List of Appendices

Appendix 1. List of countries in the sample

List of countries in the full sample:

Algeria, Argentina, Australia, Austria, Belgium, Brazil, Cameroon, Chile, Colombia, Costa Rica, Denmark, Dominican Republic, Ecuador, Egypt, Arab Rep., El Salvador, Finland, France, Greece, Guatemala, India, Iran, Islamic Rep., Italy, Kenya, Korea, Rep., Luxembourg, Malaysia, Mexico, Morocco, Nepal, Netherlands, Norway, Pakistan, Paraguay, Peru, Portugal, Singapore, South Africa, Spain, Sri Lanka, Sweden, Thailand, Turkey, United Kingdom, United States

List of the European countries in the sample:

Austria, Belgium, Denmark, Finland, France, Greece, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, United Kingdom

Appendix 2. Summary statistics for the full sample by decades

	1970-79	1980-89	1990-99	2000-09	2010-20
			GDP growth		
Min	-13.95	-27.33	-7.93	-10.89	-11.15
Q1	2.97	1.25	1.73	1.67	1.12
Median	5.03	3.46	3.67	3.37	2.55
Mean	5.10	3.25	3.48	3.21	2.23
Q3	5.03	3.46	3.67	3.37	2.55
Max	2.97	1.25	1.73	1.67	1.12
St dev	4.35	4.43	3.36	2.98	3.53
			Investment		
Min	5.96	10.33	12.53	10.85	11.89
Q1	20.02	20.70	19.63	19.44	18.49
Median	24.37	23.60	22.40	22.25	22.42
Mean	24.99	24.44	23.50	23.11	23.22
Q3	24.37	23.60	22.40	22.25	22.42
Max	20.02	20.70	19.63	19.44	18.49
St dev	7.36	6.14	6.02	5.47	6.64
			Military expenditures		
Min	0	0	0	0	0
Q1	1.66	1.78	1.47	1.21	1.08
Median	2.70	2.68	2.12	1.65	1.48
Mean	3.19	3.08	2.28	1.90	1.76
Q3	2.70	2.68	2.12	1.65	1.48
Max	1.66	1.78	1.47	1.21	1.08
St dev	2.48	1.80	1.22	1.03	1.05

Source: Author's calculations

Appendix 3. Average GDP growth rate and share of military expenditures in GDP in the European countries by decades

	1970-79		1980-89		1990-99		2000-09		2010-2020	
	gdp	milex	gdp	milex	gdp	milex	gdp	milex	gdp	milex
Austria	4.09	1.33	2	1.4	2.71	1.08	1.71	0.88	0.79	0.76
Belgium	3.53	3.01	2.15	3	2.18	1.73	1.81	1.18	0.96	0.97
Denmark	2.39	2.25	1.91	2.2	2.45	1.76	0.98	1.41	1.49	1.26
Finland	3.76	1.42	3.64	1.65	1.88	1.6	2.09	1.36	0.84	1.45
France	4.1	3.21	2.35	3.12	2.02	2.53	1.46	2.03	0.58	1.9
Greece	5.49	4.9	0.78	4.71	2.06	3.48	2.77	2.94	-2.72	2.57
Italy	4.02	2.04	2.55	1.97	1.51	1.7	0.54	1.62	-0.57	1.38
Luxembourg	3.68	0.89	4.56	1.07	4.69	0.76	3.31	0.61	2.21	0.53
Netherlands	3.46	2.8	1.96	2.78	3.32	1.92	1.67	1.4	0.98	1.24
Norway	4.46	3.14	2.86	2.77	3.56	2.47	1.84	1.68	1.27	1.6
Portugal	5.62	4.24	3.35	2.55	2.92	2.2	0.95	1.92	0.02	1.91
Spain	3.87	2.25	2.79	2.67	2.66	1.94	2.65	1.45	-0.02	1.29
Sweden	2.53	3.21	2.3	2.71	1.75	2.22	2.12	1.46	2.05	1.1
United Kingdom	3	5.03	2.67	4.96	2.24	3.2	1.62	2.47	0.96	2.2

