osm_replication1.R

bsog0621

2025-07-15

```
###Full-Power Cabinets and Caretaker Administrations in Parliamentary Democracies, 1945-2024###
###Francesco Bromo and José A. Cheibub###
###15 July 2025###

rm(list = ls())

##Load packages
library(haven)
library(plm)
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:plm':
##
##     between, lag, lead
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(psych)
library(mgcv)
```

```
## Loading required package: nlme
```

```
##
## Attaching package: 'nlme'
```

```
## The following object is masked from 'package:dplyr':
##
##     collapse
```

```
## This is mgcv 1.9-3. For overview type 'help("mgcv-package")'.
```

```
library(ggplot2)
```

```
##
## Attaching package: 'ggplot2'
```

```
## The following objects are masked from 'package:psych':
##
##     %+%, alpha
```

```r
library(ggpubr)
```

```
## Registered S3 method overwritten by 'broom':
##   method    from
##   nobs.felm lfe
```

```r
##Import data
formation_data <- read_dta("formation_data.dta")

#Table A3: Summary Statistics
describe(formation_data$formation_days) #Caretaker Duration (Days)
```

```
##    vars   n  mean    sd median trimmed   mad min max range skew kurtosis   se
## X1    1 917 60.47 66.35     41    49.8 50.41   0 593   593 2.49    11.34 2.19
```

```r
describe(formation_data$investiture) #Investiture
```

```
##    vars   n mean  sd median trimmed mad min max range  skew kurtosis   se
## X1    1 917 0.53 0.5      1    0.54   0   0   1     1 -0.12    -1.99 0.02
```

```r
describe(formation_data$post_elec) #Post-Election
```

```
##    vars   n mean   sd median trimmed mad min max range  skew kurtosis   se
## X1    1 917 0.59 0.49      1    0.62   0   0   1     1 -0.38    -1.86 0.02
```

```r
describe(formation_data$enp) #ENPP
```

```
##    vars   n mean  sd median trimmed  mad  min  max range skew kurtosis   se
## X1    1 917 3.81 1.4   3.51    3.66 1.35 1.81 10.8     9 1.08     1.34 0.05
```

```r
describe(formation_data$sd_rile) #Ideological Polarization
```

```
##    vars   n  mean   sd median trimmed  mad  min   max range skew kurtosis   se
## X1    1 883 19.75 8.57   18.1      19 7.57 0.29 55.59  55.3 0.84     0.68 0.29
```

```r
##Generalized Additive Models
data <- pdata.frame(formation_data, index=c("country_number", "event_date"))
```

```
## Warning in pdata.frame(formation_data, index = c("country_number", "event_date")): at least one NA in
##  to find out which, use, e.g., table(index(your_pdataframe), useNA = "ifany")
```

```r
data$id_year <- data %>% group_indices(event_year)
```

```
## Warning: The `...` argument of `group_indices()` is deprecated as of dplyr 1.0.0.
## i Please `group_by()` first
## Call `lifecycle::last_lifecycle_warnings()` to see where this warning was
## generated.
```

```r
data$country_number[data$country=="Australia"] <- 31
data$country_number[data$country=="Slovenia"] <- 1

#Table A4, column 1 (Whole Sample)
gam1 <- gam(formation_days ~ investiture + post_elec + enp +  sd_rile + enp*post_elec + sd_rile*post_el
summary(gam1)
```

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
```

