

From Cambodia to the Soviet Union: What Factors Influence the Probability of Death for Members of Authoritarian Regimes?

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Introduction

(Leo)

Model Specification

In this section, we give a short overview on how the model was constructed, as well as brief justifications as to why some variables are included. The variable selection is based on variables of interest, rather than trying to maximize the predictive power of the model. The dummy for the country in which the regime is, or was, located. There might be cultural reasons why countries in Latin America or Asia might differ from countries in Europe. Furthermore, the duration of the regime is included, as it might be the case that regimes that have been in power for longer have an increasing effect on the probability of death for its members, simply due to being longer in power giving more chances to die, either natural or not. Related to this, the demeaned end year of the regime is included, as the possibility of time trends seems plausible. E.g. when regimes were overturned 100 years ago, the population might have been less averse to peaceful transitions. An earlier version of this model included the start year, however, the variance inflation factor (VIF) on the coefficient was relatively large, compared to the others, so it was excluded from the model. End-of-regime two-year average GDP growth is included, as a worse economic situation might lead to a more desperate population, which in turn might lead to increased propensity of a more violent approach to overturning the current regime. Lastly, all other variables are included simply out of interest, not due to an assumption on the sign and size of the partial correlations with the outcome variable.

Results and Interpretation

(Michaela)

- insignificant coefficient on economists due to only 3% of the sample being economists, and approx. 10% are military members. Economists appear to have a *clearer* effect compared to military, but still neither effect is significant
- 2Y growth, tenure, regime end (deviation from the mean end-year) seem like the largest drivers, all three have larger variations (not binary variables)
- $\Pr(\text{death}_{Hitler} = 1 \mid \mathbf{x}_{Hitler}) = 11.76\%$, so if we observe an infinite amount of Hitlers across identical universes, then only 11.76% of them would be predicted to die during/at the end of their regimes (maybe keep this part for the presentation rather than the handout)
- $\Pr(\text{death}_{Goebbels} = 1 \mid \mathbf{x}_{Goebbels}) = 10.86\%$
- still need to find 2-3 suitable candidates for calculating the predicted probabilities (maybe Pol Pot?)

(Katrin and Dominik)

Table 1: Logistic Regression Results

<i>Dependent variable:</i>		<i>Dependent variable:</i>	
Death Dummy		Death Dummy	
Europe Dummy	−1.060 (0.575)	Regime Duration	−0.002 (0.012)
Female Dummy	−15.560 (723.003)	Age at Regime Start	0.010 (0.014)
Tenure in Regime	0.035 (0.014)	2Y GDP Growth ¹	−0.206 (0.055)
Economist Dummy	−0.433 (0.756)	Military Dummy	−0.157 (0.467)
Regime End	0.057 (0.021)	Constant	−2.073 (0.842)
Observations	721	Log Likelihood	−245.020
McFadden R ²	0.091		

Note: Standard errors of coefficients in round brackets.

¹Two-year GDP growth measured in the last two years of the respective regimes.

Model Diagnostics and Issues

Correlation between the variables leads to inflated standard errors on the respective coefficients, this multiplicative term on the standard errors is the VIF, where the standard errors are now defined by

$$\sigma_{\beta_i}^2 = n^{-1} \left[\frac{1}{1 - \rho_{\mathbf{X}_i, \mathbf{X}_j}^2} \right] \frac{\sigma_\epsilon^2}{\sigma_{\mathbf{X}_i}^2}.$$

None of the coefficients exhibit a VIF value that seems to lead to any larger concerns, using a critical value of 10 on the determination for problematic imperfect multicollinearity. However, any factor larger than one may be an issue in weak models, such as is the case here. As is denoted in Table 1, the McFadden R² is 0.091, so the model appears to have some explanatory power. To put this in further context, the hit-rate of the model, using a cutoff value of 0.5, is 88.07%, compared to a hit-rate of 87.66% when simply guessing the most likely outcome of not dying. One issue with such a model is, per definition, that external validity is not given, as we pre-select for being part of an authoritarian regime. Furthermore, the inclusion of variables specific for the regime, such as the duration, don't allow for out-of-sample validation methods, only allowing for validation and calibration based on random sub-samples of this particular dataset.

Conclusion

The model cannot capture a lot of the country-specific and time-specific factors which drive the unobserved dependent variable, at least given the data available. Thus, we are somewhat limited in the conclusions we are able to draw from this model. However, within this model, the first of three main drivers of the variation of the death probability, the economic growth rates immediately before the regime falls, which negatively influences the unobserved outcome variable. Secondly, the year in which the regime fell, which has a positive sign on the coefficient, and lastly the tenure of the individual member in their respective regime, which also has a positive coefficient.

