ISI Paper Series — Paper 3

External Supplier Concentration in the EU-27: Empirical Findings of the International Sovereignty Index (2024)

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Abstract

Analytical brief based on the ISI Paper Series (Papers 1–2). Data basis: EU-27, Methodology v1.0, Vintage 2024. The ISI is a six-dimensional composite indicator of external supplier concentration. This document summarises the principal empirical results and provides a structural interpretation. The contribution is a systematic quantification of structural heterogeneity within the EU-27.

Data basis: ISI Paper 2 — EU-27, Methodology v1.0, Vintage 2024.
Methodology: ISI Paper 1 — Methodological Foundations, Version 1.0.
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Related publications in the ISI Paper Series:
ISI Paper 1 — Technical Specification (v1.0) — DOI: https://doi.org/10.5281/zenodo.18764227
ISI Paper 2 — EU-27 Empirical Results 2024 (v1.0) — DOI: https://doi.org/10.5281/zenodo.18764170

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1 Executive Summary

Core finding. The International Sovereignty Index (ISI) is a six-dimensional composite indicator of external supplier concentration. Its empirical application to the EU-27 (vintage 2024) shows that the cross-sectional variance of composite scores is predominantly determined by two of the six axes: defence and logistics. This result is a descriptive variance finding — not a conceptual reduction of the index to two dimensions.

Principal empirical results:

- The ISI composite score ranges from France (0.236; rank 27) to Malta (0.517; rank 1). The EU-27 mean is 0.344 with a standard deviation of 0.070.
- The covariance-based variance decomposition yields the following: the defence axis contributes 35.1 % to composite variance; the logistics axis 34.3 %. Together, these two axes account for 69.4 % of total cross-sectional variance.
- The remaining four axes — finance, energy, technology, critical inputs — jointly contribute 30.6 %. Their values are distributed comparatively homogeneously across the EU-27 cross-section.
- In 16 of 27 member states, the defence axis records the highest individual axis score; in the remaining 11, the logistics axis does. None of the other four axes records the highest score in any member state.
- Removing the defence axis from the composite produces the largest rank displacement (Spearman $\rho = 0.833$ relative to the baseline ranking). All other single-axis removals yield correlations above 0.94.
- Under Dirichlet weight perturbation (10 000 draws), the mean rank-order correlation is $\rho = 0.979$. The rank ordering is stable under moderate weight variations.
- **Austria** ranks 8th (composite score 0.383; moderately concentrated). Highest axis score: defence (0.585), followed by logistics (0.526). The rank position is structurally stable — under no single-axis perturbation does Austria shift by more than two ranks.

2 What the ISI Measures

The ISI is a composite indicator that measures the *concentration of external suppliers*. For each EU member state, it captures the extent to which imports in six strategically relevant domains depend on a small number of external suppliers. The index comprises six equally weighted dimensions:

Table 1. The six ISI axes and their coverage domains.

Axis	Coverage domain
Finance	Cross-border banking and portfolio concentration
Energy	Dependence on a small number of primary energy suppliers
Technology	Import concentration in high-technology goods
Defence	Supplier concentration in arms transfers and defence-relevant imports
Critical Inputs	Concentration in critical raw materials and intermediate goods
Logistics	Dependence on a small number of transport corridors and shipping routes

Each axis score is based on a Herfindahl-Hirschman-type concentration measure, normalised to the unit interval $[0,\ 1]$. A value of zero denotes complete diversification; a value near one denotes near-complete dependence on a single external supplier. All six axes are identically scaled.

The composite score is the *equal-weighted arithmetic mean* of the six axis scores. The aggregation is deterministic — no estimation, no latent factors, no model selection. The methodology is fully documented: Paper 1 [1] presents the methodological framework; Paper 2 [2] documents the empirical application to the EU-27.

Scope and interpretation. The ISI does not measure "sovereignty" in the normative or constitutional sense. It captures a specific, quantifiable structural property: the degree of concentration of external supply relationships. High concentration is not inherently negative — it may reflect geographical proximity, trade efficiency, or alliance structures. It does, however, imply that the country's position is exposed to disruptions in a small number of supply relationships.

3 Structural Differentiation within the EU-27

3.1 Variance Contributions of the Six Axes

The ISI is conceptually a six-dimensional index. All six axes enter the composite score with equal weight and contribute to the absolute concentration level of each country. The empirical question of this section is different: which axes determine the *differences* among member states?

