ETLA Raportti | Report | 181 7.9.2026

Hidden Networks

VALUE CHAIN VULNERABILITY AND INDIRECT SOURCING IN THE NORDIC REGION

Jyrki Ali-Yrkkö
ETLA Economic Research, Finland
jyrki.ali-yrkko@etla.fi

Peter Bøegh Nielsen
Statistics Denmark, Denmark
boeegh1@oncable.dk

Suggested citation:
Ali-Yrkkö, Jyrki & Bøegh Nielsen, Peter (7.9.2026).
”Hidden Networks: Value Chain Vulnerability and Indirect Sourcing in the Nordic Region”.
Etla Report No. 181.
https://pub.etla.fi/ETLA-Raportit-Reports-181.pdf

Abstract

The findings demonstrate that regional Nordic trade contains significant hidden exposure to non-European markets. On average, 11% of intermediate imports from Nordic neighbors originate from outside Europe at the second tier. A substantial portion of this non-European exposure is concentrated in China (27.1%) and other BRICS+ countries (16.3%), representing a vulnerability that standard trade statistics, based on only direct trade, fail to capture. The methodology provides a framework for future pan-European value chain analysis.

Tiivistelmä

Arvoketjujen läpinäkymättömyys: Epäsuorat riippuvuudet Pohjoismaisissa arvoketjuissa

Tulosten mukaan Pohjoismaiden välinen kauppa sisältää merkittävää, piilevää altistumista Euroopan ulkopuolisille markkinoille. Keskimäärin 11 prosenttia muista Pohjoismaista tulevasta välituotetuonnista on arvoketjun toisessa portaassa peräisin Euroopan ulkopuolelta. Suuri osa tästä Euroopan ulkopuolisesta altistumisesta keskittyy Kiinaan (27,1 %) ja muihin BRICS+-maihin (16,3 %). Tämä muodostaa sellaisen riippuvuuden, jota tavanomaiset vain suoriin kauppayhteyksiin pohjautuvat ensimmäisen portaan (Tier 1) kauppatilastot eivät tavoita. Käytetty lähestymistapa tarjoaa uuden menetelmän tuleville yleiseurooppalaisille arvoketjuanalyyseille.

Ph.D. (Econ.) **Jyrki Ali-Yrkkö** is a Research Director at ETLA Economic Research.

Ph.D. **Peter Bøegh Nielsen** is a Chief Advicer at Statistics Denmark.

KTT **Jyrki Ali-Yrkkö** on Elinkeinoelämän tutkimuslaitoksen tutkimusjohtaja.

Ph.D. **Peter Bøegh Nielsen** on Statistics Denmarkin johtava neuvonantaja.

Acknowledgements: We would first like to thank the following project participants from each of the Nordic statistical offices: Statistics Denmark: Julie Cathrine Krabek Sørensen and Kalle Emil Holst Hansen; Statistics Finland: Merja Myllymäki, Niklas Partinen and Joackim Raikamo; Statistics Iceland: Alina Kerul; Statistics Norway: Jan Olav Rørhus and Wilmer Öden; Statistics Sweden: Samuel Hederen. The project has been funded by the Nordic Council of Ministers, to whom we express our sincere gratitude. Thanks also go to Samuli Rikama and Mikko Huuskonen (the Ministry of Economic Affairs and Employment of Finland).

Artificial intelligence has been used to support human work in the production of this report in accordance with Etla's ethical guidelines (version 14.1.2026, see https://www.etla.fi/en/ai-ethics/).

Kiitokset: Kiitämme seuraavia hankkeen osallistujia kustakin Pohjoismaiden tilastovirastosta: Tanskan tilastokeskus: Julie Cathrine Krabek Sørensen ja Kalle Emil Holst Hansen; Suomen Tilastokeskus: Merja Myllymäki, Niklas Partinen ja Joackim Raikamo; Islannin tilastokeskus: Alina Kerul; Norjan tilastokeskus: Jan Olav Rørhus ja Wilmer Öden; Ruotsin tilastokeskus: Samuel Hederen. Hankkeen on rahoittanut Pohjoismaiden ministerineuvosto, jolle lausumme parhaat kiitoksemme. Kiitokset kuuluvat myös Samuli Rikamalle ja Mikko Huuskoselle (työ- ja elinkeinoministeriö).

Tämän raportin työstämisessä on hyödynnetty tekoälyä ihmistyön tukena Etlan eettisen ohjeiston mukaisesti (versio 14.1.2026, ks. https://www.etla.fi/ai-etiikka).

