

Data Report

CONSTRUCTION OF THE TRADE REDIRECTION AND CIRCUMVENTION EVALUATION RANKING

TRACER

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Version 1, June 2026

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Data Report: Construction of the Trade Redirection and Circumvention Evaluation Ranking (TRACER)

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This report documents the practical and analytical steps taken to develop a composite index evaluating national-level compliance (or lack thereof) with export restrictions against Russia taking into account institutional capabilities and structural constraints. This work builds on a methodological framework originally developed by Corisk (Norway) and State Capture (the Netherlands), first presented at the November 2024 workshop jointly organized by State Capture, Corisk, and SITE. The analysis draws on data from the Corisk Russia Sanctions Barometer and associated trade datasets (<https://corisk.no/en/home-english/>). We are indebted to the broader expert community at sanctionsrussia.org for numerous methodological insights and contributions that have helped shape the development of this project.

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1. Introduction

As a background, following the introduction of export restrictions on war-relevant goods after Russia's full-scale invasion of Ukraine in 2022, distinct patterns emerged in international trade data. Most countries participating in the sanctions coalition sharply reduced or entirely ceased their direct exports of sanctioned goods to Russia. At the same time, exports of the same product categories increased markedly toward a set of third countries, often geographically proximate to or friendly with Russia, that were not part of the sanction regime.

These developments raise an important policy question. Although aggregate trade patterns suggest the existence of sanctions circumvention, they provide only limited insight into the role played by individual countries. High levels of trade diversion may reflect deliberate evasion, weak enforcement capacity, or structural factors such as geographic proximity and pre-existing trade relationships with Russia. Distinguishing between these explanations is essential for identifying where sanctions enforcement is most likely to be ineffective and where additional policy attention may be warranted.

This report develops a composite index designed to evaluate national-level performance with export sanctions compliance, while accounting for the country's capacity as well as structural conditions that shape incentives and opportunities for evasion. The objective is not simply to identify countries associated with elevated levels of sanctions-related trade diversion, but to assess whether observed outcomes are consistent with what would be expected given a country's institutional capabilities and structural exposure.

2. From trade patterns to the TRACER index

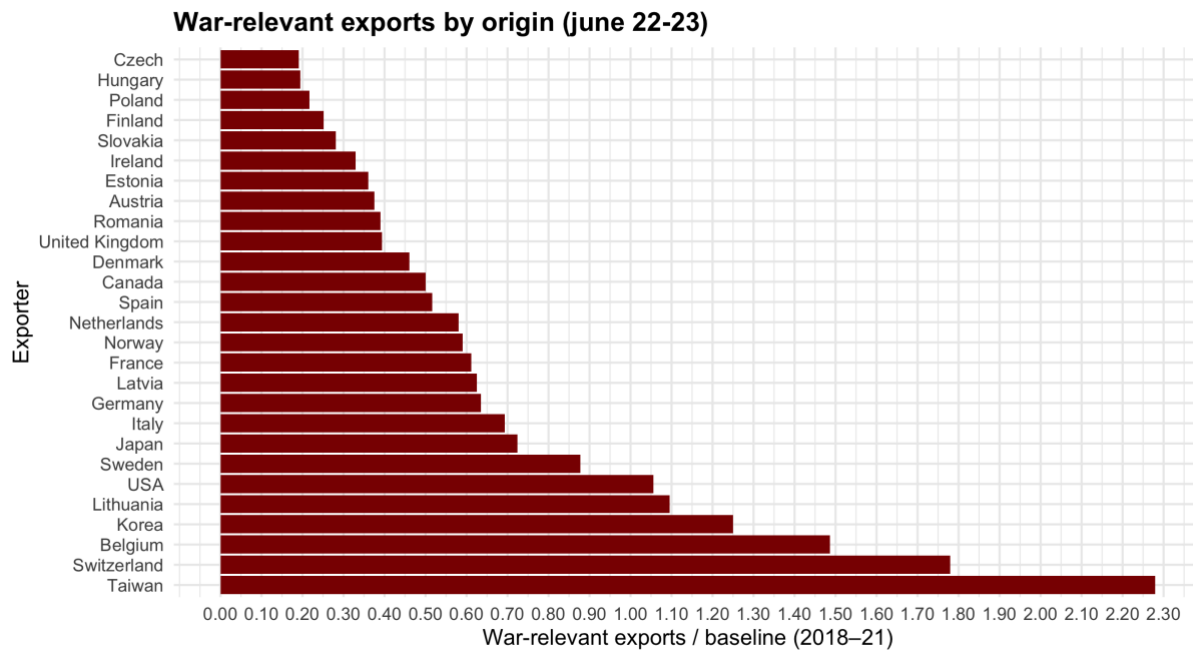
2.1. Trade flows with Russia

As a starting point, Figure 1 examines trade flows as recorded in Russian customs data. In these data, imports are classified by country of origin, defined as the country in which the goods were produced, regardless of the transit route or intermediary jurisdictions through which they pass before reaching Russia. The figure plots the post-invasion imports of 61 categories of sanctioned goods¹ by country of origin, expressed relative to each country's pre-war exports of the same goods to Russia. While most countries exhibit values below parity, indicating a decline relative to pre-war level, the observed magnitudes remain well

¹ We selected the war-relevant goods based on two criteria: their relevance to the war effort and the fact that they were sanctioned early in the period under study. This makes them analytically useful for examining sanctions evasion across the whole time period. The complete list of categories is reported in the Appendix.

above zero. This suggests that observed trade flows fall short of what full compliance with export restrictions would imply.

Figure 1: War-Relevant Exports to Russia by Country of Origin (June 2022 – June 2023)



Notes: The figure plots export by origin of 61 groups of sanctioned goods. The full list of categories is reported in the Appendix. Data are from the Russian customs records.

Figure 1 relies on Russian customs data up to the first half of 2023, after which the reliability of these data is generally considered to deteriorate. However, concerns about the quality and completeness of Russian customs statistics also extend, albeit to a lesser degree, to the earlier period. To address this limitation, an alternative approach uses official UN Comtrade data, in which countries other than Russia report their exports and imports. This allows trade flows recorded by exporters to be compared with those reported by partner countries. This approach focuses on unusually rapid growth in exports toward a selected group of intermediary countries, markets sufficiently small relative to the exporter and/or to the specific product category that large increases are difficult to explain solely by ordinary domestic demand expansion. These increases often substantially exceed what would be expected based on pre-war demand trends² in the destination countries. These flows are

² We assume a baseline growth rate of 20 percent relative to the pre-war period, with an additional 4 percentage points for each subsequent year. This adjustment is intended to account for inflation in exporting countries and general growth in importing markets. The chosen rate is conservative, based on the observation of 25 Western exporter-countries' inflation in 2022 (USA 8%, EU 10%) and the real economic growth of the intermediary countries (average 8%) (Corisk, Briefing to the *German Economic Team*, 12 April 2023, unpublished). For comparison, the highest growth rate observed in any of these countries in the 15 years previous to 2022 is 10,9 percent observed in 2013 in Kyrgyzstan. While in principle the inflation rate should be trade-weighted and could differ across countries and product categories, we assess the sensitivity of the results by varying the threshold

therefore treated as “excessive exports”, and may indicate subsequent re-routing to Russia.³

Figure 2 plots, for each country in our sample, the ratio of post-invasion excessive exports of war-relevant goods to selected intermediary countries⁴, relative to pre-war exports of the same goods. The data are based on consignment (last-exporter) trade statistics, meaning that flows are attributed to the country from which the goods were last exported before entering an intermediary market. Most countries display positive excess exports, and in some cases these increases are several times larger than historical levels. Although the magnitude of these excessive exports differs considerably across countries and years, they remain substantial when benchmarked against pre-war exports to Russia. This benchmark may be viewed as a lower-bound proxy for Russian demand prior to the invasion. For instance, a ratio of 0.40 implies that a Western country’s excess exports to intermediary countries amount to 40 percent of the Western country's pre-war exports to Russia.

Several patterns stand out. First, a relatively stable group of countries, including Canada, Spain, Lithuania, Slovakia, and, increasingly, Sweden and Czechia, consistently appear among the largest sources of excess exports across years and specifications. Second, country rankings are broadly similar whether excess exports are normalized by pre-war exports to the intermediary group or by pre-war exports to Russia, suggesting that the results are not driven solely by the choice of denominator. Third, several countries, most notably Korea and to a lesser extent Japan and the Netherlands, display persistently negative values, indicating weaker-than-expected export growth to these intermediary markets. Finally, the

