Prison Overcrowding

Data Visualization Pitch

Student Individual Assignment

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Research questions

Which are the European countries with the highest prison overcrowding in the 2022, and how has their occupancy rate evolved over time?

- How many European countries exceed 100% prison occupancy rate in the 2022?

- Which countries have been most successful in keeping occupancy below capacity in the 2022?

- What are the regional differences (North vs South Europe) in prison overcrowding?

- Are their trends improving, stable, or worsening over the 2014-2022 period, compared to the overall European average?

About Data

Dataset

Eurostat Prison capacity and number of persons held (eurostat)

Temporal coverage: 2014-2022 (9 years)

Geographic scope: 37 European countries (EU27 + Balkans + Nordic countries)

Total records: 1,454 observations

Known issues

Some small countries (Liechtenstein, Cyprus, Malta) have volatile year-to-year variations due to small prison population

Missing data for a few countries in specific years (e.g. North Macedonia: only 2016-2023)
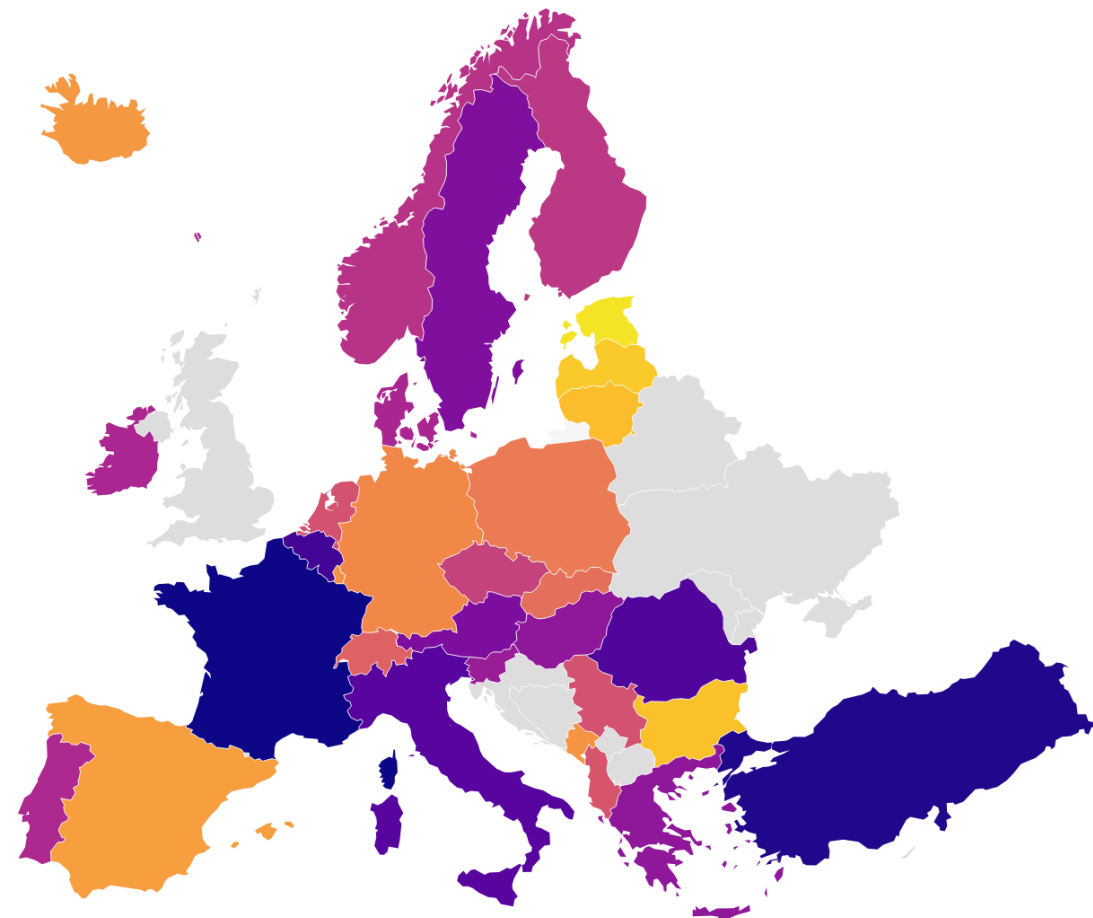
Methodology

Software & Libraries
- Python 3.12 (Jupyter Notebook environment)
- pandas (data manipulation, pivot tables, filtering)
- plotly (interactive visualization)