```
## formation_days ~ investiture + post_elec + enp + sd_rile + enp *
##     post_elec + sd_rile * post_elec + s(id_year, bs = "cr") +
##     factor(country_number)
##
## Parametric coefficients:
##                            Estimate Std. Error t value Pr(>|t|)
## (Intercept)                 1.2695    18.1707   0.070 0.944316
## investiture                 3.1046     8.1013   0.383 0.701651
## post_elec                  16.4639    12.2230   1.347 0.178356
## enp                         4.5712     2.2814   2.004 0.045424 *
## sd_rile                    -0.7021     0.3575  -1.964 0.049861 *
## factor(country_number)2    48.2835    17.2656   2.797 0.005284 **
## factor(country_number)3     8.1751    15.2679   0.535 0.592484
## factor(country_number)4    21.9470    19.2618   1.139 0.254859
## factor(country_number)5    54.5508    17.7720   3.069 0.002213 **
## factor(country_number)6     0.4364    18.1514   0.024 0.980826
## factor(country_number)7    64.6946    19.4467   3.327 0.000917 ***
## factor(country_number)8   -43.5698    17.1888  -2.535 0.011432 *
## factor(country_number)9   -16.8423    18.1563  -0.928 0.353867
## factor(country_number)10  -13.4032    16.1497  -0.830 0.406813
## factor(country_number)11  -15.8656    15.3070  -1.036 0.300269
## factor(country_number)12  -15.3725    16.9590  -0.906 0.364958
## factor(country_number)13  -10.3685    18.0607  -0.574 0.566058
## factor(country_number)14   -0.7228    20.3801  -0.035 0.971715
## factor(country_number)15   40.8552    17.0974   2.390 0.017089 *
## factor(country_number)16  -16.8512    16.4946  -1.022 0.307257
## factor(country_number)17   57.9344    16.2693   3.561 0.000390 ***
## factor(country_number)18   22.5318    14.7270   1.530 0.126402
## factor(country_number)19   -4.3770    15.7852  -0.277 0.781627
## factor(country_number)20   -5.2274    16.7551  -0.312 0.755129
## factor(country_number)21   -7.3615    18.1762  -0.405 0.685573
## factor(country_number)22  -13.5530    18.4757  -0.734 0.463422
## factor(country_number)23   41.5746    36.8802   1.127 0.259943
## factor(country_number)24   23.2455    17.6978   1.313 0.189384
## factor(country_number)25   46.9216    17.2405   2.722 0.006632 **
## factor(country_number)26   26.9697    17.1487   1.573 0.116166
## factor(country_number)27   -2.7827    17.9657  -0.155 0.876948
## factor(country_number)28   23.4043    17.0358   1.374 0.169862
## factor(country_number)29  -13.5961    16.2219  -0.838 0.402195
## factor(country_number)30    1.3714    20.4154   0.067 0.946458
## factor(country_number)31   24.3815    16.8728   1.445 0.148826
## factor(country_number)32   60.3137    18.7135   3.223 0.001317 **
## factor(country_number)33   31.1207    16.4062   1.897 0.058185 .
## factor(country_number)34  -16.3423    17.6408  -0.926 0.354508
## post_elec:enp               9.1459     2.4263   3.769 0.000175 ***
## post_elec:sd_rile           1.1948     0.3933   3.038 0.002458 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Approximate significance of smooth terms:
##             edf Ref.df    F p-value
## s(id_year) 4.3  5.288 5.46 4.5e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## R-sq.(adj) =  0.511   Deviance explained = 53.5%
## GCV = 2315.9  Scale est. = 2199.7    n = 883
```

```
#Table A4, column 2 (Established Democracies)
data_estd <- data[which(data$europe != 2),]

gam2 <- gam(formation_days ~ investiture + post_elec + enp +  sd_rile + enp*post_elec + sd_rile*post_el
summary(gam2)
```

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## formation_days ~ investiture + post_elec + enp + sd_rile + enp *