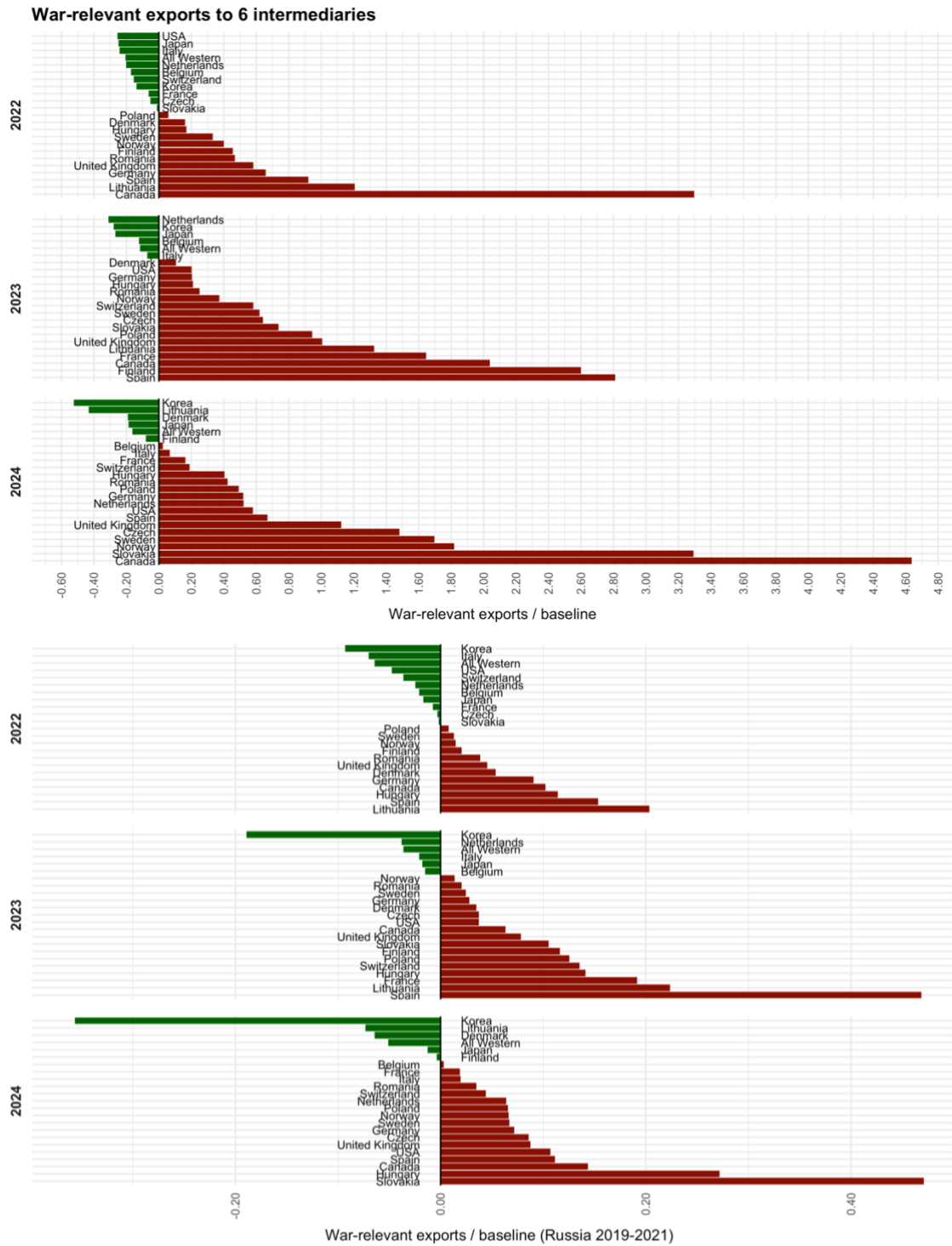
between 0 and 40 percent. The resulting country rankings remain remarkably stable. This suggests that the identified excess exports are generally well above any plausible benchmark for normal trade growth, such that reasonable changes in the threshold primarily affect the level of the measure rather than the relative ranking of countries.

³ Another possible source of error – that the excessive Western exports to intermediary countries simply offset a comparable decline in these countries’ trade with Russia or other partners, has been equally ruled out by recording strong increases in the intermediaries’ *total* imports. In 2022, the total imports from all countries in nominal US dollars increased 62.5% in Armenia, 34% in Georgia, 23% in Tajikistan, 21.8% in Serbia, and 18.3% in Uzbekistan, indicating that all countries observed considerable and often above-normal import growth under sanctions. For comparison, in 2022 total global trade increased by only 12.3% nominally, notwithstanding partial Covid-19 trade catch-up.

⁴ It is important to emphasize that the measure captures abnormal trade redirection rather than proven sanctions circumvention. However, the interpretation of excess exports as potential re-exports to Russia becomes more compelling when intermediary markets are relatively small, the goods involved are dual-use or otherwise strategically relevant, historical trade patterns have been stable, and the timing of the increase coincides with the introduction of sanctions. This creates a trade-off between precision and coverage. Restricting the analysis to smaller intermediary economies provides a cleaner signal, as large increases in exports are less plausibly explained by domestic demand alone. However, such an approach captures only part of the overall diversion of trade. Broader intermediary groups that include countries such as Turkey, China, or the United Arab Emirates are likely to account for a larger share of total rerouting activity, but the resulting excess-export measure becomes more difficult to interpret, since genuine market expansion and sanction-related re-export are harder to disentangle.

magnitude of excess exports generally increases over time, with the strongest signals appearing in 2024.

Figure 2: Excessive War-Relevant Exports to Six Intermediary Countries (2022–2024)



Notes: The figure plots export by consignment of 61 groups of sanctioned goods (the full list of categories is reported in the Appendix) to 6 intermediaries: Armenia, Georgia, Kyrgyzstan, Serbia,

Tajikistan, Uzbekistan. Other known intermediary countries are excluded due to identification challenges. For example, Azerbaijan imports capital goods for its own oil sector, making it difficult to distinguish domestic use from potential re-exports. Several of these jurisdictions also serve as intermediaries for multiple sanctioned countries, notably Iran and UAE, which complicates attribution specifically to Russia. In addition, economies such as China and Hong Kong account for such a large share of global trade that isolating abnormal or Russia-bound trade flows from aggregate data is not feasible with sufficient precision.

The evolution over time is also important. Several countries move from negative or neutral values in 2022 to clearly positive excess exports by 2024, suggesting a gradual adaptation of trade networks to the post-sanctions environment and an increasing ability to exploit intermediary-country channels.

In contrast, countries such as Lithuania, Finland, and Denmark move from positive excessive exports in 2022 to negative values by 2024. This pattern is consistent with a tightening of export controls, increased corporate compliance efforts, and the closure of previously important transit channels, reducing the scope for trade diversion through intermediary countries.

These trade patterns reveal substantial cross-country variation, but they do not, by themselves, provide a sufficient basis for comparing evasion risks or compliance performance. Trade quantities alone, however, do not provide a comparable basis for meaningful cross-country comparisons. Countries differ substantially in their initial exposure to Russian trade, geographic and logistical conditions, institutional capacity to implement new regulations, and prevailing norms of corporate and public-sector compliance. Such factors influence trade patterns independently of deliberate evasion or enforcement effort.

To address this limitation, we introduce the Trade Redirection and Circumvention Evaluation Ranking (TRACER). The TRACER index is designed to support more meaningful cross-country comparisons by combining observed trade-diversion patterns with country-level measures of institutional capacity, corporate compliance, and structural exposure.

2.2. TRACER index logic

The selection of indicators for the TRACER index is guided by several strands of literature, which identify mechanisms through which compliance is shaped at multiple levels, country, organizations, and individuals. The most important of these are deterrence and enforcement capacity, transparency and information availability, and domestic political accountability. Deterrence reflects both the formal legal framework and the effectiveness of enforcement institutions in detecting and penalizing violations. Transparency captures the availability of information necessary for monitoring and compliance, including financial and corporate disclosure. Political accountability reflects the extent to which governments face domestic incentives to enforce sanctions credibly.

The literature also highlights the importance of complementary factors operating at the firm and environmental levels. Firm-level compliance capacity captures the ability of companies

to implement internal controls and manage sanctions risk, while the broader crime environment reflects the incentives and opportunities for illicit behavior.

In addition, compliance outcomes are conditioned by structural constraints and exposure that are particularly relevant in the context of trade restrictions. These include geographic, economic, and network characteristics—such as trade infrastructure, connectivity, and openness—that shape both the opportunities for evasion and the effectiveness of enforcement, but are not themselves direct policy levers.

While these mechanisms provide the conceptual basis for indicators selection, the index is operationally organized into four pillars representing distinct dimensions of country-level capacity:

- Pillar 1: Legal Frameworks
- Pillar 2: Government Enforcement
- Pillar 3: Corporate Compliance
- Pillar 4: Constraints and Moderators

Legal frameworks determine the formal scope and clarity of applicable rules and sanctions; government enforcement captures the ability and willingness of public authorities to monitor, investigate, and penalize violations; corporate compliance reflects firms' internal controls, risk management practices, and exposure to regulatory oversight; and constraints and moderators capture structural factors, such as geography, trade infrastructure, and economic openness, that condition both the opportunities for evasion and the effectiveness of enforcement.

This approach ensures that the index remains grounded in the theoretical determinants of sanction compliance while providing a structured, policy-relevant decomposition of country-level capacities.

3. Data and methodology

3.1. Indicator dataset

The construction of the TRACER index is based on a broad set of publicly available indicators intended to capture countries' capacity to implement and enforce sanctions. Initial data collection produced 102 variables covering legal and regulatory frameworks, enforcement capacity, governance quality, financial transparency, anti-money laundering systems, corporate integrity, and broader institutional characteristics. The indicators were drawn from a range of established international sources, including V-Dem, World Justice Project, FATF, Fragile States Index, Transparency International, IMD (WCR), Ocindex, Bertelsmann (BTI), Basel Institute, Fraser Institute, IDEA, World Bank (WGI), CGGI, TRACE.

The analysis covers the period 2022–2024 and includes both sanctioning countries and intermediary countries identified in the trade analysis presented in Section 2. Table 1 reports

the country classification. For indicators that are reported less frequently than annually or remain constant over time, the most recent available value is carried forward to create a balanced panel. The resulting dataset contains 114 country-year observations.

Before aggregation, all indicators are normalized to ensure comparability across sources and measurement scales. Indicators with known theoretical bounds are scaled linearly to the [0,1] interval using those bounds, and reversed when necessary so that higher values consistently indicate stronger compliance capacity. Indicators without natural bounds are standardized within each year and subsequently rescaled to the [0,1] interval using a min-max transformation. All normalization is performed separately for each year to preserve cross-country variation while avoiding distortions arising from changes in the distribution of indicators over time.