Methodology
- Built a Jupyter notebook workflow to read, standardize, and normalize prison data from CSV files using pandas
- Created reusable Python functions in a dedicated module (prisons_data_analysis.py) for data transformation
- Each function outputs an intermediate CSV, serving as input for visualization and further analysis
- Generated charts directly from intermediate CSVs using Plotly
- Created a European prison overcrowding map (2022) using Data Wrapper Choropleth

Processing Steps
- Read CSV and standardized column names
- Converted TIME_PERIOD to integer years and pivoted data by country/year
- Calculated occupancy rate: (prisoners/capacity) × 100
- Normalized all rates as percentages for consistency
- Identified countries exceeding 100% prison occupancy in 2022
- Extracted the top 10 most overcrowded countries (2022)
- Segmented countries into North/South regions and compared statistics (mean, min, max, count)
- Generated time series for 4 countries with occupancy < 1,000 inmates (Iceland, Malta, Cyprus, Liechtenstein)
- Used LLM Copilot (Visual Studio Code) for code review and validation

European prison overcrowding map in 2022

58.72   118.96

Color scheme
- Orange: <80% (good, below capacity)
- Pink: 80-100% (acceptable, at capacity)
- Violet: 100-110% (overcrowded, critical)
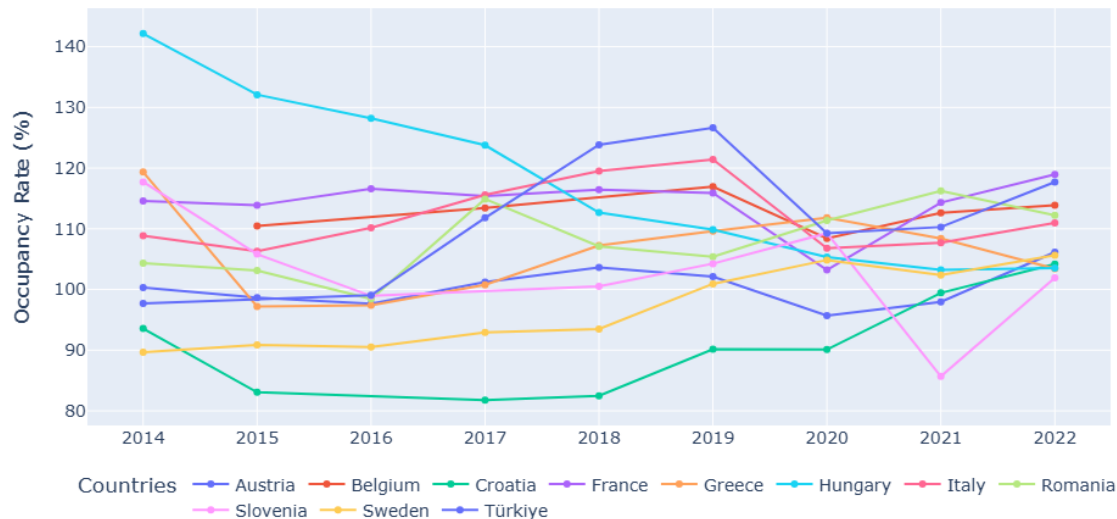- Blue: >110% (severe overcrowding, emergency)

What the map shows
- 13 countries highlighted in violet/blue: Exceeding 100% capacity
- Top 3 worst: France (118.96%), Turkey (117.70%), Romania (112.21%)
- EU27 average: 95.7%
- Best performers: Estonia, Malta, Latvia, Bulgaria, Ireland (62-75%)

Key insight
Prison overcrowding is concentrated in Southern and Central Europe, not uniformly distributed. Northern European countries successfully maintain capacity well below 100%, suggesting policy/system differences.

Created with Datawrapper

European countries exceed 100% prison occupancy in 2022

Time series line chart (2014-2022) showing prison occupancy rate evolution across European countries exceeding 100% capacity, **excluding smaller countries**.
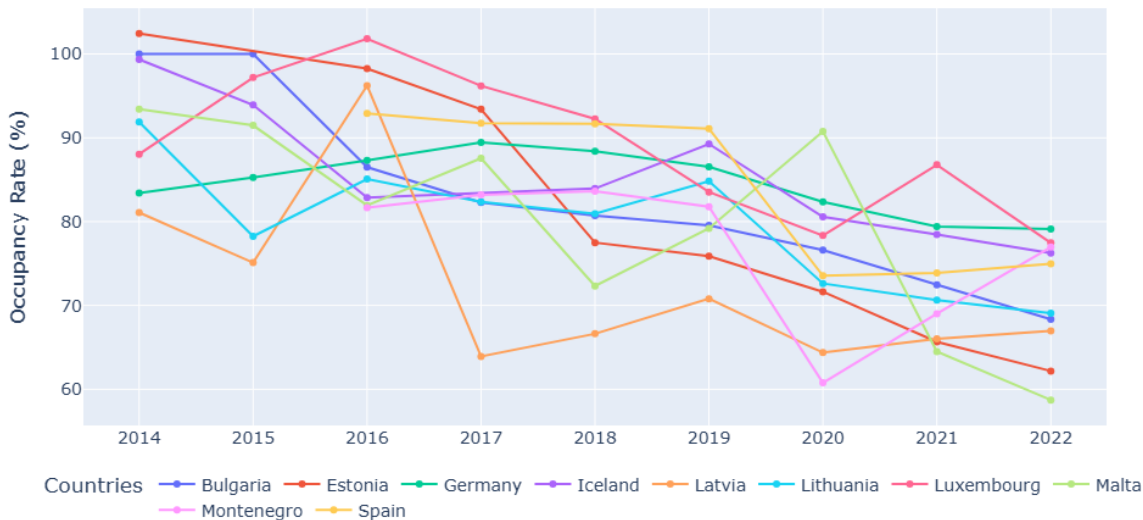
Key Insights