##     post_elec + sd_rile * post_elec + s(id_year, bs = "cr") +
##     factor(country_number)
##
## Parametric coefficients:
##                            Estimate Std. Error t value Pr(>|t|)
## (Intercept)                36.46973   14.71706   2.478 0.013448 *
## investiture                 5.24730    9.13828   0.574 0.566012
## post_elec                  24.89172   13.96288   1.783 0.075073 .
## enp                         3.41475    2.79782   1.221 0.222691
## sd_rile                    -0.03196    0.41034  -0.078 0.937946
## factor(country_number)3   -42.09984   13.43223  -3.134 0.001796 **
## factor(country_number)5     6.87960   13.09120   0.526 0.599395
## factor(country_number)8   -96.71057   13.02259  -7.426 3.30e-13 ***
## factor(country_number)10  -64.30047   12.43736  -5.170 3.07e-07 ***
## factor(country_number)11  -63.02255   11.31677  -5.569 3.67e-08 ***
## factor(country_number)12  -66.73039   16.05561  -4.156 3.64e-05 ***
## factor(country_number)13  -60.29049   17.57233  -3.431 0.000637 ***
## factor(country_number)15   -8.15069   12.52686  -0.651 0.515484
## factor(country_number)16  -66.64231   15.56882  -4.280 2.13e-05 ***
## factor(country_number)17    1.03491   16.04551   0.064 0.948592
## factor(country_number)18  -24.54030   13.51367  -1.816 0.069810 .
## factor(country_number)19  -50.43507   14.86190  -3.394 0.000729 ***
## factor(country_number)22  -63.78521   14.22116  -4.485 8.53e-06 ***
## factor(country_number)23   -3.81650   35.59412  -0.107 0.914643
## factor(country_number)24  -29.13235   13.69956  -2.127 0.033814 *
## factor(country_number)25   -0.27711   12.31807  -0.022 0.982059
## factor(country_number)26  -21.90765   12.52391  -1.749 0.080689 .
## factor(country_number)28  -26.44590   16.19911  -1.633 0.103019
## factor(country_number)31  -23.09651   11.86135  -1.947 0.051915 .
## factor(country_number)32    9.95628   17.97639   0.554 0.579859
## factor(country_number)33  -20.93092   14.24539  -1.469 0.142204
## factor(country_number)34  -62.93592   12.83663  -4.903 1.18e-06 ***
## post_elec:enp              13.21441    2.79332   4.731 2.71e-06 ***
## post_elec:sd_rile           0.45039    0.45171   0.997 0.319085
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Approximate significance of smooth terms:
##              edf Ref.df    F  p-value
```

```
## s(id_year) 4.611  5.643 5.35 4.28e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## R-sq.(adj) =  0.535   Deviance explained = 55.6%
## GCV = 2418.2  Scale est. = 2305.9    n = 724
```

```
#Table A4, column 3 (Eastern Europe)
data_ee<-data[which(data$europe==2),]

gam3 <- gam(formation_days ~ investiture + post_elec + enp +  sd_rile + enp*post_elec + sd_rile*post_el
summary(gam3)
```

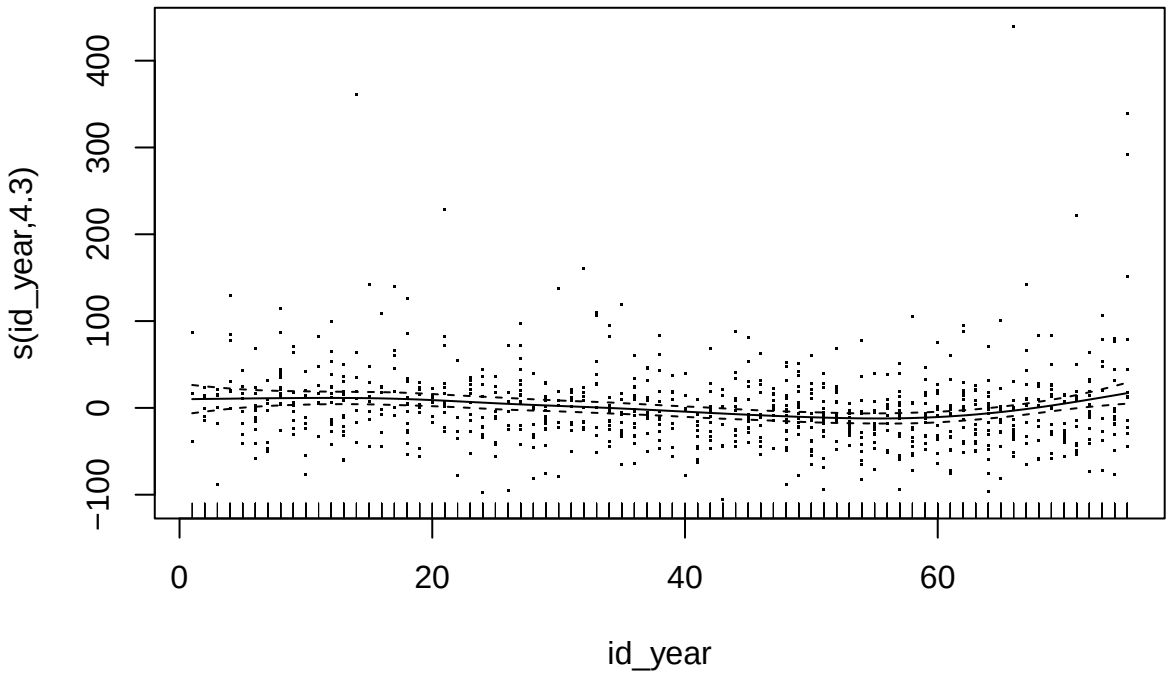
```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## formation_days ~ investiture + post_elec + enp + sd_rile + enp *