Keywords: Value chain, Tier, Resilience, Nordic, Imports, Vulnerability, Indirect

Avainsanat: Arvoketju, Toimitusporras, Resilienssi, Pohjoismaat, Tuonti, Haavoittuvuus, Välillinen

JEL: F15, F52

Contents

Executive Summary **4**

Suomenkielinen yhteenveto ja tärkeimmät päätelmät (Executive summary in Finnish) **5**

1 Introduction **6**

1.1 The Great Unbundling and the Mirage of Global Stability 6

1.2 The Hidden Geography of Systemic Exposure 6

1.3 Goals 6

2 Methodology for Measuring Indirect Vulnerability **7**

2.1 Tracking Second-Tier Links 7

2.2 Method to Calculate Vulnerabilities in the Second Tier 8

3 Supplier Dependencies in Nordic Countries **9**

3.1 Denmark 10

3.2 Finland 11

3.3 Iceland 12

3.4 Norway 13

3.5 Sweden 15

4 Conclusions and Discussion **16**

Appendix **17**

Endnote **17**

Literature **17**

Executive Summary

This report reveals that the perceived security of regional trade within the Nordic countries often masks a structural opacity at the second tier of the value chain. While intra-regional cooperation or so-called friendshoring might be a pillar of economic resilience in the geoeconomic era, this study concludes that regional sourcing does not equate to regional autonomy. This is due to dependencies on undesirable countries at the second tier of value chains or in subsequent stages.

Using a novel look-through methodology—which mirrors import and export data in a company-level between national statistical authorities—the study analyzed five key industries in each Nordic country to identify hidden vulnerabilities. The analysis shows that, on average, 10.8% of the intermediate goods imported from other Nordic countries are actually sourced from outside Europe at the second tier. This indirect exposure is highest in Denmark (14.3%) and lowest in Finland (7.2%).

Key findings regarding geopolitical exposure include:

- **China's Central Role**: Of the non-European second-tier imports, China accounts for an average of 27.1%.
- **BRICS+ Dependency**: Other BRICS+ nations contribute, on average, an additional 16.3% to these indirect imports.

Our results show that imports from other Nordic countries include value added originate not only from non-Nordic but also from non-European countries, representing a hidden vulnerability that standard Tier 1 analysis fails to capture.

The report identifies a significant wedge between private firm-level risk and public national security interests. While individual firms often prioritize cost-driven efficiency and may remain blind to their Tier 2 and Tier 3 origins, the aggregate cost of value chain failure in strategic sectors (such as healthcare, energy, or defense) far exceeds the impact on any single company.

There is no easing of geopolitical tensions in sight. For this reason, decision-makers should have a better situational awareness of the indirect dependencies and vulnerabilities within value chains.

Indirect (second-tier) exposure of imports from other Nordic countries, %

	Denmark	Finland	Iceland	Norway	Sweden	Average
Share of indirect imports from outside Europe	14.3	7.2	11.1	8.2	13.3	10.8
of which						
China's share	25.9	27.0	23.3	30.6	28.6	27.1
Other BRICS+'s share	14.2	17.5	20.0	12.2	17.5	16.3

Suomenkielinen yhteenveto ja tärkeimmät päätelmät (Executive summary in Finnish)

Tulosten mukaan Pohjoismaiden sisäinen kauppa sisältää altistumista Euroopan ulkopuolisille markkinoille, joka jää yleensä havaitsematta. Tämä piilevä altistuminen tulee arvoketjujen toisesta portaasta. Vaikka niin kutsuttu *friendshoring* eli tuotteiden hankinta ystävällismielisistä maista voi geotalouden aikakaudella parantaa arvoketjujen toimintavarmuutta, se ei sitä takaa. Tämä johtuu siitä, että arvoketjujen 2. portaassa tai sitä myöhemmissä vaiheissa on riippuvuuksia ei-toivotuista maista.

Tutkimuksessa hyödynnettiin uudenlaista menetelmää, jotta saatiin selville arvoketjun toisessa portaassa piileviä riippuvuuksia ja haavoittuvuuksia. Tuloksissa ilmeni, että keskimäärin 10,8 prosenttia muista Pohjoismaista tuoduista välituotteista on todellisuudessa peräisin Euroopan ulkopuolelta arvoketjun toisessa portaassa. Tämä epäsuora altistuminen on suurinta Tanskassa (14,3 %) ja pienintä Suomessa (7,2 %).

Merkittävimmät geopoliittista altistumista koskevat havainnot ovat:

- **Kiinan keskeinen rooli:** Euroopan ulkopuolisesta toisen portaan tuonnista Kiinan osuus on keskimäärin 27,1 %.
- **Riippuvuus muista BRICS+ -maista:** Muiden BRICS+ -maiden osuus epäsuorasta tuonnista on keskimäärin 16,3 %.

Muista Pohjoismaista peräisin oleva tuonti sisältää arvonlisää, joka on lähtöisin paitsi muualta kuin Pohjoismaista, myös Euroopan ulkopuolisista maista. Tämä on potentiaalinen haavoittuvuus, jota perinteinen ensimmäisen arvoketjuportaan (Tier 1) analyysi ei pysty havaitsemaan.