Project Code

```
# clear workspace
rm(list = ls())

# load needed libraries
library(readr)
library(pscl)
library(car)
library(pROC)
library(stargazer)

# read dataset
data <- read_csv("C:/Users/samue/Downloads/Studium/Economics (Master - Vienna)/1. Semester/Microeconomics/ELITE.csv")

# check if import worked
head(data)
```

```
## # A tibble: 6 x 22
##   COWCODE STATE REG_START REG_END REG_PARTY REG_REINST ELITE_NAME ELITE_PARTY
##   <dbl> <chr> <chr>      <chr>  <chr>      <chr>      <chr>      <chr>
## 1    255 Germ~ 30/1/1933 23/5/1~ National~ Cabinet   Backe, He~ NSDAP
## 2    255 Germ~ 30/1/1933 23/5/1~ National~ Cabinet   Blomberg,~ Independent
## 3    255 Germ~ 30/1/1933 23/5/1~ National~ Cabinet   Bormann, ~ NSDAP
## 4    255 Germ~ 30/1/1933 23/5/1~ National~ Cabinet   Darré, Ri~ NSDAP
## 5    255 Germ~ 30/1/1933 23/5/1~ National~ Cabinet   Dönitz, K~ NSDAP
## 6    255 Germ~ 30/1/1933 23/5/1~ National~ Cabinet   Dorpmülle~ NSDAP
## # ... with 14 more variables: ELITE_BIRTHDATE <chr>, ELITE_DEATHDATE <chr>,
## #   ELITE_FEMALE <dbl>, ELITE_REENTER <chr>, ELITE_REEXIT <chr>,
## #   ELITE_ENTERAGE <chr>, ELITE_EXITAGE <chr>, ELITE_RETENURE <chr>,
## #   ELITE_EXITTYPE <chr>, ELITE_EXITFATE <chr>, ELITE_EXITLEADER <chr>,
## #   ELITE_REPOSITION <chr>, ELITE_OCCUPATION <chr>, EC_GR_2Y <dbl>
```

```
head(data$ELITE_NAME)
```

```
## [1] "Backe, Herbert"          "Blomberg, Werner von"
## [3] "Bormann, Martin"         "Darré, Richard Walther"
## [5] "Dönitz, Karl"            "Dorpmüller, Julius Heinrich"
```

```
table(data$ELITE_EXITFATE)
```

```
##
##           .      Execution      Exile  Incarcerated  Incarceration
##           19           13           4             1             23
##           N/A No punishment No Punishment           OK
##           6             2           480           10
```

```
table(data$ELITE_EXITTYPE)
```

```
##
##           Assassination      Death
##           1             67
##           Death- natural      Death - accidental
##           1             1
##           Death - Assassination Death - Automobile accident
##           1             1
```

```
##           Death - combat           Death - natural
##           1                   2
##           Death - Natural           Death - suicide
##           8                   4
##           Demotion                   Execution
##           253                   2
##           Expulsion                   Regime Change
##           87                   178
##           Resignation   Ruling Institution Change
##           185                   10
```

```
# create dummy for death during regime or at end
dim(data); n <- dim(data)[1]
```

```
## [1] 827  22
```

```
death1 <- rep(1,n)
```

```
# dummy for first type of death
```

```
for(i in 1:n){
  death1[i] <- ifelse(data$ELITE_EXITTYPE[i] != 'Demotion'
    && data$ELITE_EXITTYPE[i] != 'Expulsion'
    && data$ELITE_EXITTYPE[i] != 'Death- natural'
    && data$ELITE_EXITTYPE[i] != 'Regime Change'
    && data$ELITE_EXITTYPE[i] != 'Resignation',1,0)}
table(death1)
```

```
## death1
```

```
##    0    1
```

```
## 704  98
```

```
# dummy for second type of death
```

```
death2 <- rep(1,n)
for(i in 1:n){
  death2[i] <- ifelse(data$ELITE_EXITFATE[i] == 'Execution',1,0)
}
table(death2)
```

```
## death2
```

```
##    0    1
```

```
## 545  13
```

```
# merge dummies
```

```
a <- which(death2==1)
```

```
b <- which(death1==1)
```

```
c <- c(a,b)
```

```
death <- rep(0,n)
```

```
death[c] <- 1
```

```
table(death)
```

```
## death
```

```
##    0    1
```

```
## 716 111
```

```
# dummy for country being in europe
```

```
EUROPE <- rep(0,n)
```

```
for(i in 1:n){
```

```
  EUROPE[i] <- ifelse(data$STATE[i] == 'Germany' || data$STATE[i] == 'Poland'
```

```

|| data$STATE[i] == 'East Germany' || data$STATE[i] == 'Hungary'
|| data$STATE[i] == 'Norway' || data$STATE[i] == 'Romania'
|| data$STATE[i] == 'Soviet Union',1,0)
}
table(EUROPE)

## EUROPE
##    0    1
## 209 618

# dummy for military as occupation outside of regime
MIL <- rep(0,n)
for(i in 1:n){
  MIL[i] <- ifelse(data$ELITE_OCCUPATION[i] == 'Soldier'
|| data$ELITE_OCCUPATION[i] == 'State Security'
|| data$ELITE_OCCUPATION[i] == 'Army officer'
|| data$ELITE_OCCUPATION[i] == 'Naval officer'
|| data$ELITE_OCCUPATION[i] == 'Military Police officer'
|| data$ELITE_OCCUPATION[i] == 'Police officer'
|| data$ELITE_OCCUPATION[i] == 'Air Force Officer'
|| data$ELITE_OCCUPATION[i] == 'Air Force officer',1,0)
}
table(MIL)

## MIL
##    0    1
## 714  95

# dummy for economists
ECON <- rep(0,n)
for(i in 1:n){
  ECON[i] <- ifelse(data$ELITE_OCCUPATION[i] == 'Economist'
|| data$ELITE_OCCUPATION[i] == 'economist',1,0)
}
table(ECON)

## ECON
##    0    1
## 784  25

# create function to extract date from string
substrRight <- function(x, n){
  substr(x, nchar(x)-n+1, nchar(x))
}

# get regime end year
END <- data$REG_END
END <- substrRight(END, 4)
END <- as.numeric(END)
table(END)

## END
## 1945 1949 1958 1966 1968 1973 1977 1979 1983 1989 1990 1991 2011 2019
##   71   10    5    4    9    5   12   10   22  223  176  160    4    6

# get regime start year
START <- as.numeric(substrRight(data$REG_START, 4))