##     post_elec + sd_rile * post_elec + s(id_year, bs = "cr") +
##     factor(country_number)
##
## Parametric coefficients:
##                            Estimate Std. Error t value Pr(>|t|)
## (Intercept)                 16.0697    23.2997   0.690   0.4915
## investiture                 15.9317    18.4697   0.863   0.3898
## post_elec                   44.8466    23.0521   1.945   0.0537 .
## enp                          3.5203     3.4715   1.014   0.3123
## sd_rile                     -0.9131     0.8366  -1.091   0.2769
## factor(country_number)4     11.3192    15.7629   0.718   0.4739
## factor(country_number)6     -1.5923    15.2150  -0.105   0.9168
## factor(country_number)7     61.9371    15.1668   4.084 7.42e-05 ***
## factor(country_number)9    -26.0940    13.7730  -1.895   0.0602 .
## factor(country_number)14   -12.4757    16.9312  -0.737   0.4625
## factor(country_number)20    -9.6391    12.6294  -0.763   0.4466
## factor(country_number)21   -14.4731    13.8473  -1.045   0.2977
## factor(country_number)27   -15.3649    13.9366  -1.102   0.2721
## factor(country_number)29   -28.3575    12.7079  -2.231   0.0272 *
## factor(country_number)30    2.9217    15.4198   0.189   0.8500
## post_elec:enp               0.5157     4.6650   0.111   0.9121
## post_elec:sd_rile          -0.4699     1.1194  -0.420   0.6753
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Approximate significance of smooth terms:
##               edf Ref.df     F p-value
## s(id_year) 2.081  2.613 2.954  0.0409 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## R-sq.(adj) =  0.444   Deviance explained = 50.7%
## GCV = 1399.1  Scale est. = 1231.2    n = 159
```

```
#Table A5: Country Dummies (Table A4)
coefs <- as.data.frame(summary(gam1)$p.table)
```

```r
country_coefs <- coefs[grep("^factor\\(country_number\\)", rownames(coefs)), ]
country_numbers <- as.numeric(gsub("factor\\(country_number\\)", "", rownames(country_coefs)))

country_map <- unique(data[, c("country_number", "country")])

country_dummies <- data.frame(
  country_number = country_numbers,
  estimate = country_coefs[, "Estimate"],
  std_error = country_coefs[, "Std. Error"]
)

merge(country_dummies, country_map, by = "country_number") %>%
  select(country, estimate, std_error)