Source: Author's calculations

Appendix 4. R code with the data pre-processing and estimation

```
rm(list = ls())

# Load the libraries
library('WDI')
library('openxlsx')
library('reshape2')
library('tidyr')
library('dplyr')
library('plm')
library('panelvar')
library('stargazer')
library('ggplot2')

# Load military data and pre-process the data
setwd('C:/Thesis /Data')
file_name = 'SIPRI-Milex-data-1949-2020_0.xlsx'
military = read.xlsx(file_name, sheet = 'Share of GDP', colNames = TRUE, rowNames = TRUE, rows =
c(6:197), cols = c(1,3:74), skipEmptyRows = TRUE)
military = na.omit(military)
military[] = sapply(military[], as.numeric)
military$country = row.names(military)
a = pivot_longer(military, '1949':'2020', names_to = 'year', values_to = 'militaryExp')
rownames(a) <- NULL

# Rename countries according to WDI names
a$country[a$country=='Bosnia-Herzegovina'] = 'Bosnia and Herzegovina'
a$country[a$country=='Brunei'] = 'Brunei Darussalam'
a$country[a$country=='Cape Verde'] = 'Cabo Verde'
a$country[a$country=='Central African Rep.'] = 'Central African Republic'
a$country[a$country=='Congo, Repubic of'] = 'Congo, Rep.'
a$country[a$country=='Czechia'] = 'Czech Republic'
a$country[a$country=='Dominican Rep.'] = 'Dominican Republic'
a$country[a$country=='Egypt'] = 'Egypt, Arab Rep.'
a$country[a$country=='eSwatini'] = 'Eswatini'
a$country[a$country=='Gambia'] = 'Gambia, The'
a$country[a$country=='Iran'] = 'Iran, Islamic Rep.'
a$country[a$country=='Korea, North'] = 'Korea, Dem. People\'s Rep,'
a$country[a$country=='Korea, South'] = 'Korea, Rep.'
a$country[a$country=='Kyrgyzstan'] = 'Kyrgyz Republic'
```

```
a$country[a$country=='Laos'] = 'Lao PDR'
a$country[a$country=='Korea, South'] = 'Korea, Rep.'
a$country[a$country=='Norh Macedonia'] = 'North Macedonia'
a$country[a$country=='Russia'] = 'Russian Federation'
a$country[a$country=='Slovakia'] = 'Slovak Repblic'
a$country[a$country=='Syria'] = 'Syrian Arab Republic'
a$country[a$country=='Trinidad & Tobago'] = 'Trinidad and Tobago'
a$country[a$country=='UAE'] = 'United Arab Emirates'
a$country[a$country=='UK'] = 'United Kingdom'
a$country[a$country=='USA'] = 'United States'
a$country[a$country=='Venezuela'] = 'Venezuela, RB'
a$country[a$country=='Viet Nam'] = 'Vietnam'
a$country[a$country=='Yemen'] = 'Yemen, Rep.'

# Load GDP and Investment data from WDI
#WDIsearch('capit.*GDP')
gdp = WDI(indicator=c('NY.GDP.MKTP.KD.ZG','NE.GDI.TOTL.ZS'), start=1960, end=2020)
gdp$iso2c = NULL
data = merge(gdp, a, by.x = c('country','year'), by.y =  c('country','year'), sort = TRUE)

# Find for which number of years there are maximum T x N observations for a balanced panel
obs = data.frame(year = numeric(), observations = numeric())

for (i in c(1950:2020)){
  a = subset(data, data$year>= i)
  missing <- unique(a$country[!complete.cases(a)])
  bData = a[!(a$country %in% missing),]
  obs[i-1949,1] = i
  obs[i-1949,2] = nrow(bData)
}
max(obs)

# We take a subset of countries from 1970
data = subset(data, data$year>= 1970)
missing <- unique(data$country[!complete.cases(data)])
data = data[!(data$country %in% missing),]
data$militaryExp <- data$militaryExp * 100
data$year <- as.numeric(data$year)
unique(data$country)
```

```
# Create dummies for the 10 years and produce means for gdp growth and milex for each decade
data$'decade' = ifelse((data$year >=1970)&(data$year) <=1979,'1970-79',
                  ifelse((data$year >=1980)&(data$year) <=1989,'1980-89',
                      ifelse((data$year >=1990)&(data$year) <=1999,'1990-99',
                          ifelse((data$year >=2000)&(data$year) <=2009,'2000-09','2010-20'))))
data$decade <- as.factor(data$decade)

CountryMeans <- data %>% group_by(country, decade) %>% summarize('gdp' =
round(mean(NY.GDP.MKTP.KD.ZG),4), 'milex' = round(mean(militaryExp),4))