Yritystason riskien ja kansalliseen turvallisuuteen liittyvien intressien välillä voi olla kuilu. On selvää, että kukin yritys päättää itse omista hankintakanavistaan punnitessaan niiden tuomia hyötyjä, haittoja ja riskejä. Sen sijaan koko yhteiskunnan tasolla strategisiin aloihin (mm. puolustus, energia ja terveydenhuolto) liittyvät arvoketjujen riskit voivat ylittää selvästi sen, mitä yksittäiset yritykset huomioivat.

Näköpiirissä ei ole geopoliittisten jännitteiden lieventymistä. Tästä syystä päätöksentekijöillä tulisi olla nykyistä parempi tilannekuva arvoketjujen epäsuorista riippuvuuksista ja haavoittuvuuksista.

Pohjoismaisen tuonnin sisältämä epäsuora (arvoketjun 2. porras) altistuminen Euroopan ulkopuolisista alueista

	Tanska	Suomi	Islanti	Norja	Ruotsi	Keskiarvo
Euroopan ulkopuolelta tulevan epäsuoran tuonnin osuus	14,3	7,2	11,1	8,2	13,3	10,8
josta						
Kiinan osuus	25,9	27,0	23,3	30,6	28,6	27,1
Muiden BRICS+ -maiden osuus	14,2	17,5	20,0	12,2	17,5	16,3

1 Introduction

1.1 The Great Unbundling and the Mirage of Global Stability

During the era of globalization, a fundamental assumption governed international relations: that all participating nations would adhere to a shared, rules-based multilateral system that thrived and expanded to embrace nations previously standing aside. Under this paradigm of stability and hope, Western policymakers liberalized cross-border trade and investments, establishing deep economic ties intended to foster cooperation and enhance global prosperity.

This deliberate policy shift catalyzed a global value chain (GVC) revolution, encouraging firms to outsource production segments to focus on high-value-added activities such as Research and Development (R&D) and design. Consequently, the world witnessed an unprecedented international division of tasks and the rapid transfer of knowledge across borders, weaving a tightly interconnected web of economic interdependence (Baldwin et al., 2022; Paes et al., 2024).

However, this era of cost-driven efficiency has collided with a new reality characterized by a lack of visibility. While the connectivity fostered by liberalization was once viewed as an engine of peace, recent years have shown that these asymmetries can be weaponized as coercive tools. The core of our modern vulnerability lies in the massive complexity that was ignored during the rush to liberalize. Most lead firms maintain a firm handle on their direct Tier 1 suppliers, but visibility often vanishes into a fog of complexity at the second tier and beyond. For instance, a giant like General Motors has a staggering estimated 18,000 suppliers when accounting for Tier 2 and below (Baldwin et al., 2023). Based on interviews, research into the Dutch defense industry reveals a striking parallel: many companies know their direct suppliers but remain blind to where their Tier 2 and Tier 3 suppliers source and produce their components (Berenschot, 2024).

The vulnerabilities lurking in the invisible tiers of global value chains create hidden exposure for both companies and nations. To understand these connections, we must look past face value exposure, which only identifies the immediate origin of a component, and instead employ a look-through approach as suggested by Professor Richard Baldwin and his co-authors (Baldwin et al., 2023). Their method pierces the veil of supplier networks to identify the comprehensive link between a purchasing sector in one nation and every supplying sector in every nation. The method is applied to the inter-country input-output tables by the OECD. Because these tables present interactions between industries, they cannot be used to identify product-level vulnerabilities.

1.2 The Hidden Geography of Systemic Exposure

In the past, supply chain disruptions were often isolated events like a single factory fire that could be managed at the firm level. Today, we face a new reality where shocks are increasingly systemic, affecting multiple sectors and nations simultaneously. For instance, the Covid-19 crisis disrupted many value chains around the world and caused a lack of components and increased transportation costs. Another shock was Russia's invasion of Ukraine in 2022. As a reaction to the war, numerous countries imposed sanctions against Russia and companies also voluntarily stopped buying raw materials and other intermediate goods from Russia.

While standard trade data might suggest a modest dependence on some specific country, look-through analysis might reveal that exposure is higher than face-value statistics indicate. This second-tier reliance is particularly acute in strategic sectors like semiconductors, advanced batteries, and critical raw materials, where the extraction and processing stages are often controlled by a handful of global actors (European Commission, 2023; Paes et al., 2024).

Governments are now grappling with the wedge between private and public risk evaluation. While individual firms may prioritize low-cost sourcing and just-in-time production, the aggregate cost of a total supply chain failure in sectors like healthcare, energy, or defense is far higher than any single company's bottom line.

1.3 Goals

The goal of this report is to investigate previously invisible dependencies and vulnerabilities in the second tier

of Nordic value chains. By mapping the indirect dependencies of Nordic value chains, we aim to identify the specific chokepoints where national interventions are potentially necessary to secure the invisible backbone of Nordic economies.

In this study, we focus on five economically important industries in each Nordic country and examine their second-tier vulnerabilities. In contrast to previous hidden exposure studies, our data are at the product-level which enables us to identify potential vulnerabilities in high detail.