- 10-year horizon: **overcrowding is not temporary**, it's a structural issue in Southern Europe
- Regional patterns: countries like France, Belgium, Italy and Romania show sustained overcrowding, indicating systemic capacity deficits rather than cyclical pressures

Divergent trajectories

- **Hungary displays a consistent downward trend**, declining from 142% (2014) to 104% (2022), suggesting successful prison decongestion policies
- **Croatia shows the opposite pattern**, rising from 94% (2014) to 104% (2022), indicating worsening overcrowding despite initial lower capacity pressure

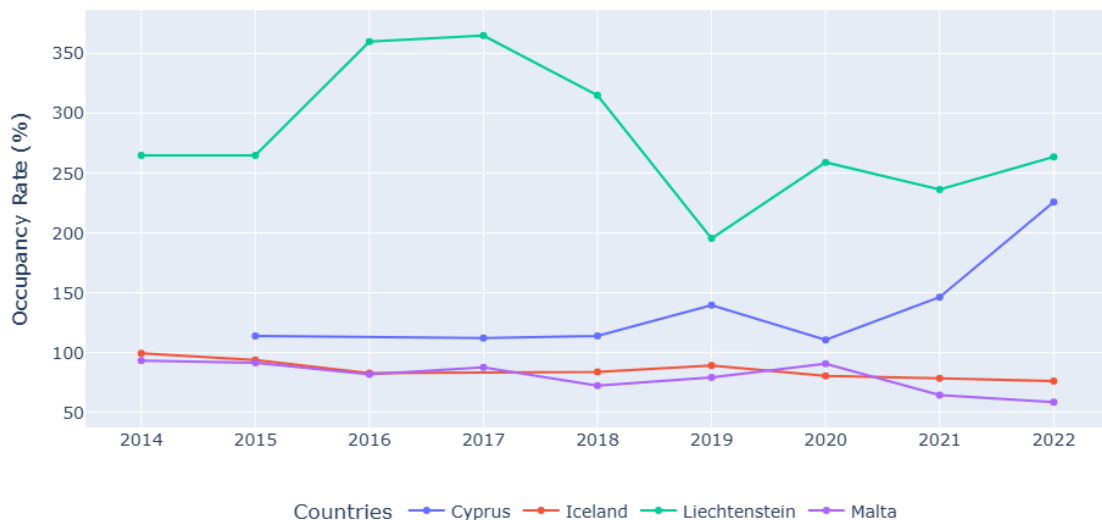# Prison capacity management success across Europe in 2022

Time series line chart (2014-2022) showing prison occupancy rates for **10 European countries consistently maintaining capacity below 100%**, demonstrating effective prison management systems.

Key Insights

- Consistent capacity management: countries like Estonia, Bulgaria, Malta, and Lithuania have achieved sustained occupancy rates well below 100%, with rates ranging from 58-79% in 2022
- **Diverse starting points**: while Estonia started above 100% (102.43% in 2014), it successfully decongested to 62.18% by 2022—demonstrating that capacity reform is achievable
- Stable trajectories: **Germany and Spain maintain steady, moderate occupancy rates** (79% and 75% respectively), reflecting long-term prison management sustainability
- Policy success model: These countries represent best-practice examples of prison system organization, particularly through **strategic decongestion policies** (visible in Estonia and Bulgaria)