```

```

table(START)

## START
## 1922 1933 1942 1944 1945 1947 1948 1949 1955 1957 1963 1966 1969 1971 1973 1975
## 160 51 20 106 117 95 10 129 9 5 4 5 12 16 12 44
## 1976 1979 1992 2010
## 13 9 6 4

# take care of regimes that have not ended
END <- ifelse(is.na(END),2020,END)
table(END)

## END
## 1945 1949 1958 1966 1968 1973 1977 1979 1983 1989 1990 1991 2011 2019 2020
## 71 10 5 4 9 5 12 10 22 223 176 160 4 6 110

# variable for regime duration
DURATION <- END-START
table(DURATION)

## DURATION
## 1 3 4 7 8 12 13 17 27 41 43 44 45 49 69 71
## 19 24 19 18 12 51 9 12 6 69 95 117 140 16 160 60

# standardize regime start year
mean(START)

## [1] 1945.261
START <- START-mean(START)

mean(END)

## [1] 1988.707
END <- END - mean(END)

#View(data)

# make data numeric for the model
death <- as.numeric(death)
ELITE_FEMALE <- as.numeric(data$ELITE_FEMALE)
ELITE_ENTERAGE <- as.numeric(data$ELITE_ENTERAGE)
ELITE_RETENURE <- as.numeric(data$ELITE_RETENURE)
EC_GR_2Y <- as.numeric(data$EC_GR_2Y)

# create dataset only based on relevant variables
data0 <- cbind(data$ELITE_NAME,death,EUROPE,START,DURATION,ELITE_FEMALE,
               ELITE_ENTERAGE,ELITE_RETENURE,EC_GR_2Y,ECON,MIL,END)
data <- cbind(death,EUROPE,START,DURATION,ELITE_FEMALE,ELITE_ENTERAGE,
               ELITE_RETENURE,EC_GR_2Y,ECON,MIL,END)

# get vectors for specific people:
hitler <- c(1,data[21,-c(1,3)])
# check if person is correct
data0[21,8] == data[21,7]