2 Methodology for Measuring Indirect Vulnerability

Measuring indirect vulnerability means recognizing that goods imported from countries considered safe suppliers (e.g., other Nordic countries) may, in a prior step, consist of intermediate goods imported from outside the region, such as China or some other non-European countries. This second layer of vulnerability is measured by identifying the source countries of the intermediate inputs used by firms that export to other Nordic countries. This approach provides an innovative framework for vulnerability assessment. The methodology is detailed below.

2.1 Tracking Second-Tier Links

We utilize register-based databases from the national statistical authorities (NSIs) of each Nordic country. The primary dataset comprises firm-level data on the import and export of intermediate goods. In addition, we utilize data on domestic value added generated by different industries.

Our analysis focuses on five industries from each Nordic country. These industries are selected based on three criteria: 1) number of employees, 2) absolute value of intermediate imports from other Nordic countries, and 3) the share of Nordic intermediate imports in total intermediate imports.

Step 1: Identifying the import manufacturing industries to be analyzed

Given the novelty of this approach, we restrict the analysis to a limited number of industries to test the methodology. First, we identify the industries that are, in absolute terms, the largest importers of raw materials and other intermediate products from other Nordic countries. Based on this import value, we compile a gross list of the ten highest-ranking industries.

Second, we select five of these ten industries for a more detailed analysis. The selection is conducted by ranking the ten industries according to the three aforementioned criteria: the value of Nordic imports, the share of Nordic imports, and the industry's total employment. Each industry thus receives three ranking positions (1st–10th). We then calculate the average ranking for each industry and select the top five.

Step 2: Identifying the intermediate goods imported from other Nordic countries

To limit the number of analyzed intermediate goods within the selected industries, we apply the following thresholds at the product level (6-digit CN):

1. Imports of the intermediate good from other Nordic countries must be worth at least EUR 5 000.
2. Imports of the intermediate good from other Nordic countries must account for at least 10% of the total imports of that good.
3. Imports of the intermediate good from a specific Nordic country must account for at least 10% of the total imports of that good from all other Nordic countries.

A list of the imported intermediate goods fulfilling these criteria is extracted for each exporting Nordic country and circulated to the relevant NSI. For example, Denmark distributes a list of intermediate goods to Finland, where the import of each good is worth at least EUR 5 000, other Nordic countries (excluding Denmark) account for at least 10% of the total imports of the good, and Finland accounts for at least 10% of the total imports of that good from other Nordic countries (excluding Denmark). These criteria must be fulfilled for at least one of the selected industries.

Step 3: Identifying exporting enterprise groups in the partner country

In this step, we mirror the import data from Step 2 (at the 6-digit CN level) with the export data of the exporting country. This is done to identify the specific enterprise groups exporting the intermediate goods. For example, we identify the enterprise groups in Denmark that export the intermediate goods that Finland, Iceland, Norway, and Sweden have identified as imports from Denmark in the previous step[1].

Because international trade is often conducted via special-purpose entities, such as wholesale units within an enterprise group, the enterprise group is used as the statistical unit to identify second-tier imports. The activity of the enterprise group is determined by the largest manufacturing enterprise within the group in terms of employment.

Step 4: Identifying indirect vulnerability

The imports of intermediate goods by the enterprise groups identified in Step 3 are measured and broken down by source region. This allows us to identify indirect vulnerability, i.e., intermediate imports originating from countries such as China.

By combining the data from Step 1 and Step 3 for each Nordic country, the import distribution for each exporting country is aggregated to measure the indirect vulnerability of each importing country (see Chapter 2.2).

2.2 Method to Calculate Vulnerabilities in the Second Tier

Imports into each Nordic country from other Nordic countries can contain vulnerable imports at the second stage of the value chain. We approximate this potential import vulnerability in the second tier, and denote it as $Indirect_vulne_N$. As mentioned earlier, our analysis is focused on five selected industries in each Nordic country.

Each selected industry i within a Nordic country N imports intermediate inputs from another Nordic country c. We denote this variable as $IM_N^{c,i}$. Each enterprise group in these source countries imports intermediate inputs from other countries. This import constitutes foreign value added generated outside that Nordic country c, which we denote as FVA_share^c which is measured in a country level. A portion of this foreign value added originates in regions that present potential geopolitical risks from a Nordic perspective, such as countries located outside Europe. We denote the share imported from outside Europe at this second stage of the value chain as $IM_share^c_{i,non_EUR}$.