The initial set of indicators is subsequently screened for statistical quality and relevance. Variables exhibiting extremely limited variation, excessive missingness, or substantial redundancy with other indicators are removed. This process reduces the dataset from 102 to 85 indicators.⁵

Table 1: Country Classification by Sanctions Role

<i>Intermediary Countries</i>	<i>Sanctioning Countries</i>
<i>Armenia</i>	Austria
<i>Azerbaijan</i>	Belgium
<i>Belarus</i>	Canada
<i>Georgia</i>	Czech Republic
<i>Kazakhstan</i>	Denmark
<i>Kyrgyzstan</i>	Estonia
<i>Serbia</i>	Finland
<i>Tajikistan</i>	France
<i>Turkey</i>	Germany
<i>Uzbekistan</i>	Greece
	Hungary
	Ireland
	Italy
	Japan
	South Korea
	Latvia
	Lithuania
	Netherlands
	Norway
	Poland
	Romania
	Slovakia
	Spain
	Sweden
	Switzerland
	Taiwan
	United Kingdom

⁵ The full list of indicators with sources is provided in the Appendix.

3.2. Identifying the Compliance-Capacity Dimension

To identify the common underlying dimension of compliance capacity reflected in the institutional indicators, we apply Principal Component Analysis (PCA) to the indicators belonging to Pillars 1–3, which capture legal frameworks, enforcement capacity, transparency, and broader governance characteristics. Pillar 4 variables are excluded from the PCA because they capture structural exposure rather than compliance capacity. Their role in the methodology is explained in Section 3.4, where they are incorporated into the regression-based index.

Not all indicators are included in the analysis. The most sanctions-specific Pillar 1 variables—maximum prison sentences, criminal convictions since 2017, enforcement actions, and strict liability provisions—are excluded from the PCA because they are extremely sparse, available for only a limited number of countries, and exhibit little variation over time. Including such variables would risk giving disproportionate influence to indicators whose statistical properties are weaker than those of the broader governance measures. These variables are nevertheless retained in the construction of the equal-weight Pillar 1 score described below.

We apply PCA to the full set of retained indicators across Pillars 1–3 rather than conducting separate analyses at the pillar level. This choice reflects a common feature of governance-related data: indicators capturing legal frameworks, enforcement capacity, transparency, and corporate compliance are often manifestations of a broader latent dimension of institutional quality. As a result, countries that perform strongly in one domain tend to perform strongly across others, generating substantial correlation among indicators.⁶ Running separate PCAs for each pillar would therefore be misleading. Because the same underlying country-level factor drives variation across multiple dimensions, each pillar-specific PCA would largely recover a similar first component, effectively duplicating the same signal and overstating the multidimensionality of the index.

Missing values are imputed using the `missMDA` package, which applies iterative PCA-based imputation with cross-validated selection of the number of components. All variables are standardized prior to PCA to ensure that no indicator dominates the results because of residual differences in variance.

⁶ A similar challenge is addressed in the World Governance Indicators (WGI), which employ an Unobserved Components Model (UCM) to aggregate highly correlated governance measures into a single latent construct, rather than attempting to extract multiple independent dimensions (Kaufmann, Kraay, and Mastruzzi, 2010).

The analysis reveals a dominant first principal component (*PC1*), which captures the primary axis of cross-country variation in compliance capacity. Figures 3 and 4 present the scree plot and the variable contribution chart. The results show that indicators from all three compliance-capacity pillars contribute positively and in the expected direction, supporting the interpretation of *PC1* as a coherent measure of overall compliance capacity. We therefore use *PC1* as the basis for the composite compliance index constructed in the following section.

Figure 3: Scree Plot – Global PCA (*PC1* Explains 41% of Variance)

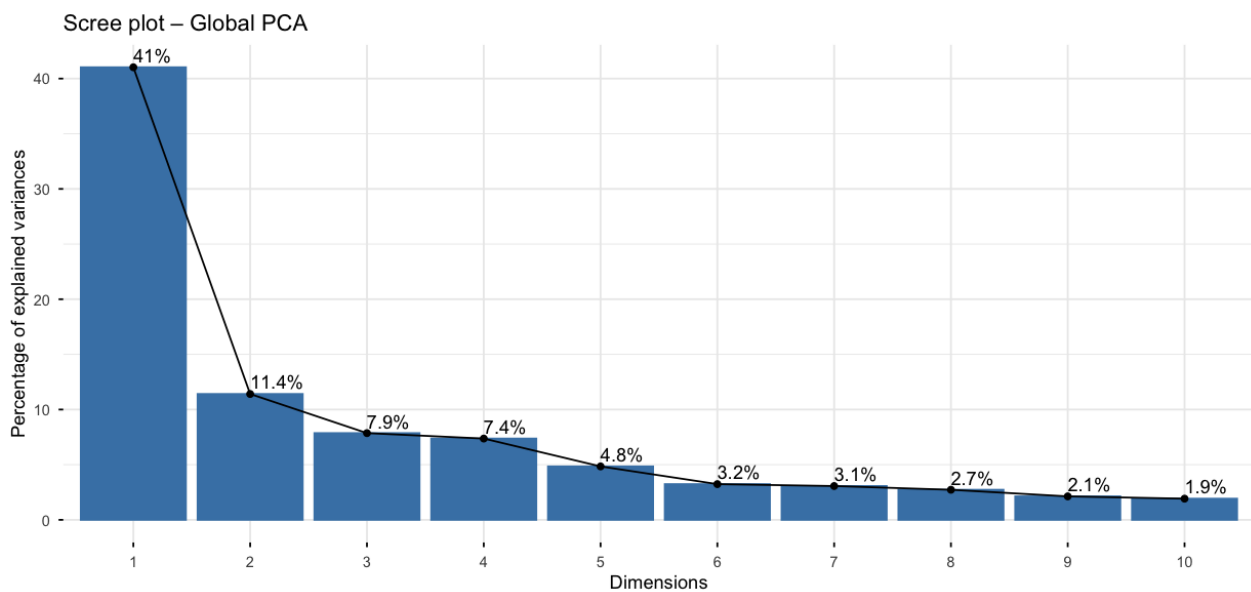
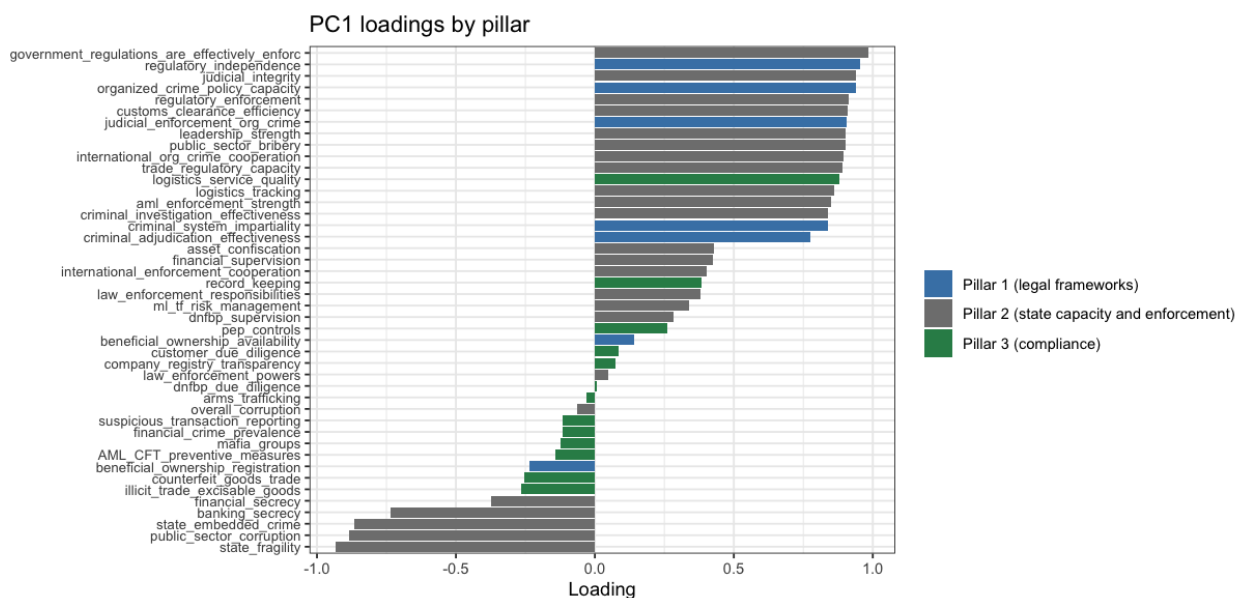


Figure 4: *PC1* Loadings by Pillar



We proceed with the construction of the index in three steps, using two complementary aggregation approaches. First, unsupervised methods summarize countries' compliance capacity directly from the indicator data, without reference to observed sanctions outcomes. This produces a PCA-based composite index (Section 3.3) and equal-weight pillar scores (Section 3.4). Second, a supervised approach (Section 3.5) links these measures to realized trade patterns, anchoring the index in observable outcomes.

3.3 PCA-based Composite Index

PCA is a dimensionality-reduction method with no causal interpretation. The composite compliance index is based directly on the PCA results described above. Each country's score corresponds to its projection onto the first principal component (PC1), which captures the overall compliance capacity across legal, enforcement, and governance indicators. PC1 is oriented so that higher values indicate stronger compliance capacity, anchored to a governing capacity reference variable. Scores are rescaled to [0, 100] within each year. The index is computed for all countries in the sample, including intermediary countries that have not enacted sanctions legislation against Russia. This reflects the fact that this index measures a theoretical capacity for compliance, based on institutional and structural characteristics, rather than observed compliance behavior.

