Some issues in the empirical analysis of military and macroeconomic dynamics in Europe

Paolo Maranzano

Researcher in Economic Statistics @ University of Milano-Bicocca, Milano, Italy

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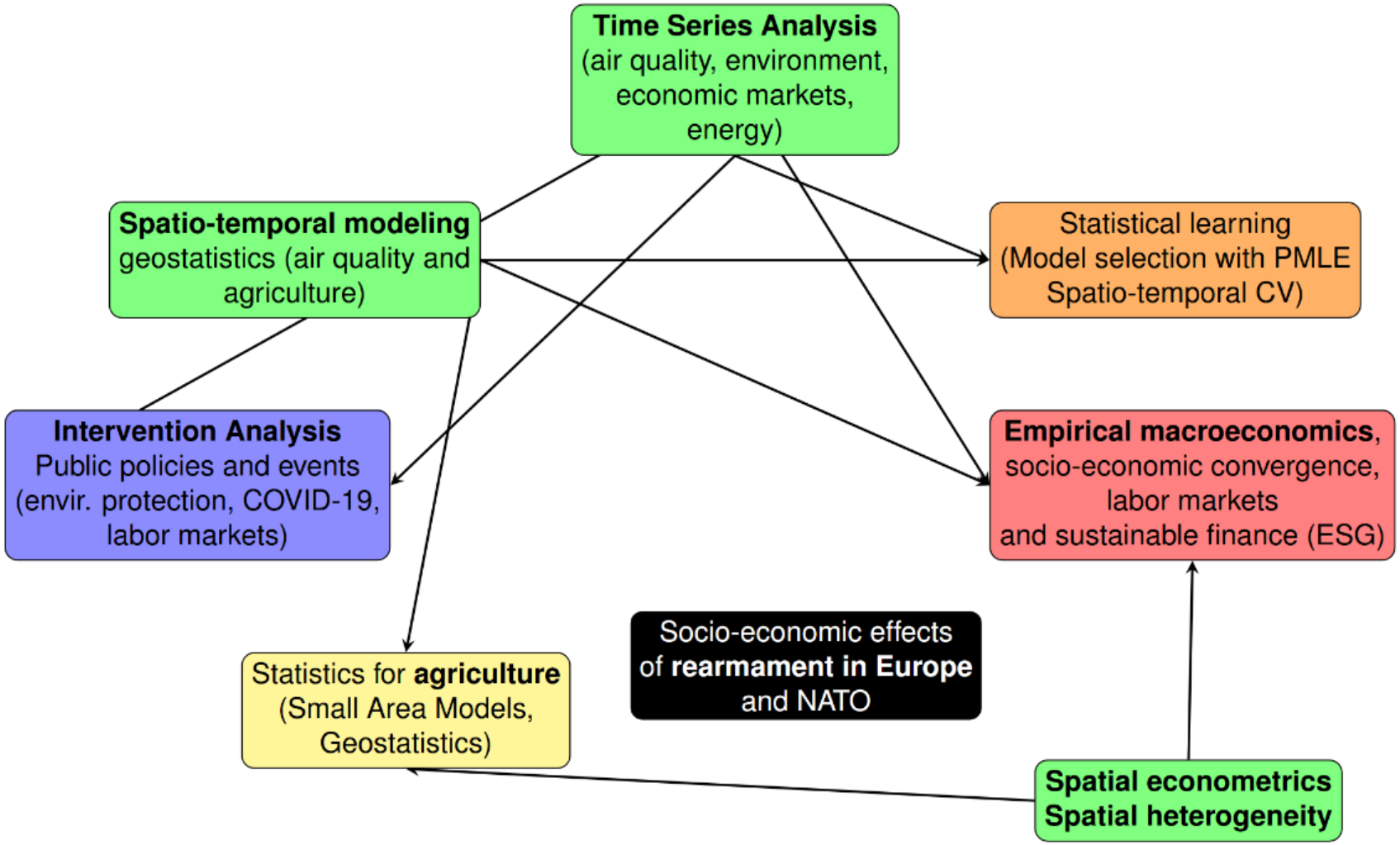
Paolone (https://www.paolomaranzano.net/)



A comprehensive dataset on military, social and macroeconomic dynamics in Europe

Since 2023 our research group (Mario Pianta, Marco Stamegna, Sara Mombelli & Friends) spent several time in building a comprehensive dataset

- On the **joint dynamics** of military expenditure and macroeconomic indicators
- For **European-NATO** countries
- In the **long-run until nowadays**
- The project is still ongoing and constantly updated.