```

```
##           country    estimate std_error
## 1         Austria  48.2834982  17.26558
## 2         Belgium   8.1751110  15.26786
## 3        Bulgaria  21.9469845  19.26177
## 4          Canada  54.5508006  17.77201
## 5         Croatia   0.4363704  18.15139
## 6         Czechia  64.6946463  19.44675
## 7         Denmark -43.5697758  17.18876
## 8         Estonia -16.8423189  18.15631
## 9         Finland -13.4031554  16.14968
## 10         France -15.8656285  15.30696
## 11        Germany -15.3724942  16.95901
## 12         Greece -10.3685187  18.06066
## 13        Hungary  -0.7228452  20.38007
## 14        Iceland  40.8551805  17.09737
## 15        Ireland -16.8511907  16.49464
## 16         Israel  57.9344296  16.26927
## 17          Italy  22.5317825  14.72698
## 18          Japan  -4.3770418  15.78518
## 19         Latvia  -5.2273735  16.75515
## 20      Lithuania  -7.3615328  18.17616
## 21     Luxembourg -13.5530205  18.47567
## 22          Malta  41.5746303  36.88022
## 23    Netherlands  23.2455011  17.69777
## 24    New Zealand  46.9215596  17.24050
## 25         Norway  26.9697177  17.14872
## 26         Poland  -2.7826515  17.96569
## 27       Portugal  23.4042913  17.03582
## 28        Romania -13.5961046  16.22190
## 29       Slovakia   1.3714174  20.41536
## 30      Australia  24.3814777  16.87278
## 31          Spain  60.3137486  18.71346
## 32         Sweden  31.1207317  16.40617
## 33 United Kingdom -16.3423201  17.64082
```

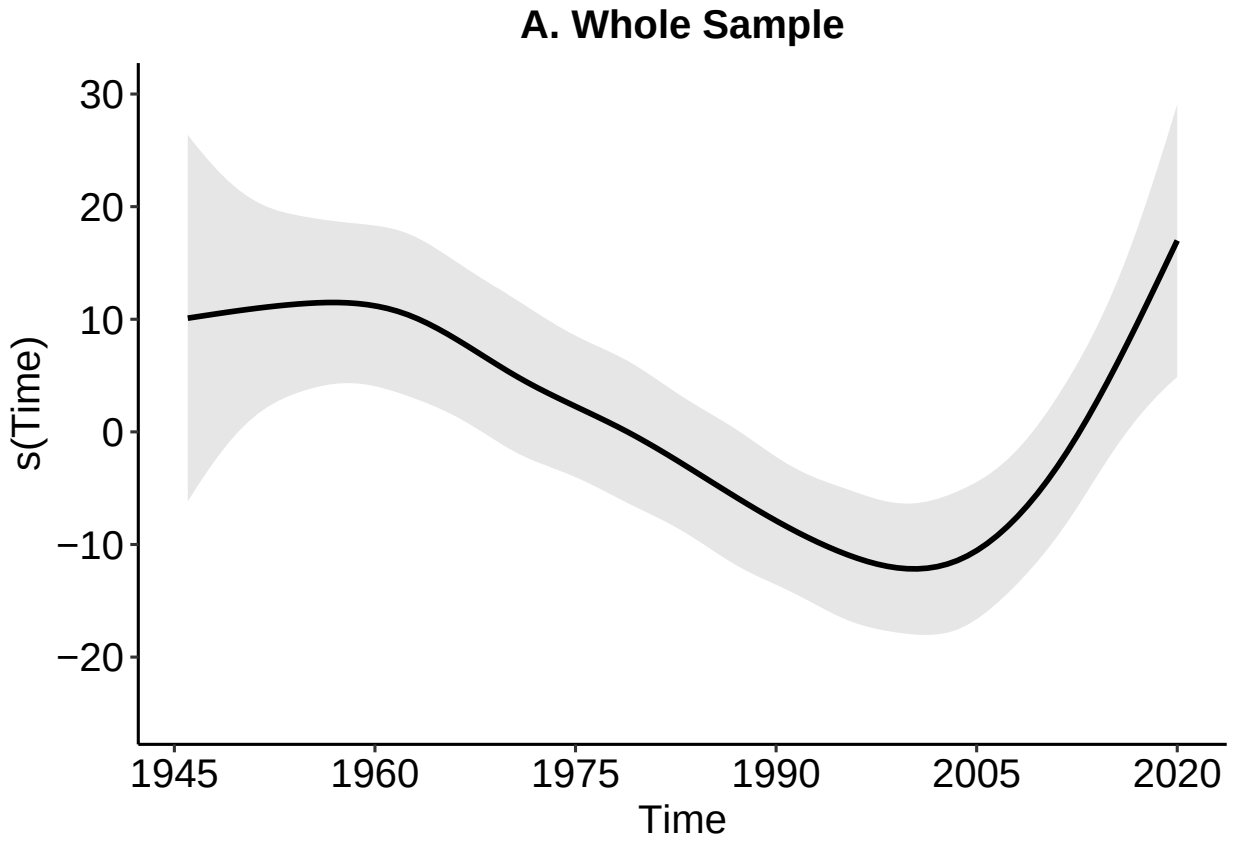
```r
#Figure A1, panel A
p_obj <- plot(gam1, residuals = TRUE)
```



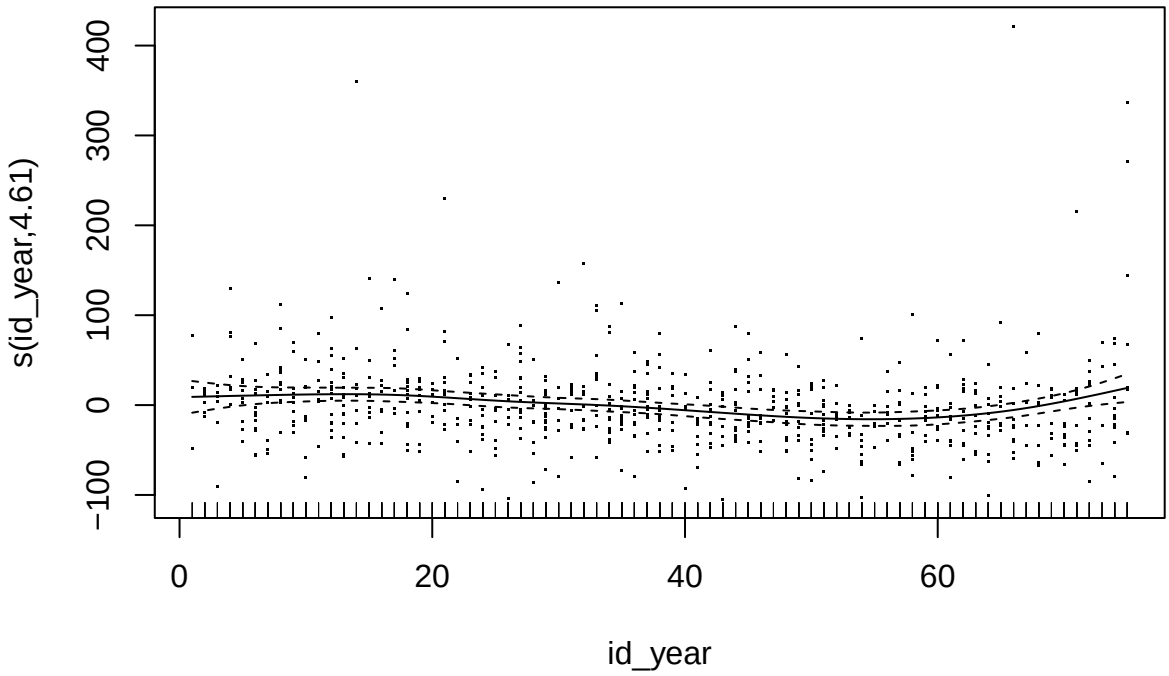

```
p_obj <- p_obj[[1]]
sm_df <- as.data.frame(p_obj[c("x", "se", "fit")])

plot_whole <- ggplot(sm_df, aes(x = x, y = fit)) +
  geom_ribbon(aes(ymin = fit - se, ymax = fit + se, y = NULL), alpha = 0.125) +
  geom_line(size = 1) +
  labs(x = "Time", y = "s(Time)") +
  theme_classic2() +
  theme(axis.title = element_text(size = 15, color = "black"), axis.text = element_text(size = 15, colo
  ggtitle("A. Whole Sample") +
  theme(plot.title = element_text(size = 15, face = "bold", hjust = 0.5)) +
  coord_cartesian(ylim = c(-25, 30)) + scale_x_continuous(breaks = seq(0, 75, 15), labels = c("0" = "19
```