3.4 Equal-Weight Pillar Scores

We also construct equal-weight (EW) scores for each of the four pillars, including pillar 4. They are intended as diagnostic breakdowns of the composite index. For each pillar, the EW score is the unweighted average of its normalized indicators after flipping the sign of contrarian variables (those where a higher raw value indicates worse performance, such as corruption or fragility indices). Scores are rescaled to [0, 100] within each year. The EW pillar scores are intended as diagnostic tools to understand which institutional dimensions drive a country's position on the composite index, not as standalone indices. They are reported in the Appendix.

3.5 Regression-based Index

The third and final step links compliance capacity to observed sanctions-evasion outcomes. A regression approach maps the composite PCA score to realized trade patterns that are compatible with sanction evasion or trade diversion. This analysis is conducted only for coalition countries, for which sanction evasion is a well-defined concept, and excludes intermediary countries.

Three outcome variables are constructed:

- **Target 1:** Excessive export of war-relevant goods (61 categories) to six intermediary countries (Armenia, Georgia, Kyrgyzstan, Serbia, Tajikistan, and Uzbekistan), attributed by consignment to the last Western country the goods transited before reaching the intermediary. This measure is related to the *negative of* export enforcement and customs capacity.

- **Target 2:** Export to Russia of the same goods, attributed by origin to the country of production (Russian customs data, available only until mid-2023), irrespective of consignment country. This measure is related to the *negative of* corporate compliance.
- **Target 3:** Share of foreign-made battlefield components identified in Russian military equipment and attributed to the country of manufacture, based on data compiled by the Kyiv School of Economics (KSE). This measure captures a particularly salient indicator of the extent to which goods originating in a country ultimately appear in Russian military systems. This measure is available only for 2023.

The baseline target is constructed as an equal-weighted average of Targets 1 and 2 when both are available; otherwise, Target 1 alone is used. To incorporate evidence from battlefield recovery data, a second target specification adds Target 3 as a penalty term. Because the three measures are expressed in different units, each is first normalized to a 0–100 scale. The final target is then calculated as the average of the normalized values of Targets 1 and 2, plus an additional contribution from normalized Target 3. This adjustment increases the target value for countries whose products are disproportionately represented among foreign components recovered from Russian military equipment.

The outcome is regressed on the composite PCA index and the contextual exposure variables (Pillar 4). Fitted values represent the part of abnormal trade that can be structurally predicted with this model⁷, i.e. the level consistent with a country’s institutional and structural characteristics. Residuals capture over- or under-performance relative to that structural baseline. The two resulting measures are interpreted as indicators of expected versus actual success with the enforcement effort.

⁷ The predictive power of this model is limited, given that it is not a trade model but rather based on proxies of compliance.

4. Results

4.1 Composite Compliance Index

Figure 5: Composite Compliance Index by Country (PC1, Global PCA, 2022–2024)

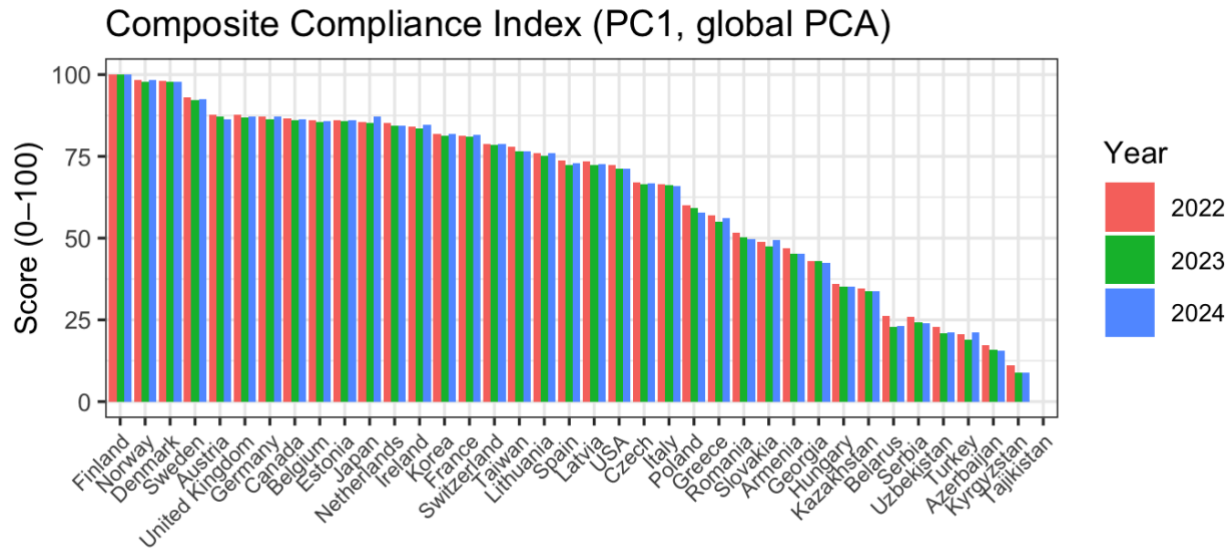


Figure 5 shows the distribution of the composite compliance index — the score on PC1 from the global PCA — across countries for each year. Higher values indicate stronger overall compliance capacity: a country with a high score combines strong legal frameworks, effective government enforcement, and sound corporate governance. Because the index is standardized and based on principal components, it captures relative positioning within the sample rather than compliance with a fixed external standard. Differences in scores represent comparative strength across countries.

The distribution displays a clear and relatively smooth gradient in enforcement capacity, with no extreme outliers and a fairly continuous decline from the highest- to the lowest-ranked countries. The top of the ranking is led by Nordic countries and a broader mix of advanced European economies (including Western and Central Europe), along with a few other highly developed OECD members. Scores then decline gradually through Southern and Eastern Europe, with several Balkan, post-Soviet, and Central Asian countries appearing toward the lower end. The distribution shows a fairly smooth gradient rather than a sharp split, indicating steady cross-country variation without clear clustering into just high and low groups.

The overall ranking remains relatively stable over time. Some upward movements are visible in 2024, that in a few cases reflect substantive changes. For example, Turkey and Japan show improvements in customer due diligence indicators.

4.2 Pillar Scores

Equal-weight pillar scores for all four pillars are reported in the Appendix. They serve as diagnostic tools, decomposing each country's overall position on the composite index into its four constituent dimensions: legal framework, government enforcement and governance, corporate compliance and financial oversight, and structural exposure.

4.3 Regression-based Index

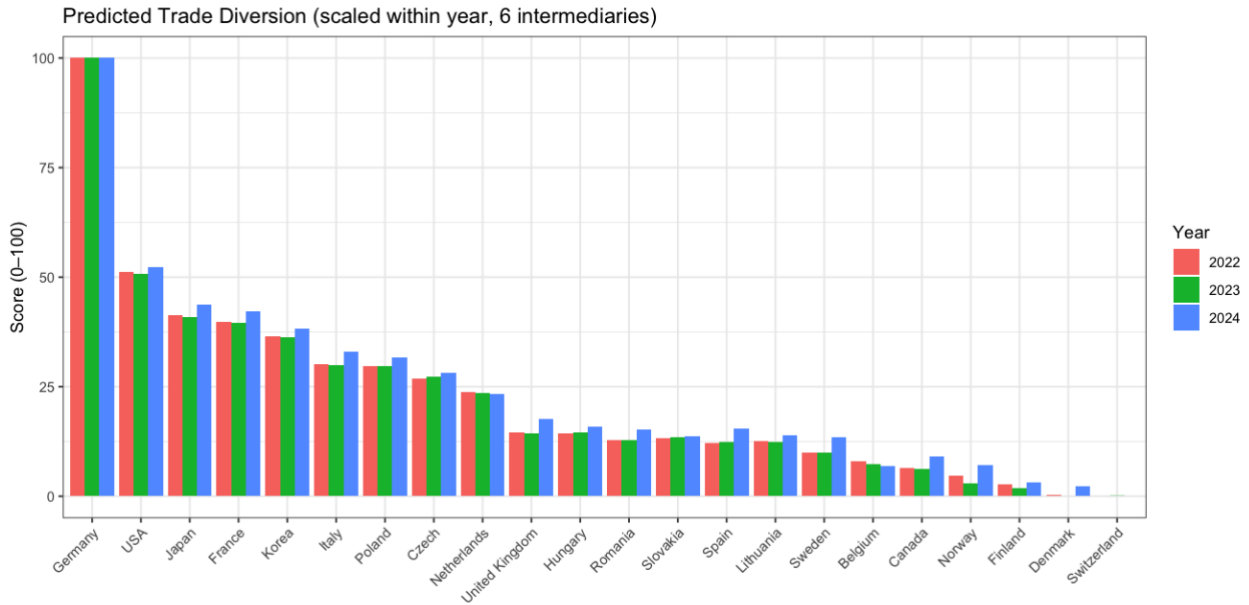
Figure 6 ranks countries by structurally predicted trade diversion, derived from the regression described in Section 3.5. The results are interpreted as follows.

Predicted trade diversion identifies where evasion pressure *should* be high, given pre-war trade links, contextual factors, and institutional capacity. It captures structural vulnerability and, as shown in Figure 6.b, generates a relatively stable cross-country ranking across the three years. The comparison with Figure 5 highlights that enforcement capacity and structural exposure are distinct dimensions. The PCA index orders countries by capability, whereas predicted trade diversion, by taking into account also realized trade patterns, orders them by structurally implied evasion pressure, combining capacity with trade integration and scale. The relationship between institutional capacity and predicted trade diversion is therefore not one-to-one. A country may rank high in Figure 5 due to strong enforcement institutions and still rank high in Figure 6 if its economic scale and trade centrality generate substantial structural exposure to trade with Russia and the six intermediaries. Germany illustrates this pattern: despite relatively strong institutional capacity, its logistical centrality and pre-war trade links imply elevated structural evasion pressure.

At the same time, countries near the top of the predicted trade diversion ranking are drawn from across the capability distribution. Germany (upper-middle in capacity), South Korea (middle), and USA (middle-lower tier) all appear among those with high predicted trade diversion, indicating that structural exposure can outweigh differences in institutional strength.