Data are **open-source** and **publicly available** for the Society through a dedicated **GitHub** folder:

https://github.com/PaoloMaranzano/MacroDefenseNATOEU.git

Institutional* data sources

Source	Examples of variables (≈ 160)
NATO	Defense expenditure (with composition) and military personnel
SIPRI	Trend Indicator Values for arms trade
Eurostat/Eurostat - ARDECO	Macroeconomic and social indicators and R&D (e.g., inflation, GDP, etc.)
Eurostat - COFOG	Composition of public expenditure by mission/scope
OECD – STAN/AMECO	Manufacture-specific and military-specific indicators (e.g., trade, GVA, investments, employment, etc.)
OECD - ICIO	Trade-specific indicators (e.g., final goods, intermediate goods, etc.)
OECD - MSTI	Government budget allocation in R&D
OECD – SOCX	Social expenditure
WB – WDI	Government expenditure by sector (e.g., education, health, total expenditure, etc.)

* Data source always affects the quality of the information: if possible, always rely on institutional sources (often are accompanied by technical documentation and metadata) → Know your data!

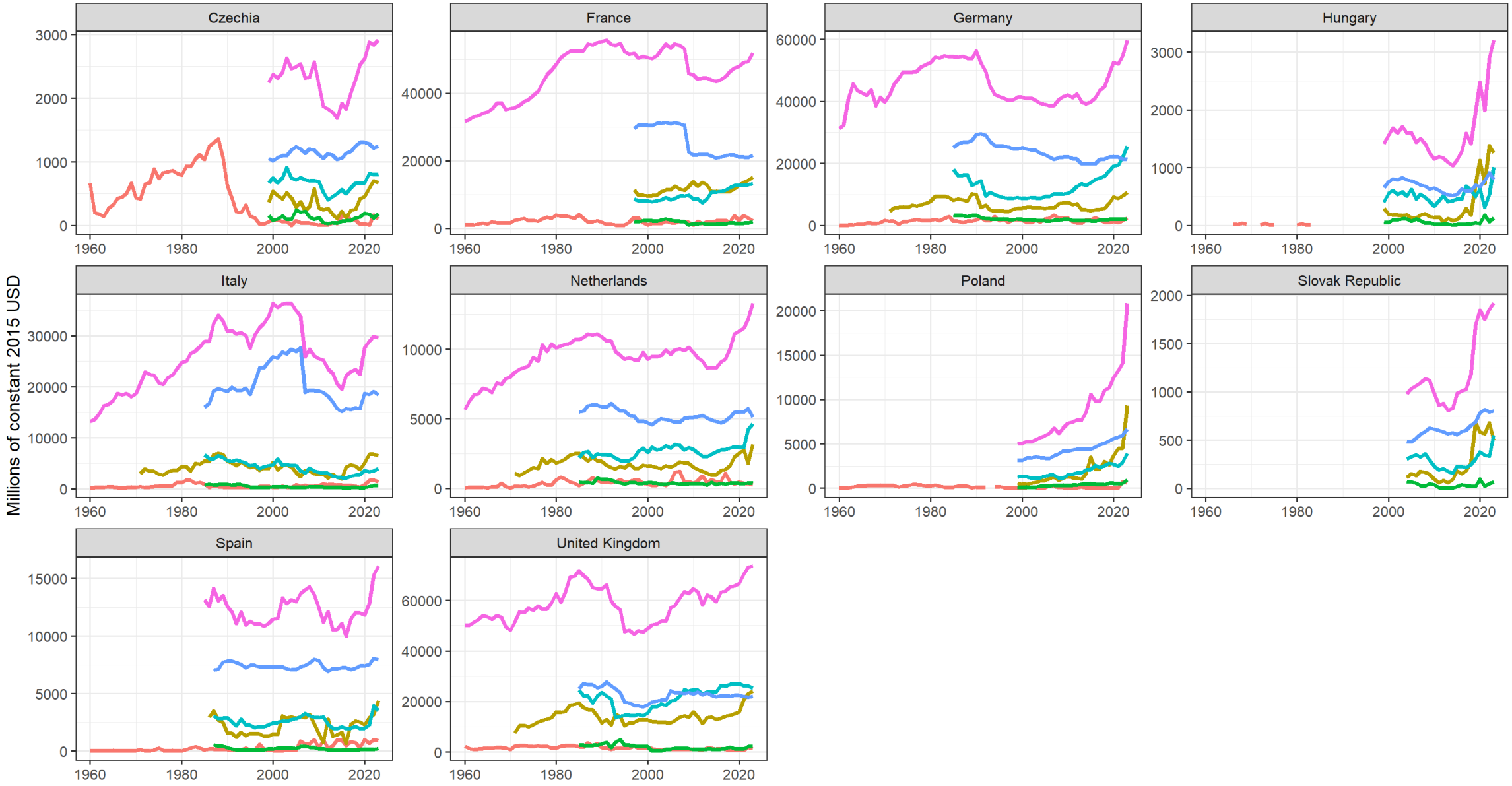
Data quality

Data features	Examples of variables
Spatial coverage	15 NATO-EU countries: Bulgaria, Czechia, France, Germany, Estonia, Hungary, Italy, Latvia, Lithuania, Netherlands, Poland, Romania, Slovak Republic, Spain, United Kingdom
Temporal coverage	Depends on the indicator and the country, but in the largest case from 1960 to 2023
Completeness rate*	Depends on the indicator and the country, but data are in general complete from 1995 to 2023
Update	Most of the data are automatically updated through software routines
Extensions	While temporal extensions seem to be unrealistic, an enlargement of the spatial coverage (e.g., to non-EU countries as US) is feasible

* Missing data imputation is not always the best choice and needs to carefully consider several caveats:

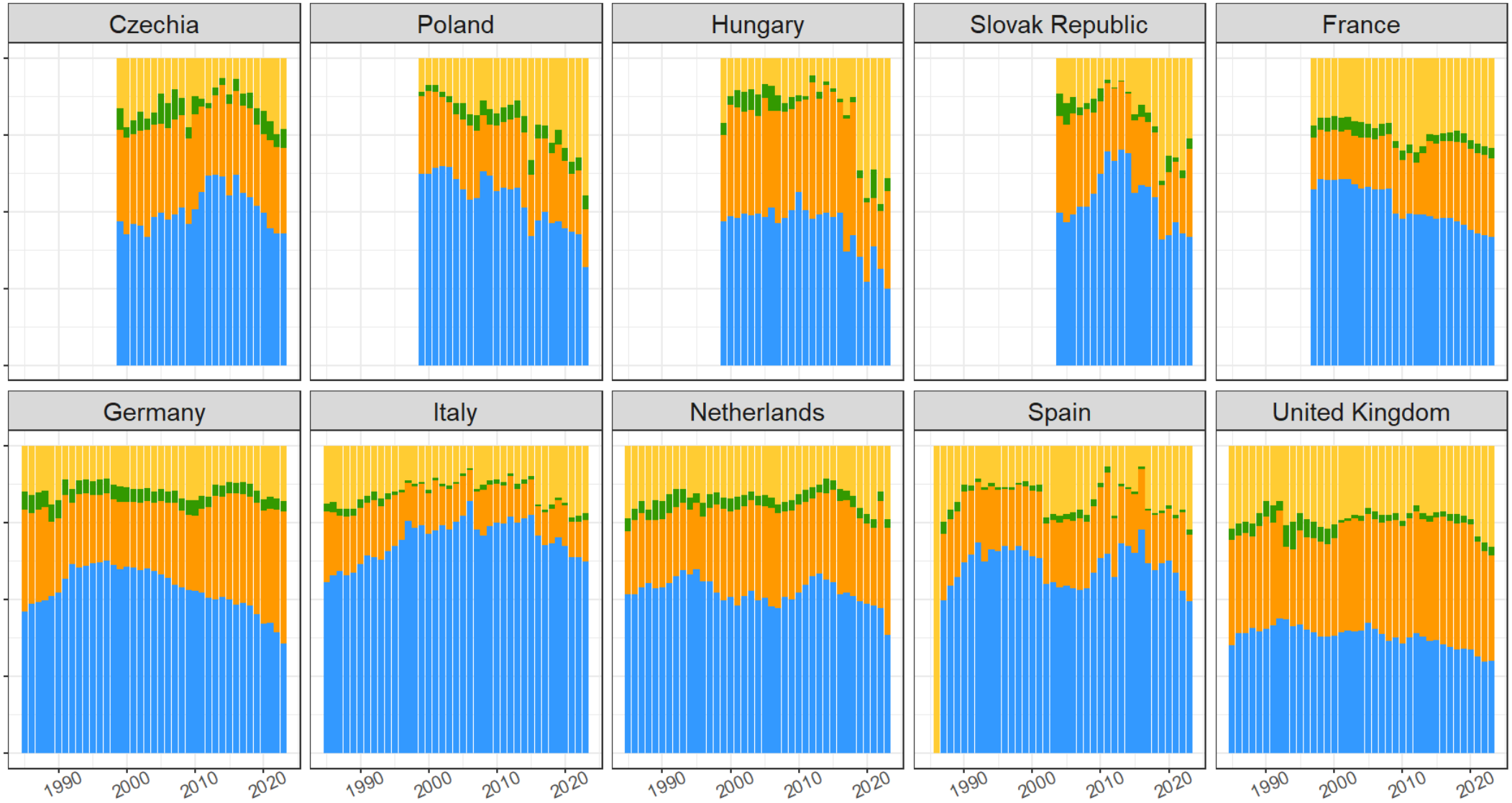
1. Model-based imputation (e.g., regression) VS unconditional imputation (e.g., use the mean)?
2. Indicator-specific imputation VS multivariate imputation?
3. Country-specific imputation VS Spatio-temporal imputation?