```

```

## ELITE_RETENURE
## TRUE
goebbles <- c(1,data[13,-c(1,3)])

# check dimension for later calculations
length(hitler)

## [1] 10
t(rep(1,length(hitler)))%*%hitler

##           [,1]
## [1,] 12.99564

data <- as.data.frame(data)
data0 <- as.data.frame(data0)
data0 <- na.exclude(data0)
#View(data0)

# remove NAs
data <- na.exclude(data)

#View(data)

# logit model
model1 <- glm(death ~ EUROPE+START+DURATION+ELITE_FEMALE+ELITE_ENTERAGE
              +ELITE_RETENURE+EC_GR_2Y+ECON+MIL,
              family = binomial(link = 'logit'), data=data)
summary(model1)

##
## Call:
## glm(formula = death ~ EUROPE + START + DURATION + ELITE_FEMALE +
##      ELITE_ENTERAGE + ELITE_RETENURE + EC_GR_2Y + ECON + MIL,
##      family = binomial(link = "logit"), data = data)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -1.1440  -0.5687  -0.4116  -0.3107   2.9320
##
## Coefficients:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)  -4.54890    1.12984  -4.026 5.67e-05 ***
## EUROPE       -1.06026    0.57492  -1.844 0.065157 .
## START         0.05698    0.02149   2.652 0.007998 **
## DURATION      0.05515    0.01421   3.882 0.000104 ***
## ELITE_FEMALE -15.55979   723.00312  -0.022 0.982830
## ELITE_ENTERAGE  0.01017    0.01389   0.732 0.464133
## ELITE_RETENURE  0.03543    0.01424   2.488 0.012839 *
## EC_GR_2Y      -0.20591    0.05481  -3.756 0.000172 ***
## ECON         -0.43318    0.75572  -0.573 0.566505
## MIL          -0.15738    0.46691  -0.337 0.736062
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```
##
## (Dispersion parameter for binomial family taken to be 1)
##
## Null deviance: 538.91 on 720 degrees of freedom
## Residual deviance: 490.04 on 711 degrees of freedom
## AIC: 510.04
##
## Number of Fisher Scoring iterations: 16

# pseudo R2s
pR2(model1)

## fitting null model for pseudo-r2

##          llh          llhNull          G2          McFadden          r2ML
## -245.01964860 -269.45408398  48.86887076  0.09068126  0.06553331
##          r2CU
##    0.12448740

# variance inflation factors
vif(model1)

##          EUROPE          START          DURATION  ELITE_FEMALE ELITE_ENTERAGE
##    3.543817    11.733995    5.790912    1.000000    1.219254
## ELITE_RETENURE    EC_GR_2Y          ECON          MIL
##    1.151339    4.189975    1.011020    1.394974

# cor(data) shows correlations across all variables
cor(EUROPE,START)

## [1] -0.7091193

# model without START
model2 <- glm(death ~ EUROPE+DURATION+ELITE_FEMALE+ELITE_ENTERAGE+ELITE_RETENURE
              +EC_GR_2Y+ECON+MIL+END,
              family = binomial(link = 'logit'), data = data)
summary(model2)

##
## Call:
## glm(formula = death ~ EUROPE + DURATION + ELITE_FEMALE + ELITE_ENTERAGE +
##      ELITE_RETENURE + EC_GR_2Y + ECON + MIL + END, family = binomial(link = "logit"),
##      data = data)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -1.1440  -0.5687  -0.4116  -0.3107   2.9320
##
## Coefficients:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)  -2.073215   0.841672  -2.463  0.013770 *
## EUROPE        -1.060259   0.574921  -1.844  0.065157 .
## DURATION      -0.001833   0.011757  -0.156  0.876084
## ELITE_FEMALE -15.559791  723.003116  -0.022  0.982830
## ELITE_ENTERAGE  0.010169   0.013891   0.732  0.464133
## ELITE_RETENURE  0.035427   0.014238   2.488  0.012839 *
## EC_GR_2Y      -0.205906   0.054814  -3.756  0.000172 ***
## ECON          -0.433185   0.755722  -0.573  0.566505
```