Conversely, some high-capacity countries rank near the bottom of the predicted trade diversion distribution. The Nordic countries and Canada score relatively high on the PCA index but exhibit low predicted trade diversion. In these cases, strong institutional capacity is combined with geographic and trade distance from key intermediary corridors, limiting structural exposure and resulting in comparatively low evasion pressure.

Figure 6: Predicted Trade Diversion Index by Country (Scaled within Year, 2022–2024)



The second output derived from the regression approach is the residual, shown in Figure 7. **Excessive trade diversion** shows where trade diversion *actually materialized* beyond what fundamentals predict. It reflects behavioral and policy-driven, including enforcement effort, firm behavior, learning effects, loopholes, and trade rerouting. Unlike predicted evasion, residual evasion varies more substantially over time.

Figure 7a: Excessive Trade Diversion by Country – Separate Years (2022, 2023, 2024)

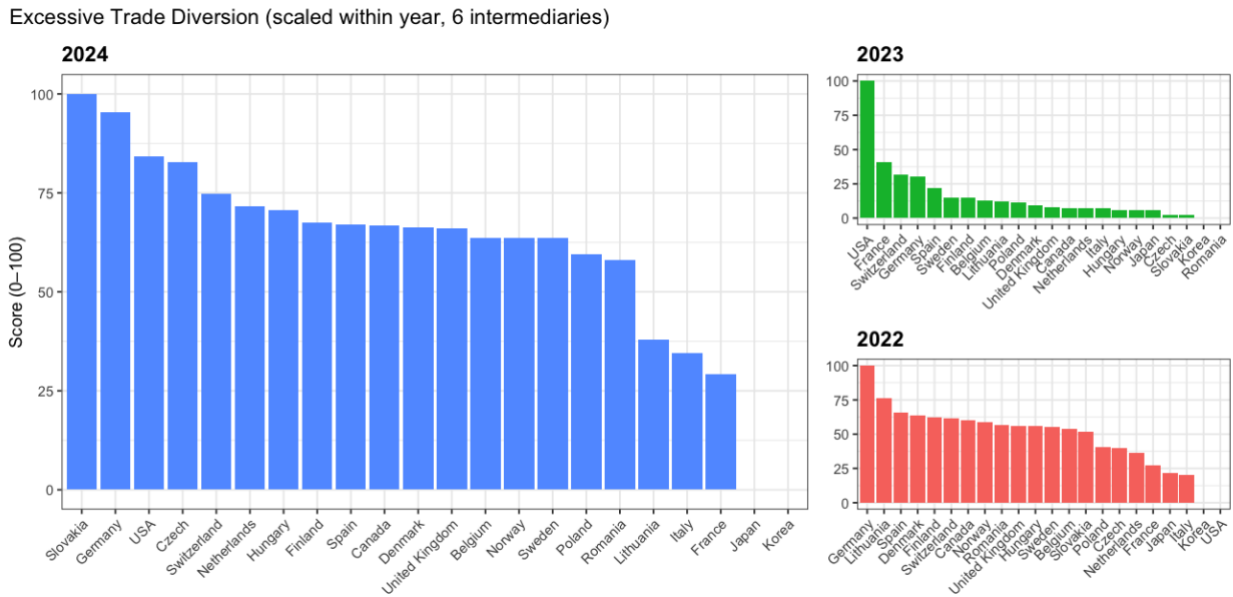


Figure 7b: Excessive Trade Diversion by Country – Pooled View (2022–2024)

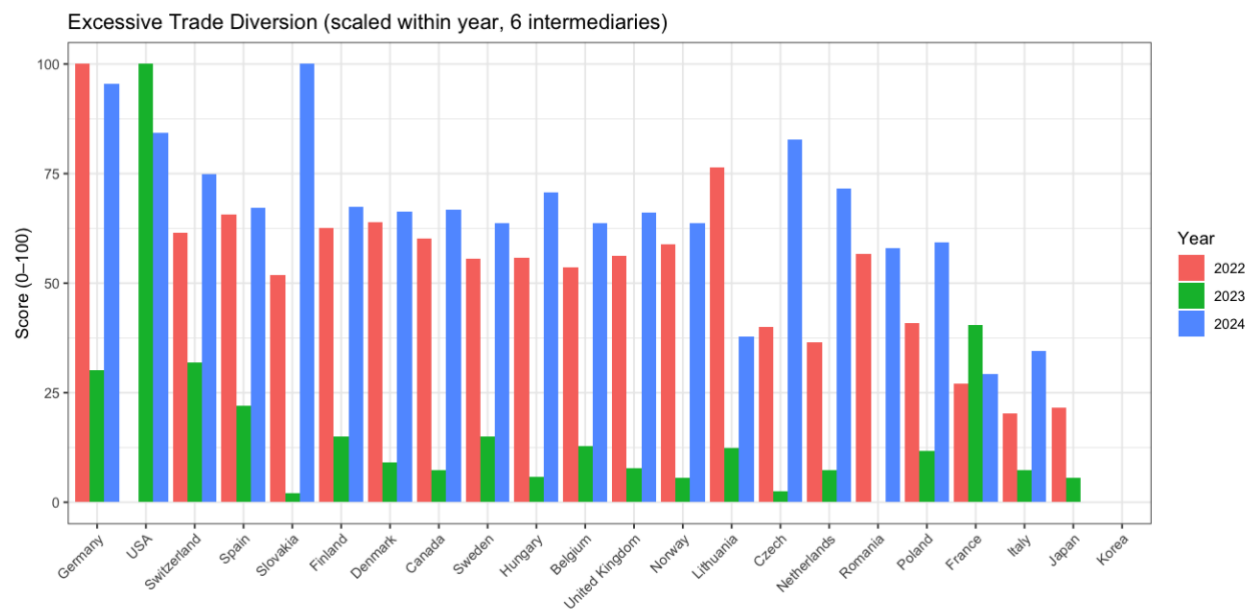


Figure 7 is particularly informative because it isolates deviations from structural expectations. In contrast to the relatively stable ranking of predicted trade diversion, excess evasion exhibits substantial reshuffling across years. Countries move markedly up and down the distribution, indicating that realized outcomes are far less stable than structural vulnerability.

Overall, volatility is markedly greater in the excessive part of trade diversion than in the predicted part. This divergence is consistent with the interpretation of residuals as capturing behavioral and policy-driven dynamics, rather than structural characteristics.

Moreover, excess trade diversion appears less concentrated across countries. Predicted trade diversion is dominated by a small number of countries with particularly high expected values, while many others cluster around zero or even negative values, suggesting that structural exposure is concentrated in a limited set of jurisdictions. In contrast, excess trade diversion is more evenly distributed across countries, indicating that deviations from expected patterns are not confined to a handful of exporters. This pattern is particularly evident in 2022 and 2024, and somewhat less pronounced in 2023.

The patterns in Figure 7 raise the question of what drives these deviations from structural expectations. Because excessive trade diversion captures outcomes beyond what institutional and other structural fundamentals predict, variation in this measure likely reflects mechanisms that are not fully embedded in institutional capacity or pre-war exposure. Several potential explanations emerge from the distribution.

First, trade diversion routes are inherently dynamic and can change rapidly in response to geopolitical events, regulatory actions, and shifts in transportation networks. As a result, excess trade diversion may vary considerably from year to year even when underlying institutional capacity remains relatively stable. For example, the tightening of the “Belarus sanctions gap” and the reduction of border crossings appear to have redirected flows away

from previously important transit channels. Similar effects may arise from developments outside the sanctions domain, including conflicts affecting major shipping corridors or large-scale trade policy changes such as new tariffs. As firms adapt to these changing conditions, patterns of trade diversion can change substantially over time even in the absence of major changes in national enforcement capacity.

Second, timing and learning effects appear important. Countries such as Lithuania that exhibit higher residual spikes in 2022 followed by normalization in 2023–24 likely experienced early adjustment frictions, with subsequent enforcement tightening and firm-level adaptation. By contrast, countries such as the Netherlands, USA and Czechia where residual trade diversion rises in 2023 or 2024 suggest delayed evasion dynamics. These later increases are consistent with firm learning, experimentation with alternative corridors, the emergence of new transit roles, or sectoral reallocation. At the same time, they may also reflect adaptation on the Russian side. As sanctions have remained in place, Russian firms, intermediaries, and procurement networks have had time to identify alternative suppliers, develop more sophisticated transshipment arrangements, establish new intermediaries in third countries, and exploit weaknesses in existing compliance systems. In this sense, residual trade diversion is shaped not only by the behavior of exporters and regulators in sanctioning countries, but also by the evolving capabilities of actors seeking to circumvent restrictions. In this sense, early spikes tend to reflect disruption, whereas late spikes reflect adaptation. The latter are typically more persistent and may require targeted, sector- or corridor-specific enforcement responses rather than broad regulatory tightening.

Third, transit and destination effects must be distinguished. Some countries may appear problematic in residual terms because goods pass through them, not because domestic firms are the ultimate source of evasion. Transit hubs may therefore register elevated excess flows even when domestic compliance is relatively strong. Interpreting residuals thus requires careful consideration of a country's role within the broader trade network.

Figures 8 to 10 plot more where countries are positioned at the intersection of two dimensions: structural vulnerability to evasion and unexplained evasion.

The top-right quadrant captures countries with high predicted trade diversion (weak institutions/high exposure) and high unexplained trade diversion. These are structural weak spots, with poor institutions and/or high exposure to the relevant trade *and* consistently high unexplained evasion. An increasing number of countries join this sector over time. Germany makes substantial improvements in 2023 but bounces back by 2024.