Defence expenditure and breakdown (source: NATO)



Composition of total defence expenditure

Source: NATO

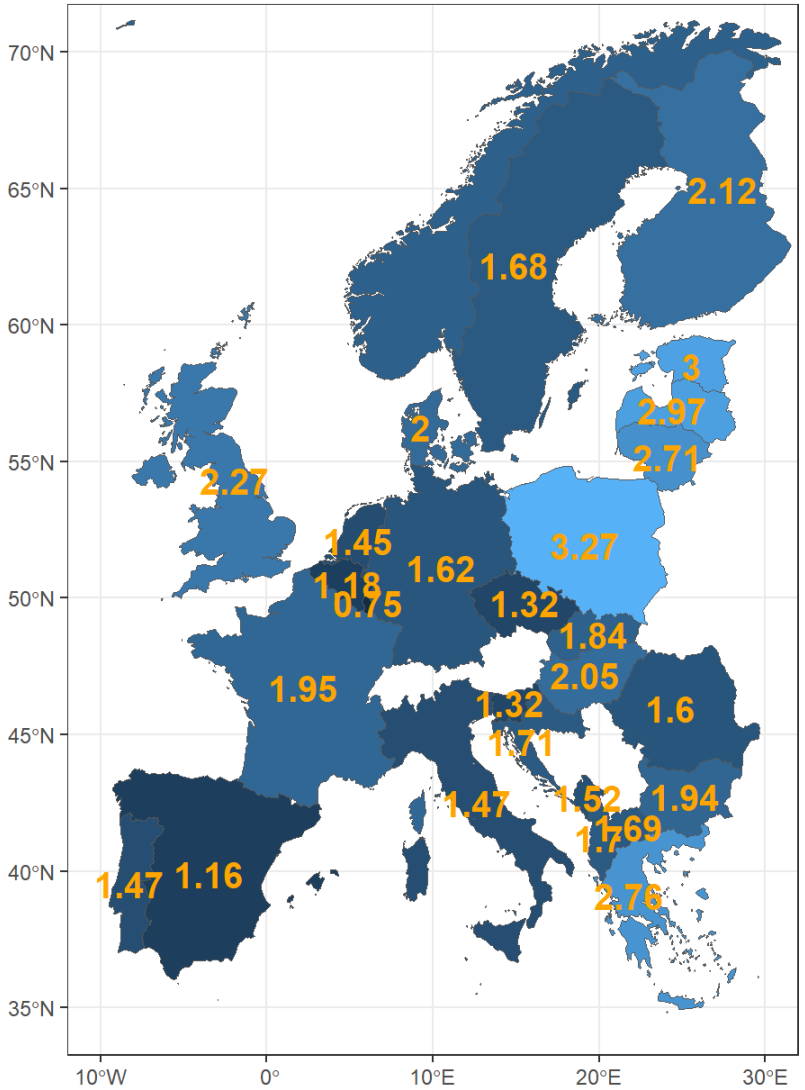


The issue of spatio-temporal comparison

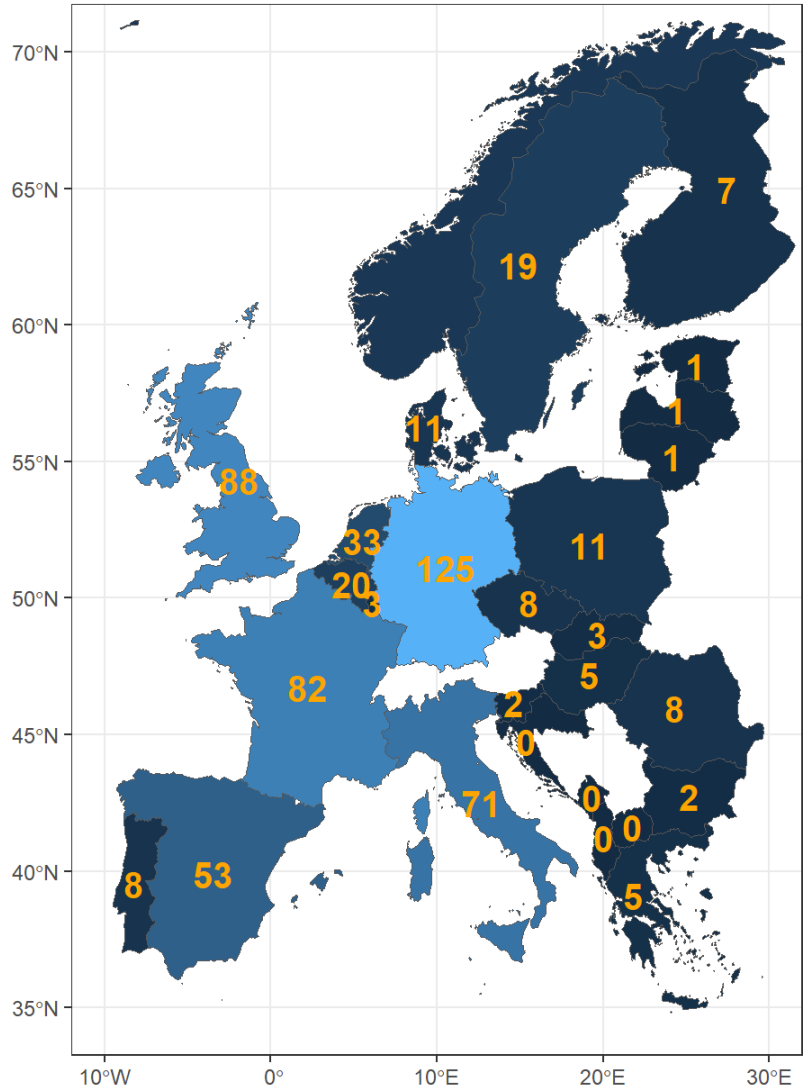
When **combining-comparing-modeling** data for **long temporal spans** and many **areas/countries** we need to consider several issues

1. **Prices**: adjust for inflation and/or purchase power parity
2. **Standardization**: comparison are often affected by the scale of the data (e.g., can I compare the total military expenditure of US with Slovak Republic?)
   - Consider standardizations or normalizations (e.g., per capita or intensity)
   - Communication is strongly affected by the scale
3. **(Dis)Similarities across areas**:
   - Countries (or blocks) may exhibit similar patterns across time which can be justified in light of socio-economic History → Consider "rational" (not heuristic) aggregation
   - Countries may also exhibit very specific patterns (e.g., shocks) → Consider adjusting for such events
4. **Long VS Short run relationship**: the variables can mutually behave differently across long and short periods:
   - A pair of countries can exhibit different degrees of correlation according to the time range
   - Consider temporal partitioning (e.g., blocks of years, sub-periods)

Share of GDP in spesa military/defense (NATO definition) in 2023



How many billions of USD we should invest to achieve 5% of GDP?