The total value of these indirect vulnerable imports is obtained by summing the import vulnerabilities generated at the second stage of the value chain across all five industries and across all four other Nordic countries (Equation 1).

$$Indirect_vulne_N = \sum_{c=1}^{4}\sum_{i=1}^{5}\left(IM_N^{c,i} x FVA_share^c x IM_share^c_{i,non_EUR}\right) \quad (1)$$

Then, we can calculate the proportion that this vulnerable import represents of the total imports from other Nordic countries (c) for the five selected industries in Nordic country N (Equation 2):

$$Indirect_vulne_share_5_selected_N = \frac{Indirect_vulne_N}{\sum_{c=1}^{4}\sum_{i=1}^{5} IM_N^{c,i}} \quad (2)$$

Variables

$Indirect_vulne_N$	The value of indirect vulnerable imports of five selected industries in the Nordic country *N*.
$Indirect_vulne_share_5_selected_N$	The share of indirect vulnerable imports (five selected industries) of Nordic country *N* of the total imports of these industries from other Nordic countries.
$IM_N^{c,i}$	The value of Nordic country *N's* intermediate goods' imports of industry *i* from other Nordic country *c*.
FVA_share^c	The share of foreign value added of Nordic country c's exports. We obtain this share from OECD's TiVa (Trade-in-value added) database.
$IM_share^c_{i,non_EUR}$	The share of non-Europe imports of exporting industry i in Nordic country c.

3 Supplier Dependencies in Nordic Countries

Nordic companies utilize a significant volume of imported materials, components, and other inputs in their manufacturing processes. These materials and semi-finished products—defined as intermediate goods—serve as inputs for the production of further goods or services.

Imports themselves are not inherently a cause for concern; quite the opposite, in fact. It is practically impossible for small Nordic countries—or in fact any country—to produce all necessary intermediate products domestically.

Thus, it is natural and economically efficient to import intermediate goods. In the current era of heightened geopolitical tensions, however, the critical question is less about the necessity of imports and more about the specific regions or countries from which those goods originate.

The analysis of first-tier intermediate goods imports by Nordic countries reveals a strong, primary reliance on European partners (excluding Nordic countries) and, secondarily, significant trade within the Nordic region itself. Imports from major non-European economies, while present, play a smaller role in supplying the necessary intermediate inputs (Table 3.1). Trade within the Nordic region serves as the second most important source for all five Nordic countries, underscoring the importance of regional supply chains. However, almost four-fifths of imported

Table 3.1 First-Tier Import Source Regions of Intermediate Goods to Nordic countries 2024, %

	Denmark	Finland	Iceland	Norway	Sweden
Other Nordic countries	18.4	23.4	21.3	20.6	22.3
Other European countries	52.5	45.5	39.8	41.3	57.3
The US	10.1	6.8	4.9	8.6	4.9
China	8.4	7.7	8.2	6.8	5.0
Other BRIC+ countries	2.8	5.0	8.9	6.8	1.7
Rest of the World	7.8	11.5	16.9	15.8	8.8

Note: Due to rounding errors, the numbers may not necessarily total 100%.

Source: Ali-Yrkkö & Bøegh Nielsen (2026).

intermediate products originate from outside the Nordic countries, leaving the Nordic share at an average of 21%.

We supplement the findings of these direct (first tier) imports of intermediate goods by tracking the imports in the second tier of the Nordic enterprise groups exporting to the other Nordic countries in order to identify possible indirect vulnerability.

The second-tier analysis focuses on five selected industries in each Nordic country as mentioned in Chapter 2 (Table 3.2).

Although the selected industries vary between the Nordic countries, some similarities can be identified. The manufacture of basic chemicals is included in the top five industries in three Nordic countries: Denmark, Norway, and Sweden.

The pulp and paper industry is included in the top five industries in both Finland and Sweden, while the manufacture of basic precious metals is included in the top five in Denmark and Norway. In Iceland, the list of selected industries is unique, as it shares no similarities with the other Nordic countries.

Next, we consider the first and second tier imports of these selected industries in each Nordic in more detail.

3.1 Denmark

First-tier analysis of the selected industries

The 410 enterprise groups in the five selected industries in Denmark imported 586.7 million EUR worth of intermediate goods directly from the other Nordic countries. This accounted for 14.0% of the total Danish import of intermediate goods from the Nordic region, compared to 15.3% for all industries.

Among the selected industries, Manufacture of basic precious and other non-ferrous metals showed the highest import share from the other Nordic countries (72.8%), while Manufacture of general-purpose machinery accounted for the lowest share (6.2%). This highlights a substantial variation in the Nordic import shares across the selected industries (Table 3.3).

Second-tier analysis of the selected industries

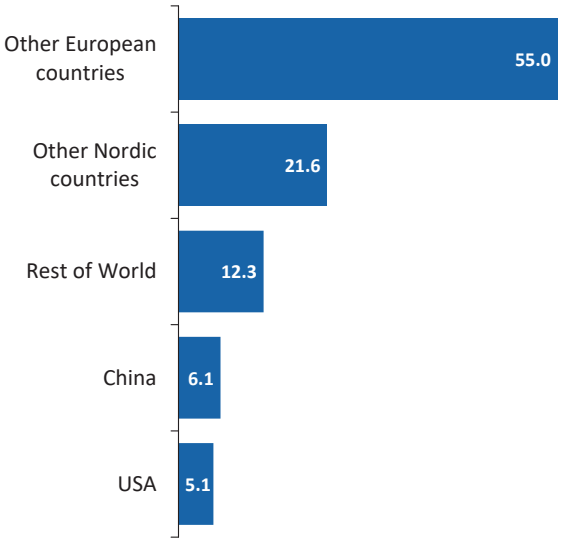
The Nordic enterprise groups exporting to the five selected industries in Denmark in 2023 rely on imported inputs themselves. Out of these imported intermediate goods, 21.6% originated from other Nordic countries and 55.0% from other European countries (Figure 3.1). The remaining 23.4% was imported from outside Europe.