ContrySumm <- pivot_wider(CountryMeans, id_cols = country, names_from = decade, values_from =
c('gdp', 'milex'))

# Save the results
file_name = 'Summary.xlsx'
write.xlsx(CountrySumm, file_name, sheetName = "Sheet1",
        col.names = TRUE, row.names = TRUE, append = FALSE)

# Same for the EU only
Europe <- c('Austria', 'Belgium', 'Denmark', 'Finland', 'France', 'Greece', 'Italy', 'Luxembourg',
'Netherlands', 'Norway', 'Portugal', 'Spain', 'Sweden','United Kingdom')
EurData <- data[is.element(data$country, Europe),]
EURMeans <- EurData %>% group_by(country, decade) %>% summarize('gdp' =
round(mean(NY.GDP.MKTP.KD.ZG),2), 'milex' = round(mean(militaryExp),2))
EURSumm <- pivot_wider(EURMeans, id_cols = country, names_from = decade, values_from = c('gdp',
'milex'))

# Save the results
file_name = 'EUSummary.xlsx'
write.xlsx(EURSumm, file_name, sheetName = "Sheet1",
        col.names = TRUE, row.names = TRUE, append = FALSE)

# Plot the military expenditures for the EU countries
ggplot(data=EurData, aes(x=year, y=militaryExp, group=country, color=country)) +
  geom_line() + geom_point() + theme_minimal() + xlab('Year') + ylab('Military expenditures, % of
GDP')



# Spearman correlation for each EU country
EurCorr <- EurData %>% group_by(country) %>% summarize('gdp / inv' =
round(cor(NY.GDP.MKTP.KD.ZG, NE.GDI.TOTL.ZS, method = 'spearman'),2),
```

```
                        'gdp / milex' = round(cor(NY.GDP.MKTP.KD.ZG, militaryExp, method =
'spearman'),2),
                        'inv / milex' = round(cor(NE.GDI.TOTL.ZS, militaryExp, method =
'spearman'),2))

# Save the result
file_name = 'EUCorr.xlsx'
write.xlsx(EurCorr, file_name, sheetName = "Sheet1",
        col.names = TRUE, row.names = TRUE, append = FALSE)

#Make a panel dataset:
pData <- pdata.frame(data, index = c("country", "year"))
pData$year <- as.numeric(pData$year)

#SUMMARY
summary(data)
apply(data, 2, sd)

TotalSummary <- data %>% group_by(decade) %>% summarize('gdp min' =
round(min(NY.GDP.MKTP.KD.ZG),2),
                                'gdp Q1' = round(quantile(NY.GDP.MKTP.KD.ZG, 0.25),2),
                                'gdp median' = round(quantile(NY.GDP.MKTP.KD.ZG, 0.5),2),
                                'gdp mean' = round(mean(NY.GDP.MKTP.KD.ZG),2),
                                'gdp Q3' = round(quantile(NY.GDP.MKTP.KD.ZG, 0.5),2),
                                'gdp max' = round(quantile(NY.GDP.MKTP.KD.ZG, 0.25),2),
                                'gdp sd' = round(sd(NY.GDP.MKTP.KD.ZG),2),
                                'inv min' = round(min(NE.GDI.TOTL.ZS),2),
                                'inv Q1' = round(quantile(NE.GDI.TOTL.ZS, 0.25),2),
                                'inv median' = round(quantile(NE.GDI.TOTL.ZS, 0.5),2),
                                'inv mean' = round(mean(NE.GDI.TOTL.ZS),2),
                                'inv Q3' = round(quantile(NE.GDI.TOTL.ZS, 0.5),2),
                                'inv max' = round(quantile(NE.GDI.TOTL.ZS, 0.25),2),
                                'inv sd' = round(sd(NE.GDI.TOTL.ZS),2),
                                'milex min' = round(min(militaryExp),2),
                                'milex Q1' = round(quantile(militaryExp, 0.25),2),
                                'milex median' = round(quantile(militaryExp, 0.5),2),
                                'milex mean' = round(mean(militaryExp),2),
                                'milex Q3' = round(quantile(militaryExp, 0.5),2),
                                'milex max' = round(quantile(militaryExp, 0.25),2),
                                'milex sd' = round(sd(militaryExp),2))
```

```
TotalSummary <- t(TotalSummary)

# Save the results
file_name = 'Summary.xlsx'
write.xlsx(TotalSummary, file_name, sheetName = "Sheet1",