Elaboration by di PM on NATO data

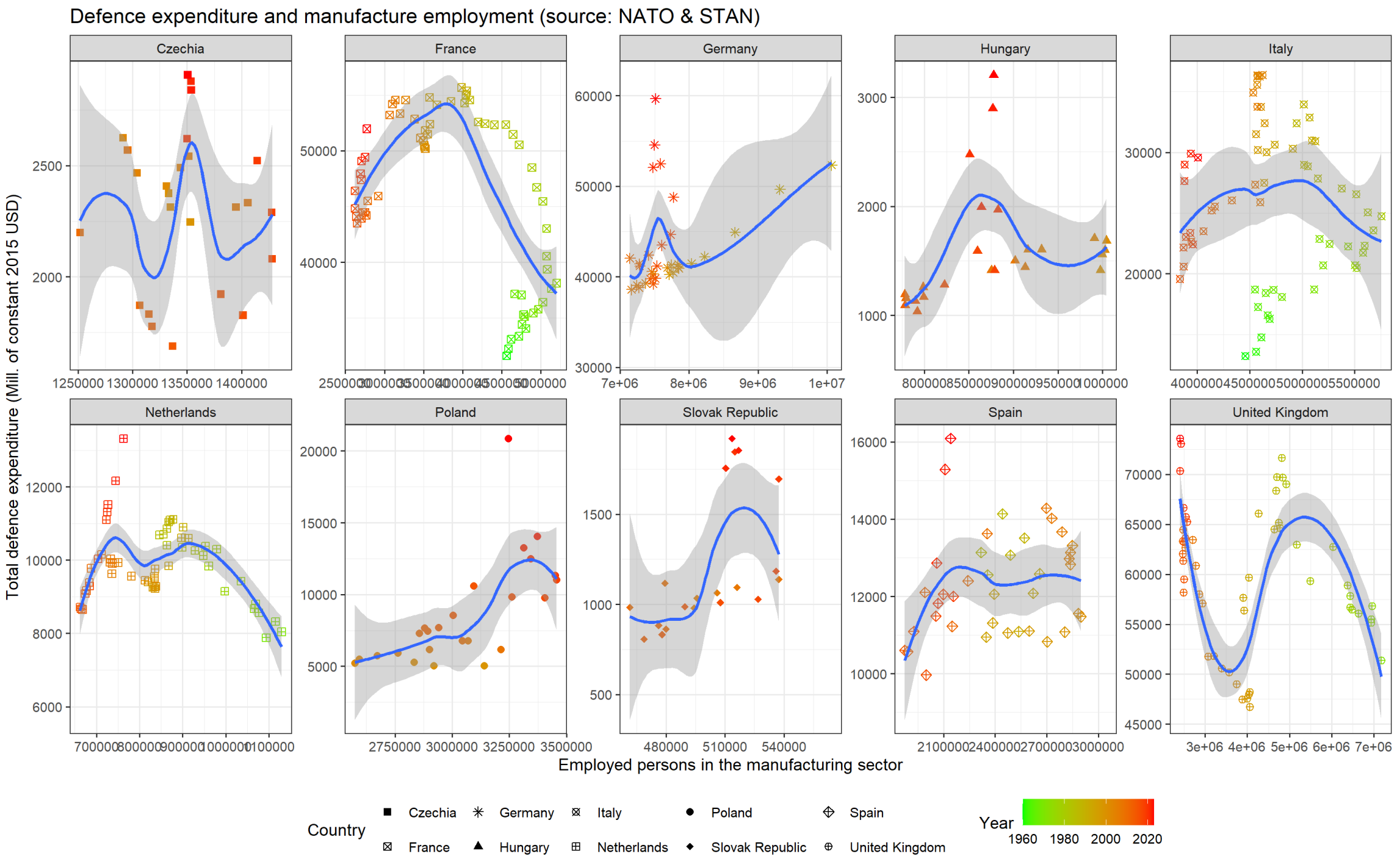
Left: share is computed as the ratio of defense expenditure over GDP (constant prices base = 2015) in 2023.

Right: the vlaue is computed as the difference between 5% of GDP and effective defense expenditure in 2023.

Some modeling issues

When **modeling** (e.g., regression) socio-economic data many interesting things can happen during the empirical stage…

1. **Start with a deep Exploratory Data Analysis (EDA):** explore your data across all the available dimensions (i.e., space, time, indicators) and extract the real value added of your data (i.e., the underlying information)
2. **Specificities:** try to adjust your models according to the EDA and field-knowledge (e.g., why to ignore the Great Recession is my data contains the 2008-2011 period?)
3. **(Non-)Linearity**: while linear models can offer a large set of empirical insights, do not restrict yourself to "too simple" (i.e., unreliable) models → Statistics moved on very fast in the last decades and now offers more powerful tools that do not require computational efforts (… but need to be properly understand!)


Defence expenditure and manufacture employment (source: NATO & STAN)
Czechia
France
Germany
Hungary
Italy
Netherlands
Poland
Slovak Republic
Spain
United Kingdom
Total defence expenditure (Mill. of constant 2015 USD)
Employed persons in the manufacturing sector
Country
Czechia
France
Germany
Hungary
Italy
Netherlands
Poland
Slovak Republic
Spain
United Kingdom
Year
1960
1980
2000
2020

Thank you!