Among the Nordic enterprise groups exporting to Denmark, Swedish groups accounted for the highest Nordic

Table 3.2 Selected industries by Nordic countries

Denmark	Finland	Iceland	Norway	Sweden
Manufacture of wood products (NACE 162)	Manufacture of pulp and paper (NACE 171)	Processing and production of meat, etc. (NACE 101)	Manufacture of basic chemicals (NACE 201)	Manufacture of pulp and paper (NACE 171)
Manufacture of basic chemicals (NACE 201)	Manufacture of plastic products (NACE 222)	Processing and production of fish, etc. (NACE 102)	Manufacture of glass (NACE 231)	Manufacture of basic chemicals (NACE 201)
Manufacture of plastic products (NACE 222)	Manufacture of basic iron (NACE 241)	Printing (NACE 181)	Manufacture of basic iron (NACE 241)	Manufacture of other fabricated metal products (NACE 259)
Manufacture of basic precious metals (NACE 244)	Manufacture of wiring (NACE 273)	Manufacture of paints, etc. (NACE 203)	Manufacture of basic precious metals (NACE 244)	Manufacture of electric motors (NACE 271)
Manufacture of general-purpose machinery (NACE 281)	Manufacture of other special-purpose machinery (NACE 289)	Manufacture of structural metal products (NACE 251)	Casting of metals (NACE 245)	Manufacture of motor vehicles (NACE 291)

Figure 3.1 Second tier import pattern for Nordic enterprise groups exporting to Denmark (2023)



Note: The figures indicate the proportion of total second-tier intermediate imports in the value chain originating from different regions.

import share (23.0%). Meanwhile, Norwegian enterprise groups—with nearly 39.4% of their imports sourcing from non-European countries—represented the highest potential value chain risk for the selected Danish industries.

As presented before (Table 3.3.), in 2023, the five selected Danish industries imported for 586.7 million EUR from the other Nordic countries in direct first-tier import accounting for 14.0% of total Danish import of intermediate goods.

Our results show that this direct import from other Nordic countries involves potential vulnerabilities. To calculate the magnitude of this vulnerability, we use the method presented in Chapter 2.2 (Equation 2). The results suggest that imports from other Nordic countries include 14.3% worth of materials and other intermediate goods sourced from outside Europe. Of this share, more than a quarter originates from China. Thus, a second-tier analysis reveals a further value chain risk that cannot be observed by looking only at direct imports

3.2 Finland

First-tier analysis of the selected industries

The 374 enterprise groups in the selected industries in Finland imported for 1183.7 million EUR intermediate goods directly from the other Nordic countries. This accounted for 19.6% of the total Finnish import of intermediate goods from the Nordic region, compared to 21.6% for all industries.

Among the selected industries, Manufacture of wiring and wiring devices showed the highest import share from the other Nordic countries (26.8%), while Manufacture of plastic products accounted for the lowest share (13.1%).

Table 3.3 Financial figures for selected Danish industries (2023)

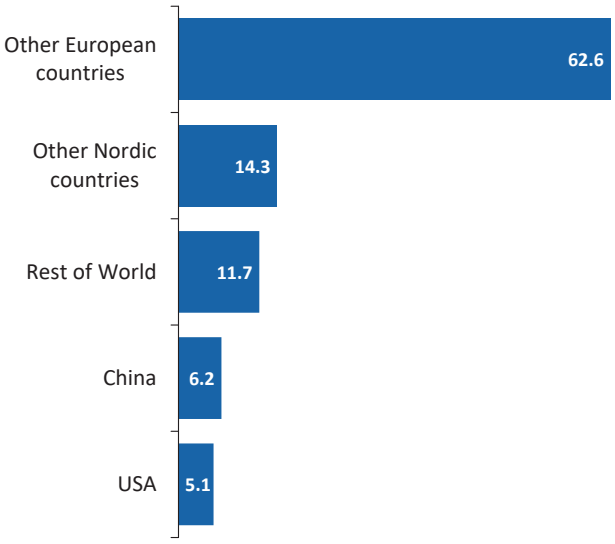
NACE 3-digit	NACE name	Nordic import, mio. EUR	Nordic import, %	Number of enterprise groups	Number of fulltime employees	Gross value added, mio. EUR
162	Manufacture of products of wood, cork, straw and plaiting materials	105.5	21.8	76	10,381	1,613.0
201	Manufacture of basic chemicals, fertilisers and nitrogen compounds, plastics and synthetic rubber in primary forms	97.3	28.3	35	1,742	312.5
222	Manufacture of plastic products	74.3	10.9	175	9,029	1,129.4
244	Manufacture of basic precious and other non-ferrous metals	156.3	72.8	6	913	83.3
281	Manufacture of general-purpose machinery	153.3	6.2	118	42,277	9,944.4
	Total selected industries	**586.7**	**14.0**	**410**	**64,343**	**13,082.6**

In this respect, the differences between the selected industries are not particularly remarkable (Table 3.4).