```
## Warning: Using `size` aesthetic for lines was deprecated in ggplot2 3.4.0.
## i Please use `linewidth` instead.
## This warning is displayed once every 8 hours.
## Call `lifecycle::last_lifecycle_warnings()` to see where this warning was
## generated.
```

```
plot_whole
```

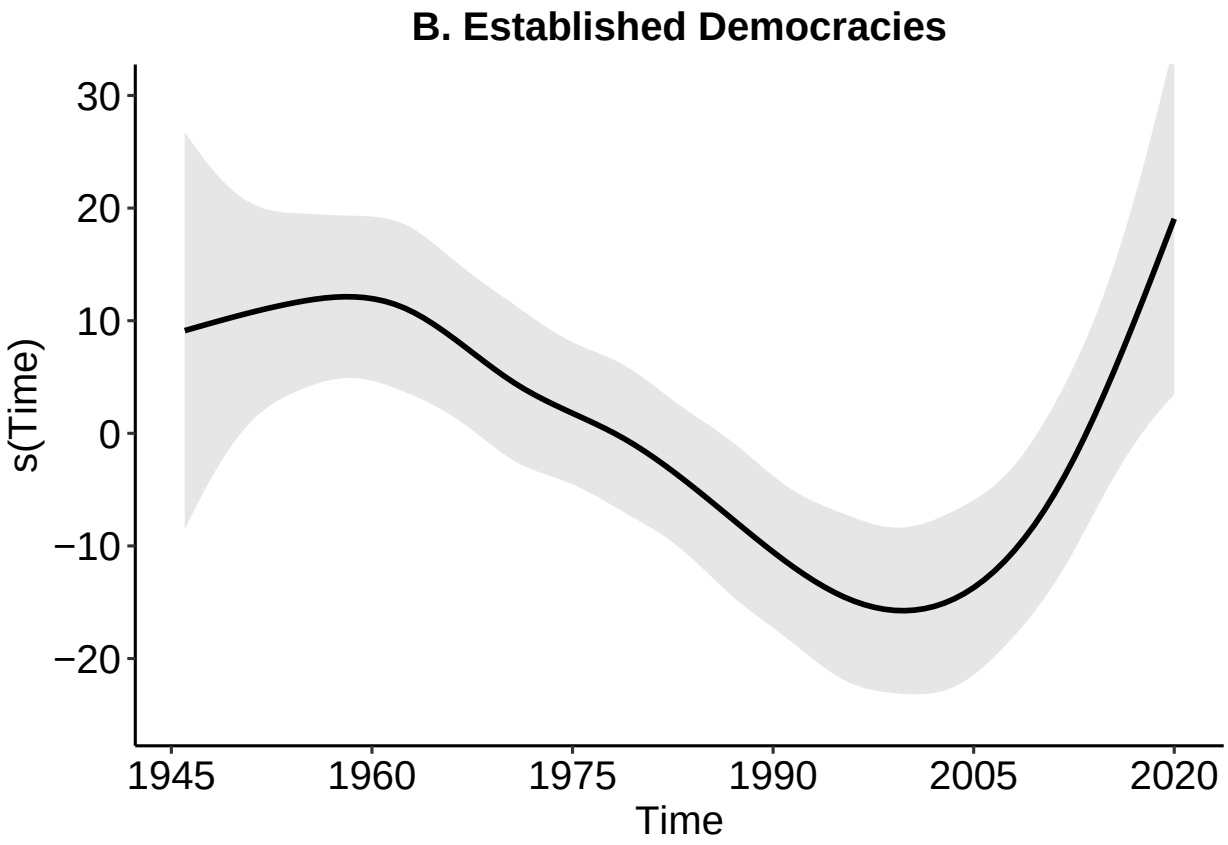



```
#Figure A1, panel B
p_obj_estd <- plot(gam2, residuals = TRUE)
```

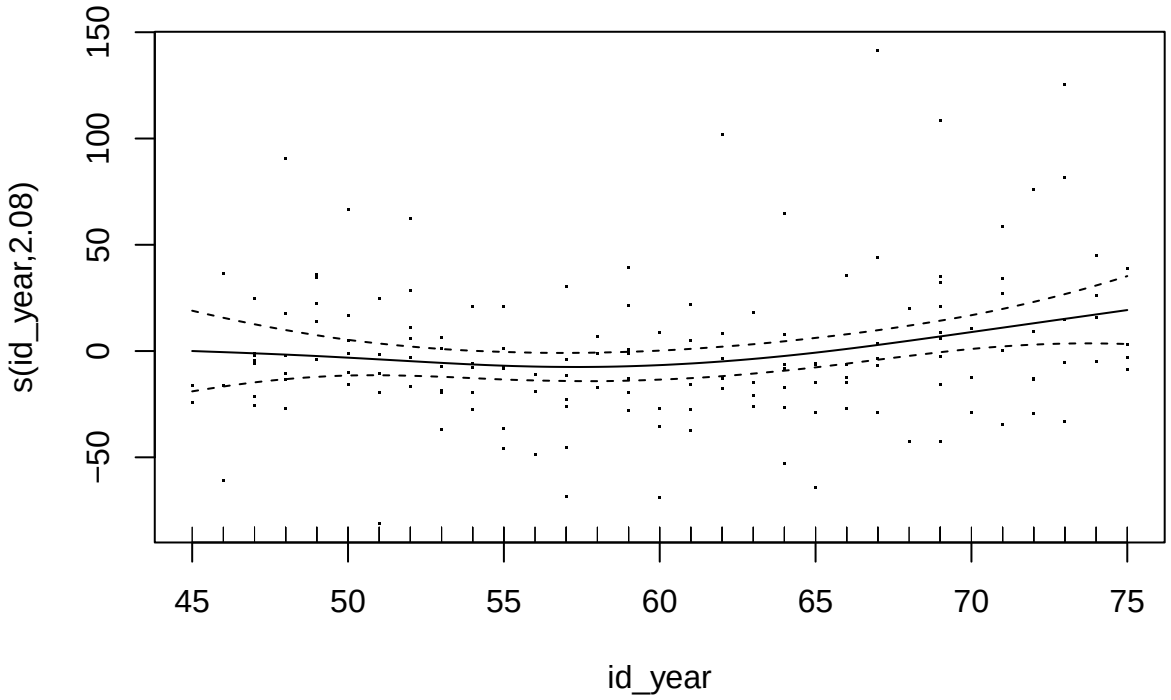



```
p_obj_estd <- p_obj_estd[[1]]
sm_df_estd <- as.data.frame(p_obj_estd[c("x", "se", "fit")])
```

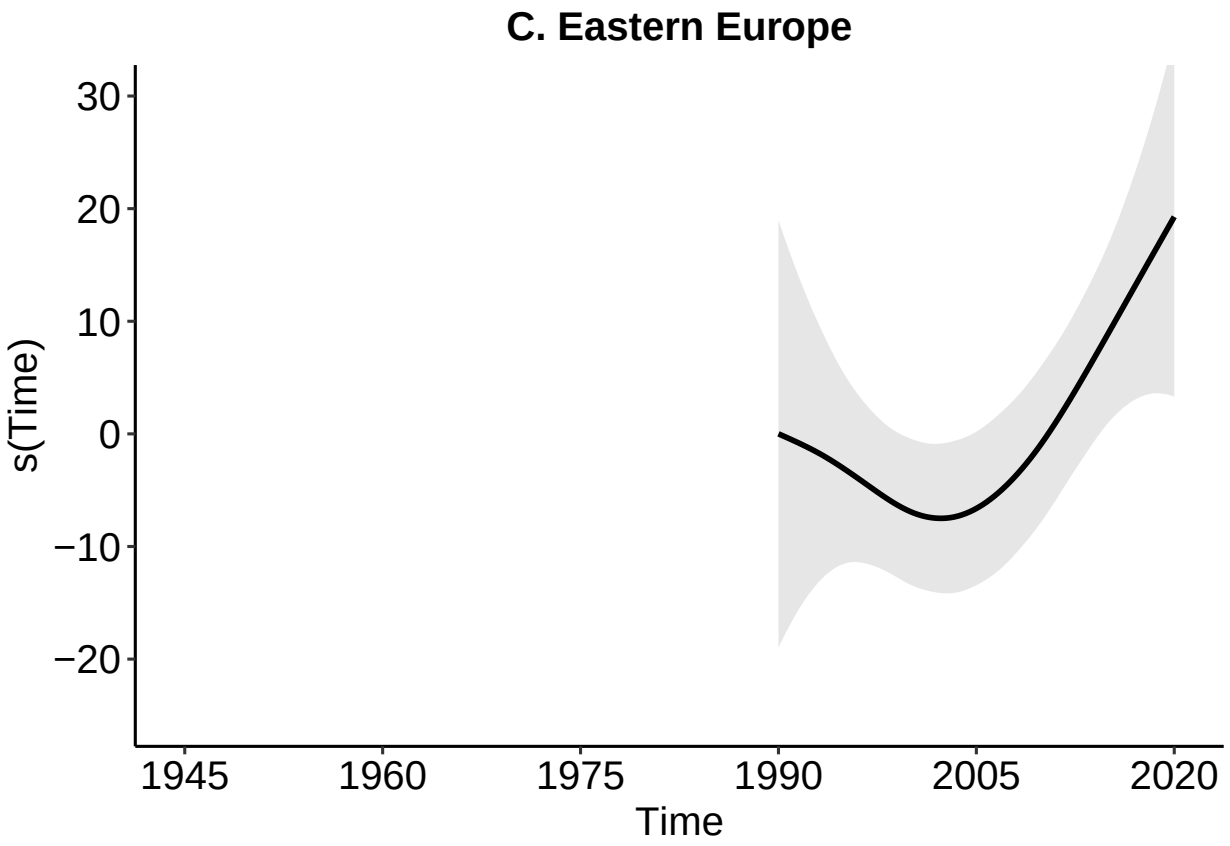
```r
plot_estd <- ggplot(sm_df_estd, aes(x = x, y = fit)) +
  geom_ribbon(aes(ymin = fit - se, ymax = fit + se, y = NULL), alpha = 0.125) +