Since all six axes are identically normalised to the interval $[0,\ 1]$ and enter the composite with equal weight, the covariance-based variance decomposition is directly interpretable. The cross-sectional variance of composite scores is predominantly determined by two axes:

Table 2. Variance decomposition of the ISI composite score, EU-27.

Axis	Share of composite variance
Defence	35.1 %
Logistics	34.3 %
Critical Inputs	20.9 %
Technology	5.2 %
Energy	3.5 %
Finance	1.0 %
Defence + Logistics	69.4 %
Remaining four axes	30.6 %

Approximately 64 % of total variance is attributable to own-variance (dispersion of each axis across countries); 36 % is attributable to cross-covariances (joint variation across axes). Defence and logistics dominate both components.

Methodological note. The variance decomposition is purely descriptive. It identifies which axes statistically determine cross-sectional variance — not which axes are politically paramount. An axis may be of the highest political relevance yet contribute little to cross-sectional differentiation if all member states exhibit similar values on that axis. Political priority and statistical differentiation are analytically distinct categories.

The finding implies that structural heterogeneity within the EU is not uniformly distributed across all strategic domains but concentrated in a small number of dimensions. Integration-policy tensions are more likely where national profiles diverge substantially.

3.2 Why Energy and Technology Differentiate Less

Energy dependence is of high relevance for many member states. Across the EU-27 cross-section, however, it differentiates countries less strongly than defence and logistics. The reason is empirical: energy concentration scores exhibit comparatively low dispersion. Most member states display similar degrees of energy supplier concentration. The same applies to the technology axis.

Both axes contribute to the absolute concentration level of each country but generate smaller differences among countries than defence and logistics.

3.3 Axis Dominance at the Country Level

In 16 member states, the defence axis records the highest individual axis score; in 11, the logistics axis does. None of the remaining four axes records the highest score in any member state. This pattern describes the empirical distribution of axis maxima — it does not imply that the ISI can be conceptually reduced to two axes. The index remains a six-dimensional instrument; the observed two-axis dominance is a finding about the data, not about the construction.

4 Austria in the EU-27 Context

Austria ranks 8th of 27 with a composite score of 0.383. It is classified as "moderately concentrated" — the same category as 23 of the 27 member states.

Table 3. Austria's axis profile.

Axis	Score	Axis rank (of 27)
Defence	0.585	11th
Logistics	0.526	10th
Energy	0.456	3rd
Critical Inputs	0.319	7th
Technology	0.261	5th
Finance	0.149	11th

Austria's highest axis score is on defence (0.585), followed by logistics (0.526). The gap between the two is 0.059 — Austria does not exhibit a strongly asymmetric axis profile.

Energy concentration. Austria's third-highest axis score is energy (0.456), rank 3 in the EU. This reflects the documented dependence on a small number of gas suppliers. Because energy concentration is distributed comparatively homogeneously across the EU cross-section, it affects Austria's composite ranking only marginally.

Profile balance. Austria's coefficient of variation across the six axes is 0.40 — a comparatively balanced axis profile. For comparison: Sweden (rank 7; composite score 0.399) records a defence score of 0.881 but a finance score of only 0.116 — a substantially more asymmetric profile.

Rank stability. Under leave-one-out analysis — the systematic removal of each individual axis — Austria's rank shifts by at most two positions. Under Dirichlet weight perturbation (10 000 Monte Carlo draws), Austria's rank standard deviation is approximately 1.1. The 95 % confidence interval spans ranks 6 to 10. Austria's position in the upper middle range is structurally robust.

Neighbourhood. Austria is situated between Sweden (rank 7; 0.399) and Italy (rank 9; 0.374). The distances are 0.016 upward and 0.009 downward. Moderate changes to a single axis could

shift Austria by one to two rank positions; a move into the top 5 or below rank 12 would require substantial structural changes.

5 Robustness of Results

A legitimate concern regarding any composite indicator is the dependence of results on specific methodological choices. Three tests address this concern.

5.1 Leave-one-out Analysis

When each axis is individually removed from the composite, six alternative rankings result. Removing the defence axis produces the lowest correlation with the baseline ranking (Spearman $\rho = 0.833$) — confirming that defence is the single most influential axis for rank differentiation. Removing logistics yields $\rho = 0.926$. All remaining removals produce correlations above 0.94.