Second-tier analysis of the selected industries

The Nordic enterprise groups exporting to the five selected industries in Finland use imported inputs, of which 14.3% was imported from Other Nordic countries and 62.6% from Other European countries. The remaining 23.1% was imported from countries outside Europe (Figure 3.2.)

Figure 3.2 Second tier import pattern for Nordic enterprise groups exporting to Finland (2023)



Note: The figures indicate the proportion of total second-tier intermediate imports in the value chain originating from different regions.

Of the Nordic enterprise groups exporting to Finland, Swedish enterprise groups showed with 15.4% the largest Nordic import share, while the Norwegian enterprise groups with nearly half (49.1%) of their import from non-European countries represented the highest potential value chain risk for the selected Finnish industries.

In 2023, the five selected Finnish industries imported 1183.7 million EUR worth of intermediate goods directly from the other Nordic countries, accounting for 9.1% of the total Finnish import of intermediate goods. Based on our second-tier analysis, these first-tier imports include 7.2% of intermediate inputs sourced from outside Europe (Equation 2). Out of these non-European second-tier imports, 27.0% originate from China and an additional 17.5% from other BRICS+ countries.

3.3 Iceland

First-tier analysis of the selected industries

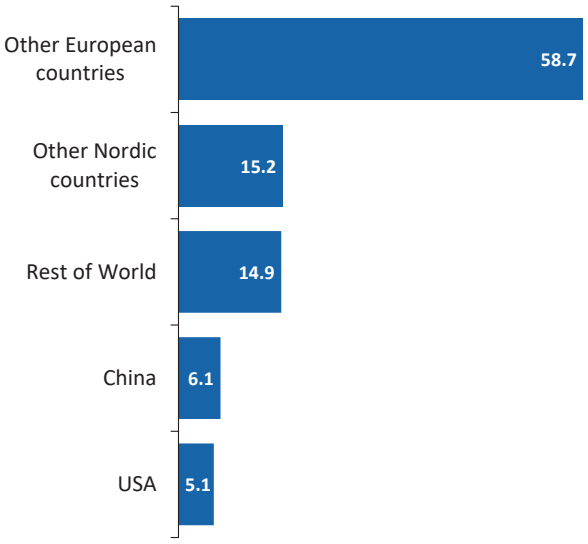
The 118 enterprise groups in the selected industries in Iceland imported for 72.9 million EUR intermediate goods directly from the other Nordic countries. This accounted for 36.3% of the total Icelandic import of intermediate goods from the Nordic region, compared to 22.2% for all industries.

Table 3.4 Financial figures for selected Finnish industries (2023)

NACE 3-digit	NACE name	Nordic import, mio. EUR	Nordic import, %	Number of enterprise groups	Number of fulltime employees	Gross value added, mio. EUR
171	Manufacture of pulp, paper and paperboard	194.1	23.7	20	14,592	1,920.5
222	Manufacture of plastic products	93.5	13.1	162	11,755	1,025.4
241	Manufacture of basic iron and steel and of ferro-alloys	607.5	20.5	7	8,012	848.9
273	Manufacture of wiring and wiring devices	134.8	26.8	11	1,577	149.2
289	Manufacture of other special-purpose machinery	153.9	14.7	174	22,040	3,712.8
	Total selected industries	**1,183.7**	**19.6**	**374**	**57,977**	**7,656.7**

Among the selected industries, Processing and preserving of meat and meat products showed the highest import share from the other Nordic countries (82.8%), while Processing and preserving of fish, crustaceans, and molluscs accounted for the lowest share (21.0%). Thus, the role of the other Nordic countries in first-tier imports varies significantly between industries (Table 3.5).

Figure 3.3 Second tier import pattern for Nordic enterprise groups exporting to Iceland (2023)



Note: The figures indicate the proportion of total second-tier intermediate imports in the value chain originating from different regions.

Second-tier analysis of the selected industries

The Nordic enterprise groups exporting to the five selected industries in Iceland imports themselves intermediate goods. Out of these first-tier imports from other Nordic countries, 15.2% was imported from Other Nordic countries and 58.7% from Other European countries (Figure 3.3).

The remaining 26.1% was imported from countries outside Europe. Of the Nordic enterprise groups exporting to Iceland, Swedish enterprise groups showed with 23.0% the largest Nordic import share, while the Norwegian enterprise groups with nearly 39.4% of import from non-European countries represented the highest potential value chain risk for the selected Icelandic industries.