        col.names = TRUE, row.names = TRUE, append = FALSE)



########## PVAR ESTIMATION ###############
# Test for unit roots
# GDP growth
purtest(pData$NY.GDP.MKTP.KD.ZG,pmax = 4, exo = "intercept", test = c("levinlin"))

# Investment
purtest(pData$NE.GDI.TOTL.ZS, pmax = 4, exo = "intercept", test = c("levinlin"))

# Military
purtest(pData$militaryExp, pmax = 4, exo = "intercept", test = c("levinlin"))

# Estimate PVAR model full sample
model1 = pvargmm(dependent_vars = c('NY.GDP.MKTP.KD.ZG', 'NE.GDI.TOTL.ZS', 'militaryExp'),
                         lags = 1, transformation = 'fd',
                         data = pData,
                         panel_identifier=c("country", "year"),
                         steps = c("twostep"),
                         system_instruments = FALSE,
                         max_instr_dependent_vars = 10,
                         max_instr_predet_vars = 10,
                         min_instr_dependent_vars = 2L,
                         min_instr_predet_vars = 1L,
                         collapse = FALSE)
summary(model1)

# Estimate PVAR model for the EU
Europe <- c('Austria', 'Belgium', 'Denmark', 'Finland', 'France', 'Greece', 'Italy', 'Luxembourg',
'Netherlands', 'Norway', 'Portugal', 'Spain', 'Sweden','United Kingdom')
EurData <- pData[is.element(data$country, Europe),]

model2 = pvargmm(dependent_vars = c('NY.GDP.MKTP.KD.ZG', 'NE.GDI.TOTL.ZS', 'militaryExp'),
```

```
            lags = 1, transformation = 'fd',
            data = EurData,
            panel_identifier=c("country", "year"),
            steps = c("twostep"),
            system_instruments = FALSE,
            max_instr_dependent_vars = 10,
            max_instr_predet_vars = 10,
            min_instr_dependent_vars = 2L,
            min_instr_predet_vars = 1L,
            collapse = FALSE)

summary(model2)

# Divide european countries before and after 1991
EurDataPre <- EurData[as.integer(EurData$year) < 1992-1969, ]
EurDataPost <- EurData[as.integer(EurData$year) >= 1992-1969, ]

# Estimate PVAR model for the EU before 1991
model3 = pvargmm(dependent_vars = c('NY.GDP.MKTP.KD.ZG', 'NE.GDI.TOTL.ZS', 'militaryExp'),
            lags = 1, transformation = 'fd',
            data = EurDataPre,
            panel_identifier=c("country", "year"),
            steps = c("twostep"),
            system_instruments = FALSE,
            max_instr_dependent_vars = 10,
            max_instr_predet_vars = 10,
            min_instr_dependent_vars = 2L,
            min_instr_predet_vars = 1L,
            collapse = FALSE)

summary(model3)

# Estimate PVAR model for the EU after 1991
model4 = pvargmm(dependent_vars = c('NY.GDP.MKTP.KD.ZG', 'NE.GDI.TOTL.ZS', 'militaryExp'),
            lags = 1, transformation = 'fd',
            data = EurDataPost,
            panel_identifier=c("country", "year"),
            steps = c("twostep"),
            system_instruments = FALSE,
            max_instr_dependent_vars = 10,
```

```
            max_instr_predet_vars = 10,
            min_instr_dependent_vars = 2L,
            min_instr_predet_vars = 1L,
            collapse = FALSE)

summary(model4)



# OUTPUTS TO PRINT:
# List of countries
paste0(unique(data$country), collapse = " ", sep = ",")

#SUmmary statistics
summary(data)
apply(data, 2, sd)

#########################
# Appendix:



# Check the data (SKIP)
cntrs<-rownames(military[is.na(military$`1949`),])
rownames(military[is.na(military$`1992`),])
sum(rownames(military[is.na(military$`1950`),]) == cntrs)

apply(military, 2, function(x) sum(rownames(military[is.na(x),])==cntrs))

# Check when countries are not in the set
gdpconts = unique(gdp$country)
milconts = unique(a$country)

sort(setdiff(milconts, gdpconts))
sort(setdiff(gdpconts, milconts))
```