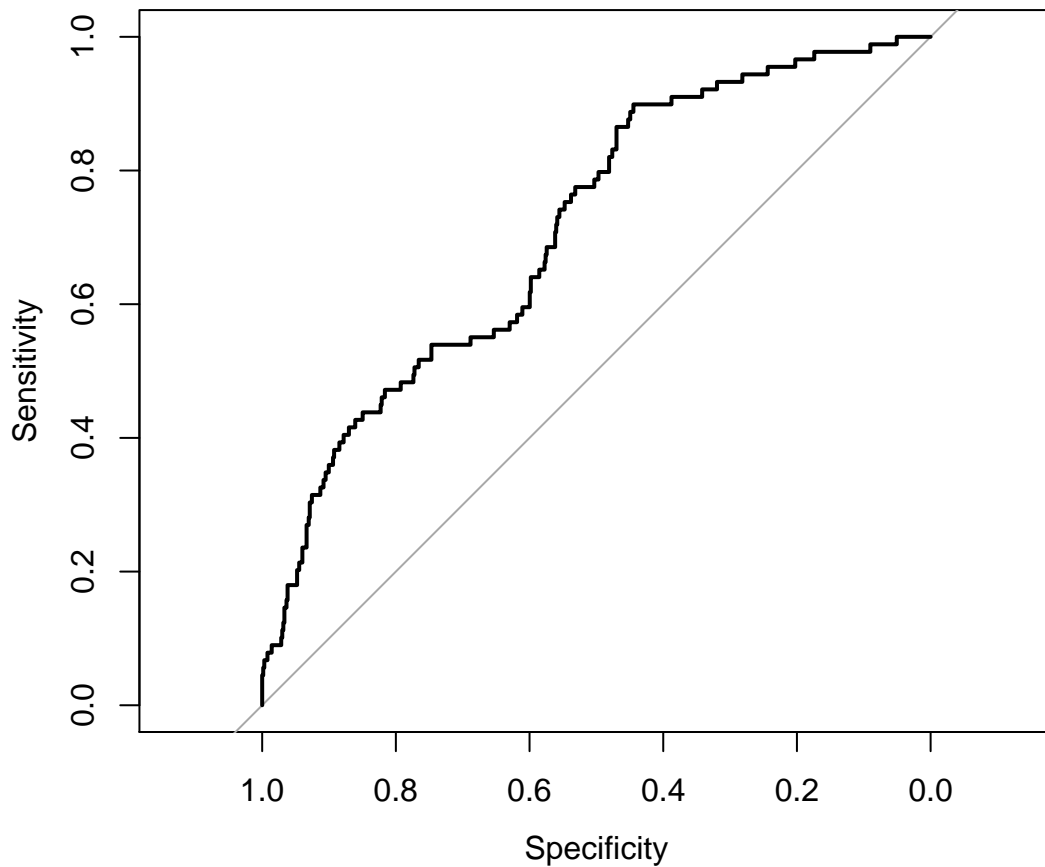
```
## MIL          -0.157384  0.466913  -0.337 0.736062
## END          0.056983  0.021486   2.652 0.007998 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##      Null deviance: 538.91  on 720  degrees of freedom
## Residual deviance: 490.04  on 711  degrees of freedom
## AIC: 510.04
##
## Number of Fisher Scoring iterations: 16
```

```
pR2(model2)
```

```
## fitting null model for pseudo-r2
```

```
##          llh          llhNull          G2          McFadden          r2ML
## -245.01964860 -269.45408398   48.86887076   0.09068126   0.06553331
##          r2CU
##    0.12448740
```

```
roc(data$death,predict.glm(model2,type='response'),plot=TRUE)
```



```
##
```

```
## Call:
## roc.default(response = data$death, predictor = predict.glm(model2, type = "response"), plot = TRUE)
##
## Data: predict.glm(model2, type = "response") in 632 controls (data$death 0) < 89 cases (data$death 1)
## Area under the curve: 0.712
```

```
vif(model2)
```

```
##          EUROPE          DURATION    ELITE_FEMALE ELITE_ENTERAGE ELITE_RETENURE
##          3.543817          3.966153          1.000000          1.219254          1.151339
##          EC_GR_2Y          ECON          MIL          END
##          4.189975          1.011020          1.394974          8.011559
```

```
# get hit rate of the model with a 0.5 cutoff
cutoff <- 0.5
# get predicted probabilities
latent_pred <- predict.glm(model2,type = 'response')
# get binary result from the cutoff
latent_bin <- ifelse(latent_pred >= cutoff,1,0)
# hitrate
mean(latent_bin==data$death)
```

```
## [1] 0.8807212
```

```
# percentage by just guessing more likely outcome
1-mean(data$death)
```