The bottom-left quadrant captures countries with low predicted trade diversion (strong institutions/low exposure) and low trade diversion (best case). Here is where countries increasingly cluster over 2023. By 2024, however, an increasing number of countries leaves this category. This shift is driven by increases in exposure to sanctioned trade flows rather than by changes in institutional quality.

The top-left quadrant captures countries with strong institutions (and low exposure), but high trade diversion. These cases are potential red flags: countries with the capacity to

enforce sanctions yet exhibiting excess trade flows. Many countries appear consistently in this category. Several Nordic and Baltic countries fall into this group in 2022, move out of it by 2023, but bounce back in 2024 (with the exception of Lithuania).

The bottom-right quadrant captures countries with weak institutions and/or high exposure, but better-than-expected outcomes. Several countries fall persistently into this category during the period examined, these are the surprises of good enforcement. Some though deviate to the top-right group in 2024, increasing residuals, which show either enforcement deterioration or changed trade pressure (maybe because of changed routes).

Figure 8: Predicted vs. Excess Trade Diversion: Country Positions (2022)

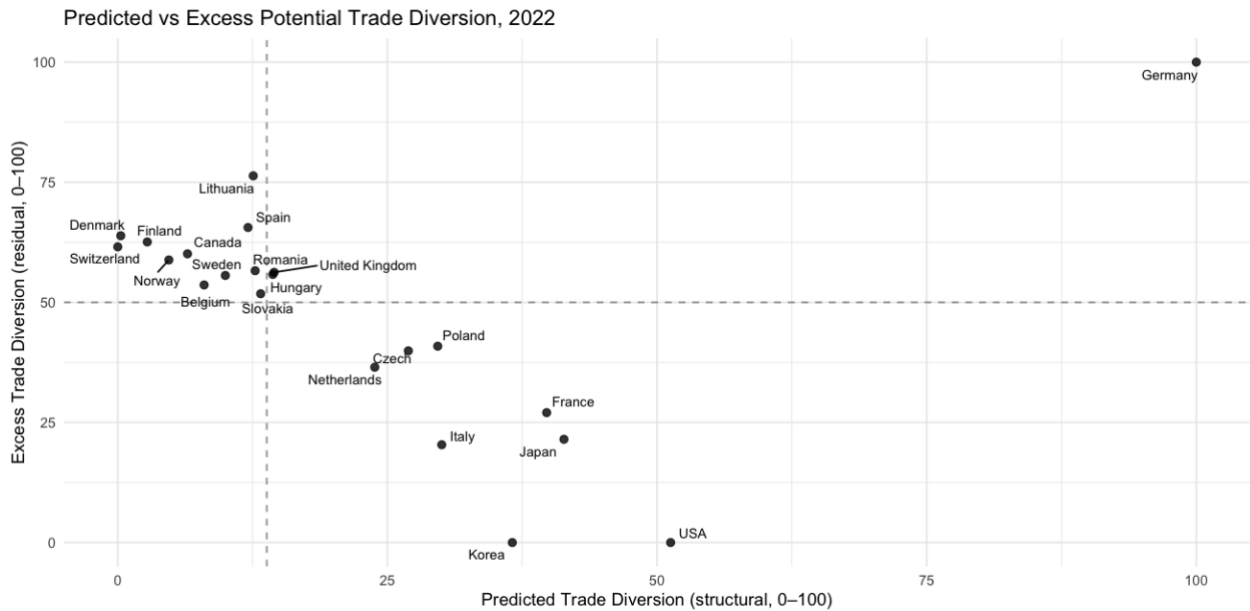


Figure 9: Predicted vs. Excess Trade Diversion: Country Positions (2023)

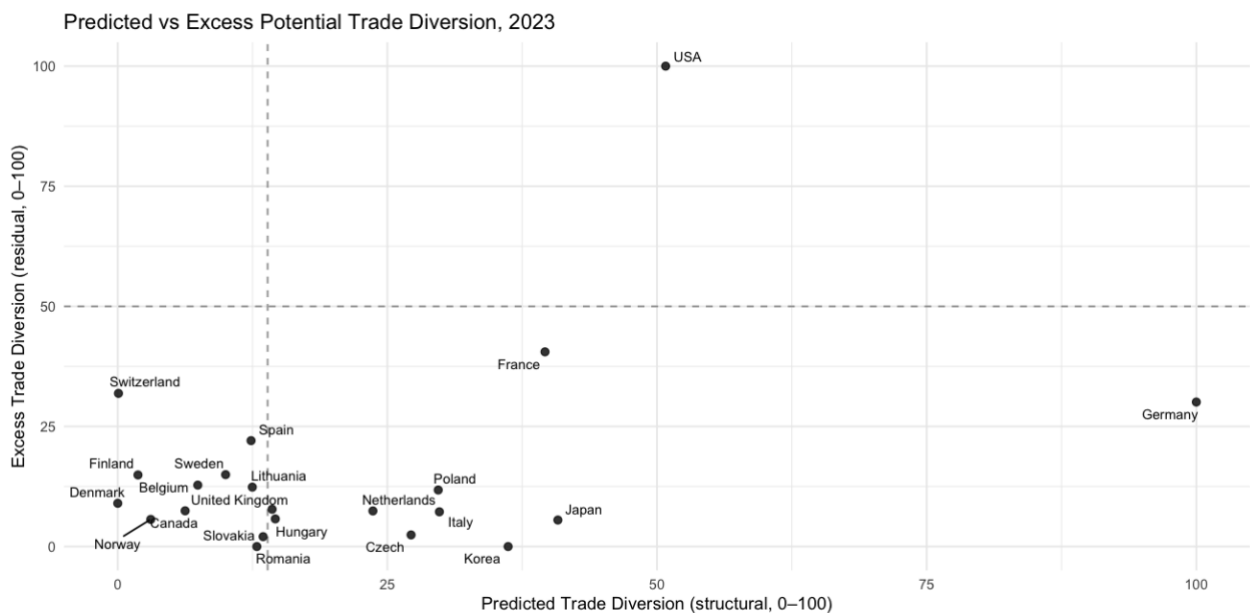
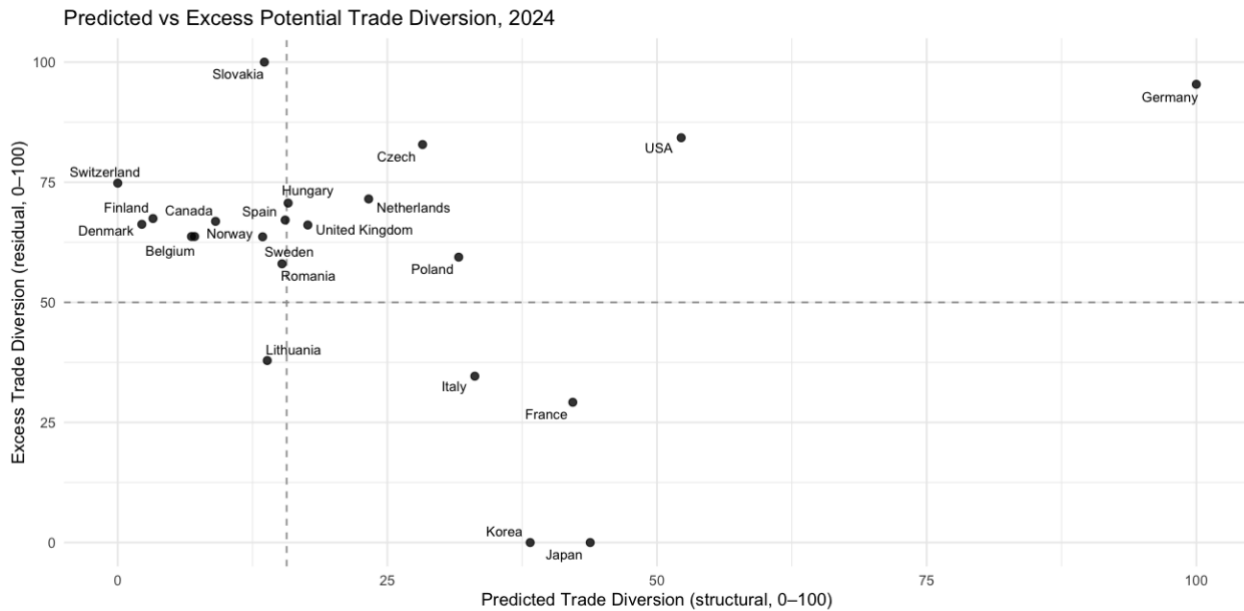


Figure 10: Predicted vs. Excess Trade Diversion: Country Positions (2024)



Consistent with the patterns discussed above, predicted evasion distribution is relatively stable over time, while excess evasion displays large year-to-year swings. These dynamics are unlikely to be driven by institutions alone. Instead, they point to the importance of transit trade, re-export activity, shifting trade corridors, and the ongoing adaptation of sanctions evasion networks.

5. Conclusion

This report presents a composite index of national-level sanctions compliance capacity, designed to assess countries' ability to enforce — or fail to enforce — export restrictions imposed on Russia following the 2022 full-scale invasion of Ukraine. The index addresses an important gap in existing monitoring tools. While prior work has tracked the economic effects of sanctions on Russia or assessed anti-money-laundering frameworks at the country level, no systematic cross-country measure of sanctions enforcement capacity have previously been developed. The index combines a large set of publicly available indicators reflecting the legal frameworks, government enforcement, corporate compliance, and structural exposure of each country, and links these to observed trade-based measures of potential evasion.

Methodologically, the report develops a three-tier approach. A global principal component analysis is used to derive a composite compliance-capacity index from a broad set of institutional indicators, while pillar-level scores provide diagnostic information on specific dimensions of compliance capacity. A regression-based final step then maps institutional capacity and structural exposure to observed trade diversion outcomes, disaggregating them into a predicted part (where evasion pressure is structurally expected) and an

excessive or unexplained part (where trade diversion materialized beyond what fundamentals explain).