The ordering is monotonic: axes with higher variance contributions produce larger rank displacements upon removal.

5.2 Weight Stability

Equal weighting is a design choice. To test its consequences, 10 000 alternative weight vectors are drawn from a symmetric Dirichlet distribution and the composite score is recomputed for each draw. The mean rank-order correlation across all draws is 0.979 — the rank ordering is stable under moderate weight variations.

The highest rank volatility is exhibited by the Netherlands (standard deviation ≈ 3.07 rank positions). This volatility reflects the asymmetric axis profile of the Netherlands: the defence score (0.960) lies far above the level of the remaining five axes. Stronger weighting of the defence axis raises the Dutch rank position; weaker weighting lowers it. For the large majority of member states, the ranking is stable to within one to two positions.

5.3 Correlation Structure

The six axes are largely independent of one another. Of 15 pairwise correlations, only two are statistically significant after Bonferroni correction: energy–technology and critical inputs–logistics. The finance axis is nearly orthogonal to all other axes (highest $|t|$-value: 1.11).

This independence is analytically advantageous: the variance decomposition reflects genuine structural content rather than statistical redundancy. The low multicollinearity prevents artificial variance inflation of individual axes.

6 Interpretation and Analytical Implications

The ISI does not prescribe policy. It provides an empirical measurement basis.

Cross-sectional variance and absolute concentration. Defence and logistics determine cross-sectional variance. It does *not* follow that the remaining axes are irrelevant for individual member

states. A country may exhibit a high absolute concentration score on the energy axis without that score differentiating countries in the cross-section. Political priority and statistical differentiation are analytically distinct categories.

Empirical grounding of strategic debates. The term "strategic autonomy" is ubiquitous in EU policy discourse but rarely linked to comparable, quantitative data. The ISI provides such an anchor point. The variance decomposition shows that defence procurement and logistics corridors generate the largest differences among member states — domains that receive comparatively little attention in public debate relative to energy and technology.

Energy and technology. Energy dependence is of high importance for numerous member states. Across the EU-27 cross-section, however, it differentiates countries less strongly than defence and logistics because energy concentration scores are distributed comparatively uniformly. The same applies to technology. Both axes require independent analysis; their low contribution to cross-sectional dispersion does not diminish their substantive significance.

Austria. Rank 8 places Austria in the upper middle range of external concentration. The comparatively balanced axis profile exhibits neither a singular concentration peak nor an exceptional diversification strength.

Measurement, not evaluation. A high composite score does not mean that a country "performs poorly." Malta's rank 1 reflects size and geographical location, not policy failure. France's rank 27 reflects the structural diversification of a large, well-connected economy. The index measures concentration — what policymakers derive from it is a separate question.

7 Limitations

Re-export bias. Trade statistics capture bilateral flows but do not always identify the actual origin of goods. Countries that function as trade hubs (such as the Netherlands or Belgium) may appear more diversified than they actually are.

Amplification effect for small economies. Small, open economies with a limited number of trading partners mechanically generate higher concentration scores. Malta and Cyprus rank 1st and 2nd in part because geography and size constrain their sourcing options. This is a real feature of their situation, not a measurement error — it should, however, be interpreted accordingly.

Cross-sectional limitation. The dataset captures the 2024 vintage. Supplier concentration may change as a result of political decisions, market developments, or geopolitical events. A single cross-section cannot capture dynamics. Future ISI vintages will enable trend analysis.

Equal weighting. The aggregation treats all six axes as equally important. This is a normative assumption. A decision-maker who regards energy dependence as paramount would apply different weights and obtain a different ranking. The Dirichlet perturbation analysis shows that moderate deviations from equal weighting do not fundamentally alter the results.

This brief is based on the ISI Paper Series (Papers 1–2), prepared by the Research Unit of the International Sovereignty Institute. The underlying data and the complete methodology are publicly documented.

References

[1] International Sovereignty Institute. International Sovereignty Index (ISI) technical specification, version 1.0. Zenodo, 2026. ISI Paper Series, Paper 1. doi: 10.5281/zenodo.18764227.

[2] International Sovereignty Institute. International Sovereignty Index (ISI): EU-27 empirical results 2024 (v1.0). Zenodo, 2026. ISI Paper Series, Paper 2. doi: 10.5281/zenodo.18764170.