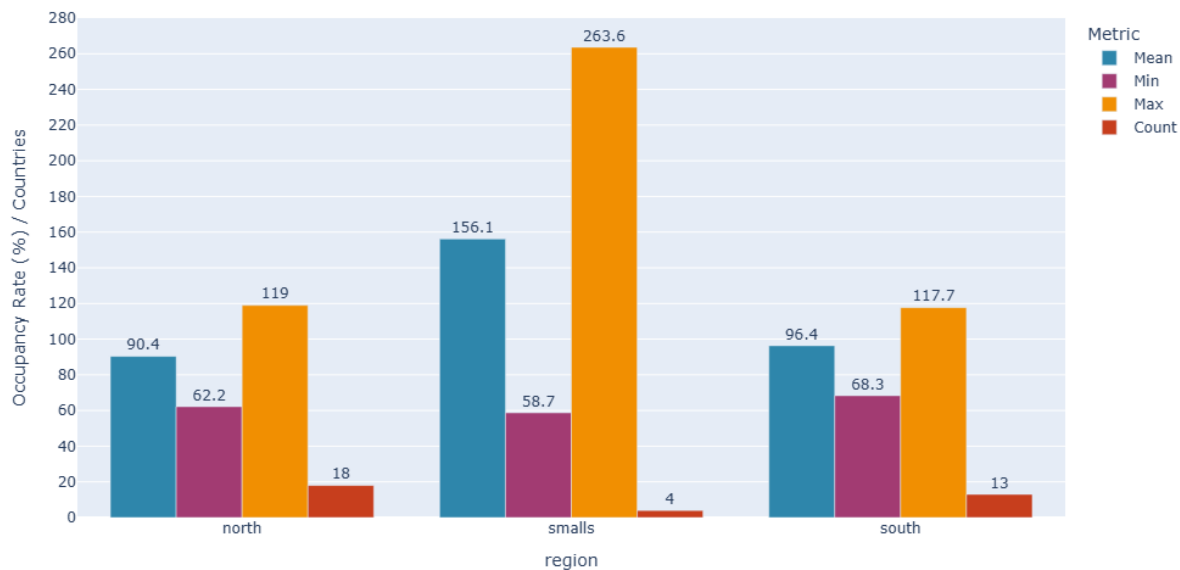# Prison population trends in smaller European systems (2014-2022)

Time series line chart (2014-2022) tracking prison occupancy rates in **Europe's smallest prison systems**: Cyprus, Iceland, Liechtenstein, and Malta.

Key Insights

Extreme volatility in small populations: with absolute prison populations under 1,000, these micro-systems exhibit dramatic occupancy fluctuations. **A single admission or release represents a significant percentage change in system capacity**

- Cyprus: climbs from 114% (2018) to 226% (2022)— a 99-point surge driven by minimal absolute population changes
- Liechtenstein: Oscillates between 195-365% occupancy across the decade—reflecting its ultra-small prison population (typically <200 inmates)
- Malta & Iceland: Show more moderate volatility, with Malta achieving decongestion (93% → 59%) and Iceland maintaining steady efficiency (99% → 76%)

Prison capacity divides Europe: North vs South divergence in 2022

Bar chart comparison (2022) analyzing regional prison capacity patterns across 35 European countries, segmented into Northern Europe (18), Southern Europe (13) and smaller systems (4).

Key Insights

• Northern Europe leads in capacity management: mean occupancy of 90.40% indicates systematic efficiency, with controlled variance (min 62.20%, max 119%)
• Southern Europe approaches threshold: mean occupancy of 96.40% remains below 100% at aggregate level, yet proximity to capacity threshold signals structural strain, with ceiling at 117.70%
• Micro-countries exhibit extreme volatility and are therefore analyzed separately
• Regional disparity is structural: the 6-point gap between North (90.39%) and South (96.35%)

European Prison Overcrowding: Key Findings

- Structural overcrowding persists: 11+ European countries exceed 100% occupancy consistently across the 2014–2022 decade, indicating systemic rather than cyclical patterns

- North-South capacity buffer disparity: Northern systems operate with ~10% capacity margin above current occupancy; Southern systems operate with ~4% margin—creating differential structural resilience

- Hungary's downward trajectory: prison occupancy declined from 142.16% (2014) to 103.51% (2022) a 38.65-point reduction demonstrates long-term trend reversal is empirically possible

- Croatia's inverse pattern: prison occupancy rose from 93.56% (2014) to 104.18% (2022), indicating divergent regional trajectories despite similar geographic proximity

- Micro-systems show extreme volatility: Smaller jurisdictions (Cyprus, Iceland, Liechtenstein, Malta) exhibit 50–205 percentage-point swings across the decade, reflecting the amplified impact of population-scale variations

"Prison overcrowding"

by Giorgio Evola

Developed using data from the Eurostat database, with charts and analyses produced in Python.

Dataset: Eurostat Prison capacity and number of persons held (last update 23/04/2025 11:00).

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