  geom_line(size = 1) +
  labs(x = "Time", y = "s(Time)") +
  theme_classic2() +
  theme(axis.title = element_text(size = 15, color = "black"), axis.text = element_text(size = 15, colo
  ggtitle("B. Established Democracies") +
  theme(plot.title = element_text(size = 15, face = "bold", hjust = 0.5)) +
  coord_cartesian(ylim = c(-25, 30)) + scale_x_continuous(breaks = seq(0, 75, 15), labels = c("0" = "19
plot_estd
```



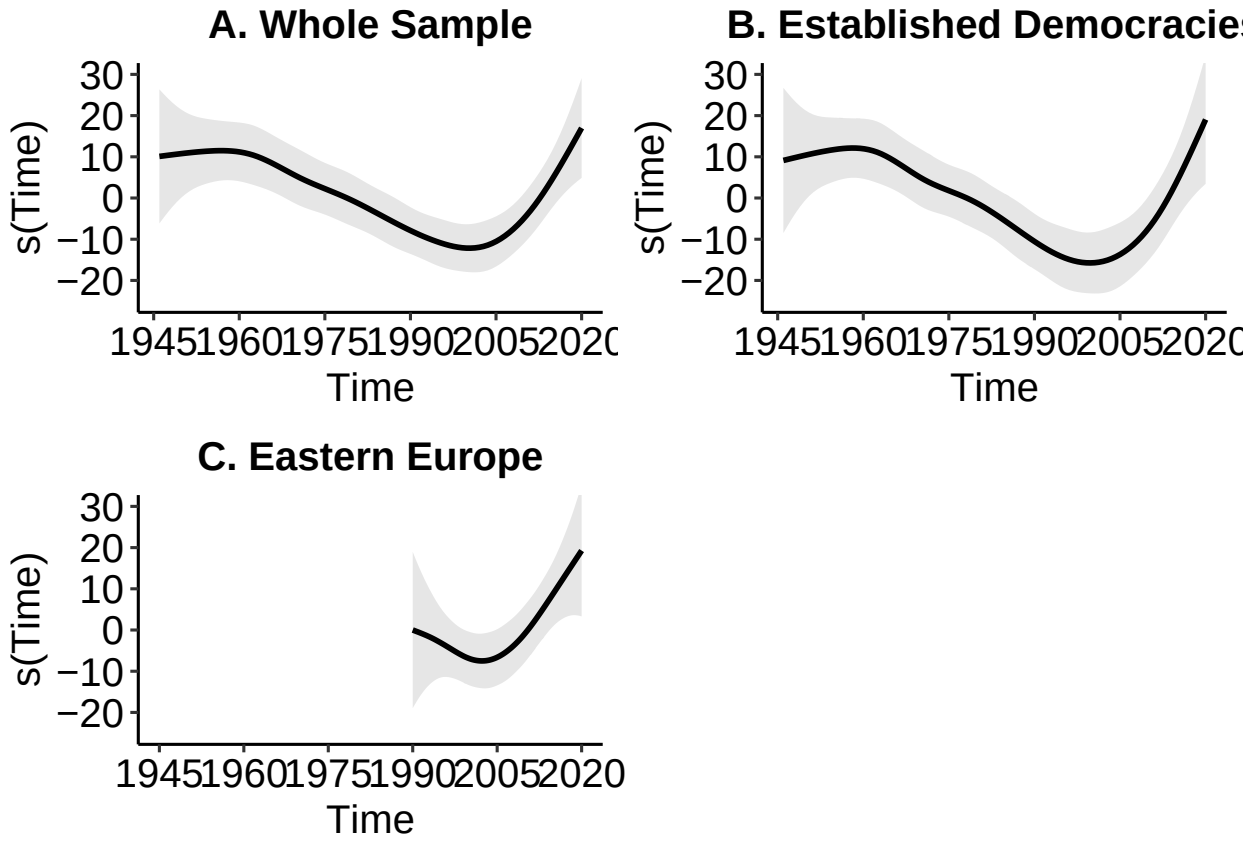

```r
#Figure A1, panel C
p_obj_ee <- plot(gam3, residuals = TRUE)
```




```
p_obj_ee <- p_obj_ee[[1]]
sm_df_ee <- as.data.frame(p_obj_ee[c("x", "se", "fit")])

plot_ee <- ggplot(sm_df_ee, aes(x = x, y = fit)) +
  geom_ribbon(aes(ymin = fit - se, ymax = fit + se, y = NULL), alpha = 0.125) +
  geom_line(size = 1) +
  labs(x = "Time", y = "s(Time)") +
  theme_classic2() +
  theme(axis.title = element_text(size = 15, color = "black"), axis.text = element_text(size = 15, colo
  ggtitle("C. Eastern Europe") +
  theme(plot.title = element_text(size = 15, face = "bold", hjust = 0.5)) +
  coord_cartesian(ylim = c(-25, 30), xlim = c(0, 75)) + scale_x_continuous(breaks = seq(0, 75, 15), lab
plot_ee
```




```
#Figure A1: Effect of Time on the Duration of Caretaker Administrations, 1945-2020
plot_all <- ggarrange(plot_whole, plot_estd, plot_ee, ncol = 2, nrow = 2)
plot_all
```




```
#getwd()
#ggsave("plot_all.jpeg", plot_all, width=7.5, height=5, dpi=300)
```