.factor(country)Eritrea                   0.409971
## as.factor(country)Estonia                   0.001372 **
## as.factor(country)Ethiopia                  0.193541
## as.factor(country)Fiji                      0.002758 **
## as.factor(country)Finland                    < 2e-16 ***
## as.factor(country)France                    0.001207 **
## as.factor(country)Gabon                     0.099249 .
## as.factor(country)Georgia                   1.34e-13 ***
## as.factor(country)Germany                   3.02e-08 ***
## as.factor(country)Ghana                     0.053642 .
## as.factor(country)Greece                    2.51e-08 ***
## as.factor(country)Guatemala                 3.66e-13 ***
## as.factor(country)Guinea                    6.34e-10 ***
## as.factor(country)Guinea-Bissau             8.46e-08 ***
## as.factor(country)Guyana                    0.023046 *
## as.factor(country)Haiti                     0.166910
## as.factor(country)Honduras                  0.117398
## as.factor(country)Hungary                    < 2e-16 ***
## as.factor(country)India                      < 2e-16 ***
## as.factor(country)Indonesia                  < 2e-16 ***
## as.factor(country)Iraq                       < 2e-16 ***
## as.factor(country)Ireland                    < 2e-16 ***
## as.factor(country)Israel                          NA
## as.factor(country)Italy                     1.91e-10 ***
## as.factor(country)Jamaica                   0.008160 **
## as.factor(country)Japan                            NA
## as.factor(country)Jordan                    0.521999
## as.factor(country)Kazakhstan                1.23e-15 ***
## as.factor(country)Kenya                     0.000977 ***
## as.factor(country)Kosovo                     < 2e-16 ***
## as.factor(country)Kuwait                    0.777440
## as.factor(country)Latvia                    8.43e-11 ***
```

```
## as.factor(country)Lebanon             5.90e-10 ***
## as.factor(country)Lesotho             0.637514
## as.factor(country)Liberia             0.452493
## as.factor(country)Libya               3.84e-15 ***
## as.factor(country)Lithuania           2.00e-08 ***
## as.factor(country)Luxembourg          8.85e-09 ***
## as.factor(country)Madagascar          0.026327 *
## as.factor(country)Malawi              0.502856
## as.factor(country)Malaysia             < 2e-16 ***
## as.factor(country)Mali                6.24e-06 ***
## as.factor(country)Mauritania          8.11e-08 ***
## as.factor(country)Mauritius           0.036036 *
## as.factor(country)Mexico              0.696555
## as.factor(country)Moldova             1.33e-15 ***
## as.factor(country)Montenegro          7.72e-09 ***
## as.factor(country)Morocco             0.540252
## as.factor(country)Mozambique          0.028752 *
## as.factor(country)Namibia             0.261613
## as.factor(country)Nepal                     NA
## as.factor(country)Netherlands          < 2e-16 ***
## as.factor(country)New Zealand         7.31e-05 ***
## as.factor(country)Nicaragua           1.38e-13 ***
## as.factor(country)Niger               2.80e-12 ***
## as.factor(country)Nigeria             2.85e-07 ***
## as.factor(country)Norway               < 2e-16 ***
## as.factor(country)Pakistan            2.51e-05 ***
## as.factor(country)Panama              0.613588
## as.factor(country)Papua New Guinea    0.037093 *
## as.factor(country)Paraguay            0.244507
## as.factor(country)Peru                 < 2e-16 ***
## as.factor(country)Philippines         0.310304
## as.factor(country)Poland               < 2e-16 ***
## as.factor(country)Portugal             < 2e-16 ***
## as.factor(country)Qatar               0.149052
## as.factor(country)Romania             2.59e-11 ***
## as.factor(country)Rwanda              0.004089 **
## as.factor(country)Saudi Arabia        0.000708 ***
## as.factor(country)Senegal             5.71e-13 ***
## as.factor(country)Serbia              6.22e-08 ***
## as.factor(country)Sierra Leone        0.000255 ***
## as.factor(country)Singapore           8.97e-11 ***
## as.factor(country)Slovenia            4.80e-08 ***
## as.factor(country)Solomon Islands     0.011255 *
## as.factor(country)Somalia                   NA
## as.factor(country)South Africa        7.33e-13 ***
## as.factor(country)South Sudan         0.046341 *
## as.factor(country)Spain               0.045442 *
## as.factor(country)Sri Lanka           0.432856
## as.factor(country)Sudan               0.000116 ***
## as.factor(country)Suriname            0.649566
## as.factor(country)Sweden               < 2e-16 ***
## as.factor(country)Switzerland          < 2e-16 ***
## as.factor(country)Tajikistan          4.66e-10 ***
## as.factor(country)Tanzania            0.116172
```

```
## as.factor(country)Thailand                          NA
## as.factor(country)Togo                         0.304424
## as.factor(country)Trinidad and Tobago          0.000712 ***
## as.factor(country)Tunisia                             NA
## as.factor(country)Turkmenistan                 1.55e-07 ***
## as.factor(country)Uganda                       4.89e-06 ***
## as.factor(country)Ukraine                      2.79e-06 ***
## as.factor(country)United Kingdom                     NA
## as.factor(country)Uruguay                            NA
## as.factor(country)Uzbekistan                   1.10e-10 ***
## as.factor(country)Vietnam                            NA
## as.factor(country)Zambia                       0.764421
## as.factor(country)Zimbabwe                           NA
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for Negative Binomial(0.9733) family taken to be 1)
##
##     Null deviance: 9492.4  on 2688  degrees of freedom
## Residual deviance: 2780.7  on 2502  degrees of freedom
## AIC: 19854
##
## Number of Fisher Scoring iterations: 1
##
##
##               Theta:  0.9733
##           Std. Err.:  0.0261
##
##  2 x log-likelihood:  -19477.8100
```

#RANDOM EFFECT

```
#glmer.nb(Incidents~polity2+GDP+Region+Religion+Population+(1|country), data=df1)
#summary(mod5)
#The aim was to implement a random mixed effect model and compare it with fixed effect models using Hau
```