Three substantive findings stand out. First, the composite compliance index reveals a smooth and continuous gradient across countries, with no sharp discontinuity between a “compliant” and a “non-compliant” group. Nordic and Western European countries occupy the top of the distribution; post-Soviet and Central Asian states the bottom; and most of the sample lies along a gradual slope in between. This gradient is stable across 2022 to 2024, indicating that institutional capacity evolves slowly and that the ranking is not an artifact of any single year’s data. Second, predicted trade diversion — the structural baseline derived from the regression — is also relatively stable over time and reflects the combination of institutional capacity with pre-war trade exposure. Countries such as Germany, USA and France rank highly in predicted trade diversion not because of weak institutions but because their pre-war trade integration with Russia generates substantial structural pressure. Third, excessive trade diversion is volatile, broadly distributed, and far more informative for policy monitoring. Several countries appear consistently in the top-left quadrant: they possess the institutional capacity to enforce sanctions yet exhibit systematically elevated residuals, suggesting behavioral or structural factors that institutional indicators do not capture.

An important caveat is that excessive trade diversion should not be viewed solely as a measure of weaknesses in domestic enforcement or corporate compliance. It also reflects the adaptive nature of sanctions evasion networks. This has the implication that, while strengthening enforcement at source remains important—including improved due diligence, end-user verification, and “know your customer” procedures—effective responses increasingly require a broader international perspective. This may involve closer cooperation with key transit and intermediary countries, greater monitoring of financial and logistics networks, enhanced information sharing across jurisdictions, and a stronger focus on identifying emerging circumvention routes before they become entrenched. As evasion strategies evolve, enforcement systems must adapt accordingly.

Several limitations should be noted. The composite index is fundamentally an institutional measure and does not directly capture enforcement outcomes. Although the regression-based extension introduces observed trade data as a behavioral anchor, data limitations remain. In particular, Target 2 (Russian customs data) is only available through mid-2023, and Target 3 (KSE measure of battlefield component origin) only for 2023, limiting the precision of the composite outcome variable in the other periods. Some of the institutional indicators are time-invariant or updated infrequently, which constrains the ability to detect within-country change. Finally, the excessive trade diversion measure captures deviations from a structural baseline, but cannot by itself distinguish deliberate non-compliance from limited administrative capacity or transit effects beyond national control.

The scope of the index is also intentionally limited. The current framework focuses exclusively on export restrictions and therefore covers only one dimension of sanctions compliance. Two other domains are particularly consequential for the effectiveness of the Russia sanctions regime and remain outside the current scope. First, compliance with

import and resale restrictions on fossil fuels — oil, gas, LNG, and refined products — is central to constraining Russian revenues and has been the target of successive sanctions packages, including the oil price cap mechanism. Second, financial sanctions, encompassing asset freezes, restrictions on correspondent banking, and exclusion from payment systems, have become increasingly targeted in more recent packages and represent a distinct compliance domain with its own institutional infrastructure. Extending the index to cover these dimensions is a natural direction for future work.

Despite these limitations, TRACER is designed to be updateable as new data become available and extendable to other sanctions regimes. Its three-tier structure — composite capacity index, pillar-level diagnostic scores, and regression-based evasion measures — allows users to engage at different levels of detail depending on whether the goal is cross-country ranking, institutional diagnosis, or behavioral monitoring. From a policy perspectives, the excess evasion measure highlights countries whose observed trade behavior deviates from what their institutional capacity and structural characteristics would predict, thereby identifying potential priorities for diplomatic engagement, technical assistance, and regulatory scrutiny. More broadly, the framework demonstrates how institutional capacity and observed outcomes can be integrated into a single monitoring system, providing a foundation for future research on sanctions effectiveness and enforcement.

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Appendix

Table A.1: War-Relevant Goods Categories

HS Code	Product Description
88	Aircraft, spacecraft, and parts thereof
2806	Hydrogen chloride (hydrochloric acid); chlorosulphuric acid
282911	Sodium chlorate
3208	Paints and varnishes (non-aqueous medium)
3209	Paints and varnishes (aqueous medium)
3403	Lubricating preparations
380120	Colloidal or semi-colloidal graphite
3819	Hydraulic brake fluids and similar liquids
3820	Anti-freezing and de-icing preparations
382499	Chemical products and preparations n.e.s.
3902	Polymers of propylene or other olefins (primary forms)
3903	Polymers of styrene (primary forms)
3906	Acrylic polymers (primary forms)
3908	Polyamides (primary forms)
391220	Cellulose nitrates (including collodions)
4002	Synthetic rubber and factice
4011	New pneumatic rubber tyres
4012	Retreaded or used pneumatic tyres
401693	Rubber gaskets, washers and seals
6810	Articles of cement, concrete or artificial stone
7309	Reservoirs, tanks, vats (iron or steel)
820760	Interchangeable tools for boring or broaching
8402	Steam or vapor generating boilers
8404	Auxiliary plant for boilers
8407	Spark-ignition internal combustion engines
8409	Parts for internal combustion engines
8416	Furnace burners; mechanical stokers
843010	Pile drivers and pile extractors
8456	Machine tools using laser, ultrasonic, etc.
8457	Machining centres; multi-station machine tools

8461	Machine tools for planing, shaping, slotting, broaching
8466	Parts and accessories for machine tools
8475	Machines for assembling electric lamps/tubes or glass
8481	Taps, valves and similar appliances
8482	Ball or roller bearings
8483	Transmission shafts, gears, clutches
8484	Gaskets and similar joints
8502	Electric generating sets and rotary converters
851431	Industrial electric furnaces and ovens
852691	Radio navigation apparatus (e.g., GPS equipment)
853221	Tantalum fixed capacitors
853224	Ceramic dielectric capacitors (multi-layer)
853941	Arc lamps
8541	Diodes, transistors, semiconductor devices
8542	Electronic integrated circuits
8548	Electrical parts of machinery n.e.s.
860290	Railway locomotives (other types)
8604	Railway maintenance/service vehicles
8701.20	Road tractors for semi-trailers
870410	Dumpers for off-highway use
870422	Diesel trucks (5–20 tons)
870432	Trucks with spark-ignition engine (>5 tons)
8705	Special purpose motor vehicles
8708	Parts and accessories of motor vehicles
870990	Parts of works trucks
871639	Trailers and semi-trailers (other)
901010	Apparatus for developing photographic film
901310	Telescopic sights for weapons
901320	Lasers (other than laser diodes)
901380	Optical devices and instruments n.e.s.
901420	Aeronautical/space navigation instruments
901480	Other navigation instruments
901580	Surveying, hydrographic, meteorological instruments

9026	Instruments for measuring flow, level, pressure
902910	Revolution counters, taximeters, odometers
903120	Test benches
9406	Prefabricated buildings

Table A.2: Full List of Indicators

Shorthand	Indicator	Pillar	Sub-domain	Source
criminal_adjudication_effectiveness	Criminal adjudication system is timely and effective	1	Ability	WJP
organized_crime_policy_capacity	National policies and laws, ability to respond to organized crime	1	Ability	OCINDEX
judicial_enforcement_org_crime	Judicial system and detention, ability to enforce judgement regarding organized crime	1	Ability	OCINDEX
criminal_system_impartiality	Criminal system is impartial	1	Governance	WJP
online_legislation_access	Online gazette / legislation access	1	Governance	CorruptionRisk
max_prison_sentence_sanctions	Maximum prison sentence, sanctions law	1	Punitivity	
sanctions_convictions_since_2017	Criminal convictions for sanction violations	1	Punitivity	
sanctions_enforcement_actions_since_2017	Penalties / fines / convictions for sanctions	1	Punitivity	
strict_liability_sanctions	Strict liability in sanctions law	1	Punitivity	
regulatory_enforcement	Government regulations are effectively enforced (6.1)	2	Ability - GEN	WJP
leadership_strength	Political leadership strength	2	Ability - CRIM	OCINDEX
state_fragility	Fragile States Index	2	Ability - CRIM	FFP
criminal_investigation_effectiveness	Criminal investigation	2	Ability - CRIM	WJP

	system is effective			
law_enforcement_powers	R.31 (Law enforcement powers)	2	Ability - CRIM	FATF
beneficial_ownership_registration	Beneficial ownership registration	2	Ability - CRIM	TJN
aml_enforcement_strength	AML enforcement strength	2	Ability - CRIM	OCINDEX
beneficial_ownership_availability	IO5 (Beneficial ownership availability)	2	Ability - FIN	FATF
ml_tf_risk_management	IO1 (ML/TF risk management)	2	Ability - FIN	FATF
financial_supervision	R.26 (Financial supervision)	2	Ability - FIN	FATF
dnfbp_supervision	R.28 (DNFBP supervision)	2	Ability - FIN	FATF
law_enforcement_responsibilities	R.30 (Law enforcement responsibilities)	2	Ability - FIN	FATF
financial_secrecy	Financial secrecy index	2	Ability - FIN	TJN
banking_secrecy	Banking secrecy score	2	Ability - FIN	TJN
trade_regulatory_capacity	Trade regulatory capacity	2	Ability - CRIM	OCINDEX
customs_clearance_efficiency	Customs clearance efficiency	2	Ability - CUST	WDI
logistics_tracking	Logistics tracking ability	2	Ability - CUST	WDI
state_embedded_crime	State-embedded crime	2	Ability - CUST	OCINDEX
international_enforcement_cooperation	IO2 (International cooperation)	2	Cooperation	FATF
international_org_crime_cooperation	International cooperation (organized crime)	2	Ability - CRIM	OCINDEX