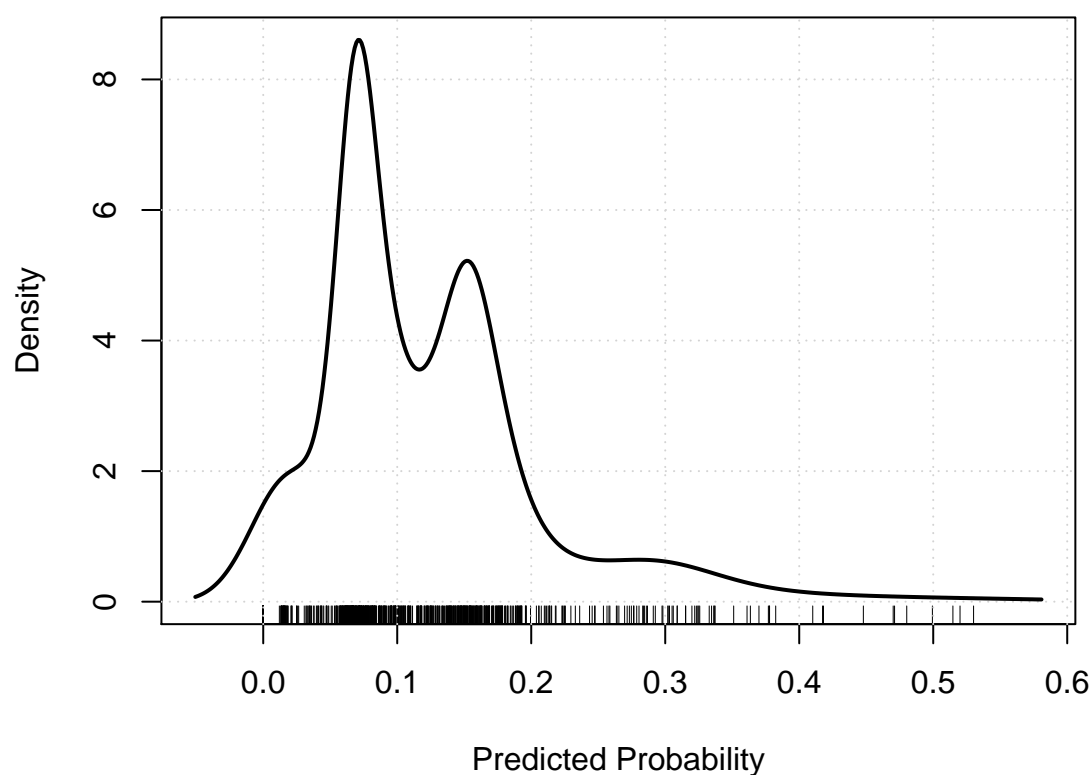
```
## [1] 0.8765603
```

```
# maximal predicted probability
max(latent_pred)
```

```
## [1] 0.5301167
```

```
densityPlot(latent_pred, ylab = 'Density',
             xlab = 'Predicted Probability',
             main = 'Density Plot of Latent Probability of Death')
```

Density Plot of Latent Probability of Death



```
# check coefficient vector lengths
length(model2$coefficients);length(hitler)
```

```
## [1] 10
```

```
## [1] 10
```

```
# check vectors for matching variables
hitler
```

```
##          EUROPE      DURATION  ELITE_FEMALE ELITE_ENTERAGE
##      1.00000      1.00000      12.00000      0.00000      43.80822
## ELITE_RETENURE  EC_GR_2Y      ECON          MIL          END
##      12.25479     -13.36000      0.00000      0.00000     -43.70738
```

```
model2$coefficients
```

```
##      (Intercept)      EUROPE      DURATION  ELITE_FEMALE ELITE_ENTERAGE
## -2.073214543    -1.060258788   -0.001833297  -15.559790990    0.010168763
## ELITE_RETENURE  EC_GR_2Y      ECON          MIL          END
##      0.035427232   -0.205906013   -0.433184552   -0.157384010    0.056982796
```

```
# get probabilities
```

```
Pr_hitler <- 1/(1+exp(-t(model2$coefficients)%*(hitler)))
```

```
Pr_hitler
```

```
##          [,1]
```

```
## [1,] 0.1175843
Pr_goebbles <- 1/(1+exp(-t(model2$coefficients)%*%(goebbles)))
Pr_goebbles

##           [,1]
## [1,] 0.1086048
# verify that the model would predict wrongly
latent_bin[21]==data$death[21]

##      21
## FALSE
latent_bin[13]==data$death[13]

##      13
## FALSE
# Get the predicted probabilities for Hitler, Goebbels, someone from
# SE Asia (no external war), Stalin (communist).

# check for percentage of economists and military
mean(na.omit(data$ECON)); mean(na.omit(data$MIL))

## [1] 0.03467406
## [1] 0.1054092
mean(na.omit(data$death))

## [1] 0.1234397
```

References

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