regulatory_independence	Regulatory independence	2	Governance	WJP
asset_confiscation	IO8 (Asset confiscation)	2	Governance	FATF
company_registry_transparency	Company registry transparency	2	Governance	CorruptionRisk
overall_corruption	Corruption (composite score)	2	Corruption	Freedom House
public_sector_corruption	Public sector corruption index	2	Corruption	V-Dem
public_sector_bribery	Public sector bribery	2	Corruption	World Bank
judicial_integrity	Criminal system free of corruption	2	Corruption	WJP
civil_society_freedom	Civil society / civil liberties	2	Checks	Freedom House
record_keeping	R.11 (Record keeping)	3	Ability - GEN	FATF
customer_due_diligence	R.10 (Customer due diligence)	3	Ability - GEN	FATF
dnfbp_due_diligence	R.22 (DNFBP due diligence)	3	Ability - GEN	FATF
logistics_service_quality	Logistics service quality	3	Ability - LOG	WDI
AML_CFT_preventive_measures_and_reporting	IO4 (AML/CFT preventive measures)	3	Ability - FIN	FATF
pep_controls	R.12 (PEP controls)	3	Ability - FIN	FATF
suspicious_transaction_reporting	R.20 (Suspicious transaction reporting)	3	Ability - FIN	FATF
mafia_groups	Mafia-style groups	3	Compliance	OCINDEX
financial_crime_prevalence	Financial crimes	3	Compliance	OCINDEX
counterfeit_goods_trade	Counterfeit goods trade	3	Compliance	OCINDEX

illicit_trade_excisable_goods_alt	Illicit trade (excisable goods)	3	Compliance	OCINDEX
arms_trafficking	Arms trafficking	3	Compliance	OCINDEX
border_length_russia_km	Border length with Russia	4		
road_border_crossings_russia_belarus	Border crossings (RU/BY)	4		
total_ports_and_terminals	Total ports and terminals	4		GFP
active_sea_ports_exporting_to_russia	Active ports exporting to Russia	4		ExportGenius
current_account_balance	Current account balance	4		IMF
gdp_current_usd	GDP	4		IMF
population	Population	4		IMF
road_border_crossings_total	Total road border crossings	4		
available_sea_ports	Available sea ports	4		

Equal-Weight Pillar Scores

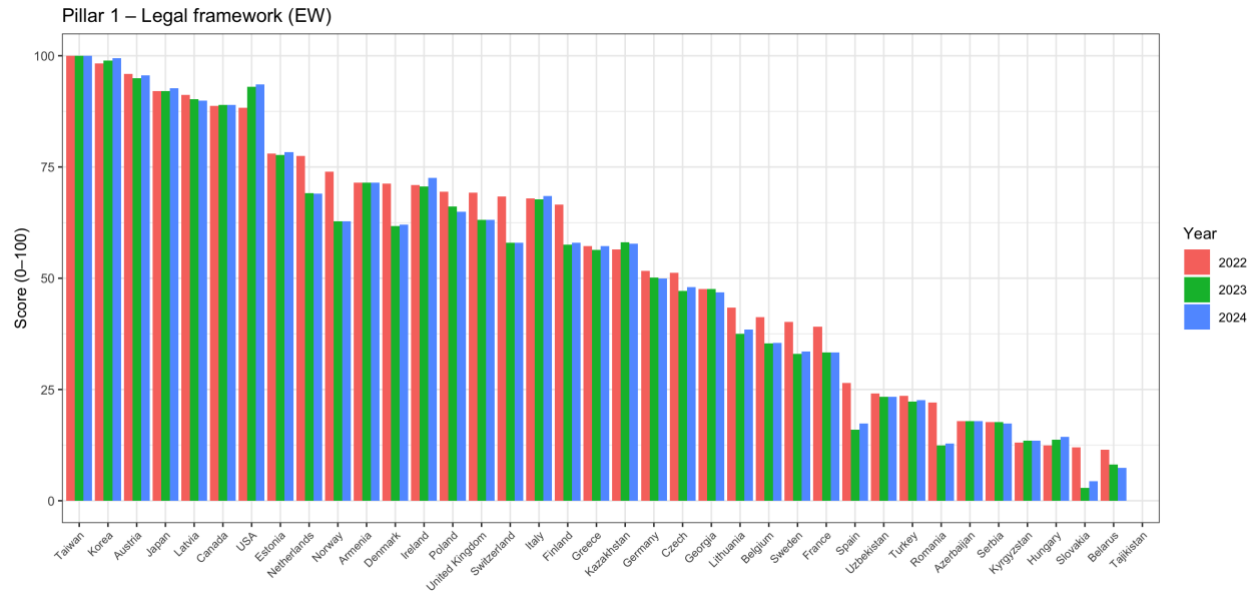


Figure A.1: Equal-Weight Scores – Pillar 1: Legal Frameworks

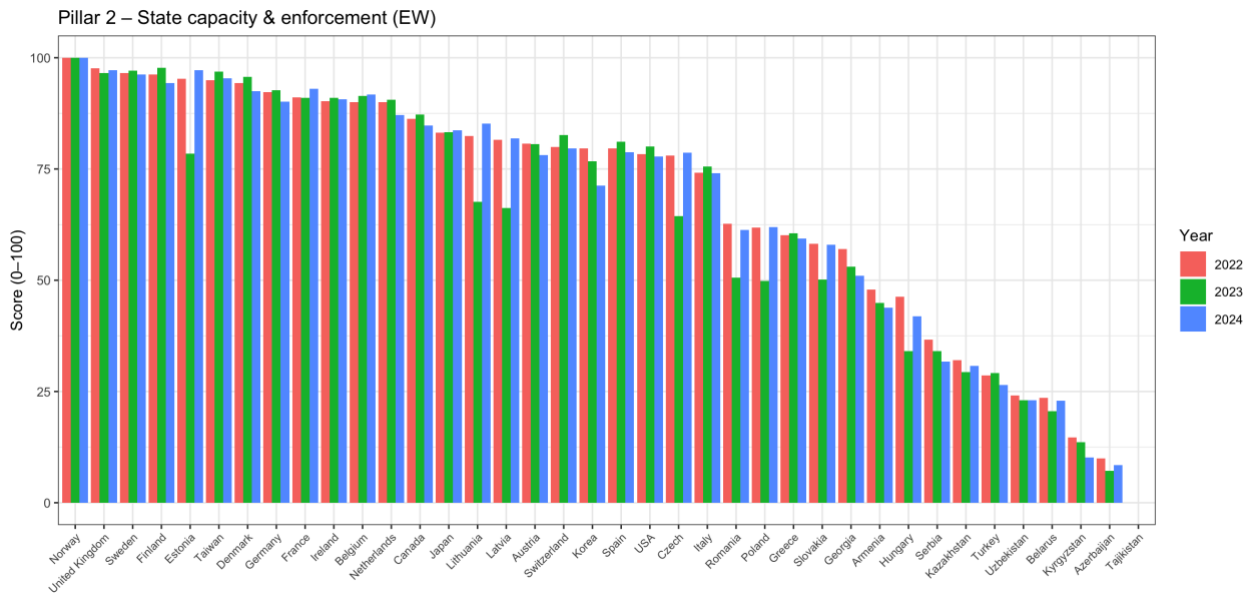


Figure A.2: Equal-Weight Scores – Pillar 2: State Capacity and Enforcement

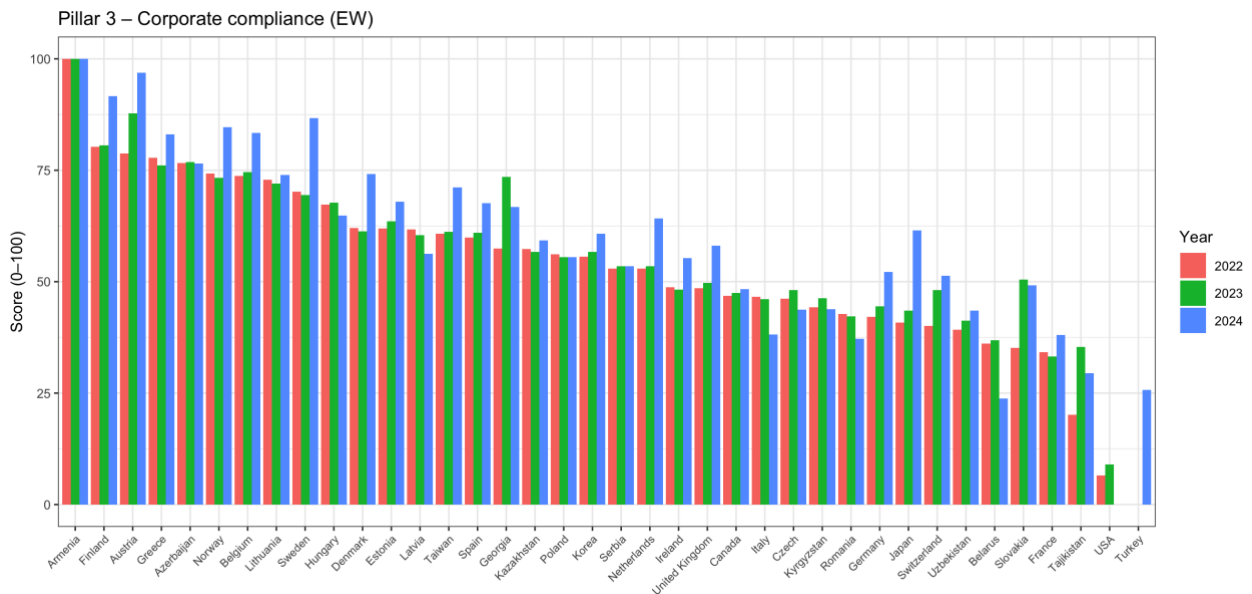


Figure A.3: Equal-Weight Scores – Pillar 3: Corporate Compliance