In 2023, the five selected Icelandic industries imported 72.9 million EUR worth of intermediate goods directly from the other Nordic countries. Based on our second-tier analysis, these first-tier imports include 11.1% worth of intermediate inputs sourced from outside Europe. Looking at these non-European imports in more detail, approximately 23.3% originate from China and an additional 20.0% from other BRICS+ countries.

3.4 Norway

First-tier analysis of the selected industries

In 2023, the 149 enterprise groups in the selected industries in Norway imported for 778.2 million EUR interme-

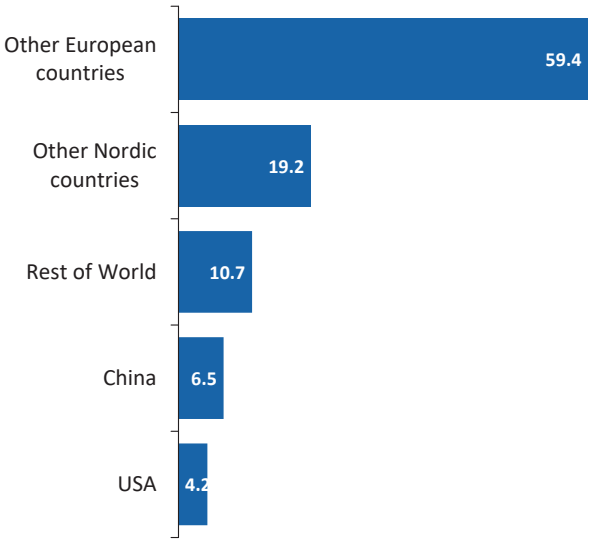
Table 3.5 Financial figures for selected Icelandic industries (2023)

NACE 3-digit	NACE name	Nordic import, mio. EUR	Nordic import, %	Number of enterprise groups	Number of fulltime employees	Gross value added, mio. EUR
101	Processing and preserving of meat and production of meat products	15.3	82.8	15	1228	144.8
102	Processing and preserving of fish, crustaceans and molluscs	8.2	21.0	57	4,105	909.0
181	Printing and service activities related to printing	11.2	37.2	39	381	41.5
203	Manufacture of paints, etc.	4.7	65.1	1	68	7.5
251	Manufacture of structural metal products	33.6	31.6	6	851	108.7
	Total selected industries	**72.9**	**36.3**	**118**	**6,633**	**1,211.4**

diate goods directly from the other Nordic countries. This accounted for 14.7% of the total Norwegian import of intermediate goods from the Nordic region, compared to 18.1% for all industries.

The role of the Nordic region as a source of first-tier imports varies between the five selected industries. While Manufacture of glass and glass products sources 36.3% of its imports from other Nordic countries, the corresponding share for Manufacture of basic precious and other non-ferrous metals is only 9.4% (Table 3.6).

Figure 3.4 Second tier import pattern for Nordic enterprise groups exporting to Norway (2023)



Note: The figures indicate the proportion of total second-tier intermediate imports in the value chain originating from different regions.

Second-tier analysis of the selected industries

The Nordic enterprise groups exporting to the five selected industries in Norway import themselves intermediate goods from different regions. Out of this second-tier imports, 19.2% was imported from Other Nordic countries and 59.4% from Other European countries. The remaining 21.4% was imported from countries outside Europe (Figure 3.4).

Of the Nordic enterprise groups exporting to Norway, Swedish enterprise groups showed with 22.0% the largest Nordic import share, while the Finnish enterprise groups with 28.6% of their import from non-European countries represented the highest potential value chain risk for the selected Norwegian industries.

In 2023, the five selected Norwegian industries imported directly 778.2 million EUR from the other Nordic countries. Based on our second-tier analysis, these first-tier imports include 8.2% worth of intermediate inputs sourced from outside Europe. Looking at these non-European imports in more detail, approximately 30.6% originate from China, and an additional 12.2% come from other BRICS+ countries.

Table 3.6 Financial figures for selected Norwegian industries (2023)

NACE 3-digit	NACE name	Nordic import, mio. EUR	Nordic import, %	Number of enterprise groups	Number of fulltime employees	Gross value added, mio. EUR
201	Manufacture of basic chemicals, fertilisers and nitrogen compounds, plastics and synthetic rubber in primary forms	261.6	14.9	51	7,809	1,595.2
231	Manufacture of glass and glass products	157.7	36.3	57	6,679	603.7
241	Manufacture of basic iron and steel and of ferro-alloys	120.8	19.2	9	2,326	403.3
244	Manufacture of basic precious and other non-ferrous metals	229.4	9.4	15	8,528	2,096.0
245	Casting of metals	8.6	30.8	17	576	50.4
	Total selected industries	**778.2**	**14.7**	**149**	**25,919**	**4,748.5**

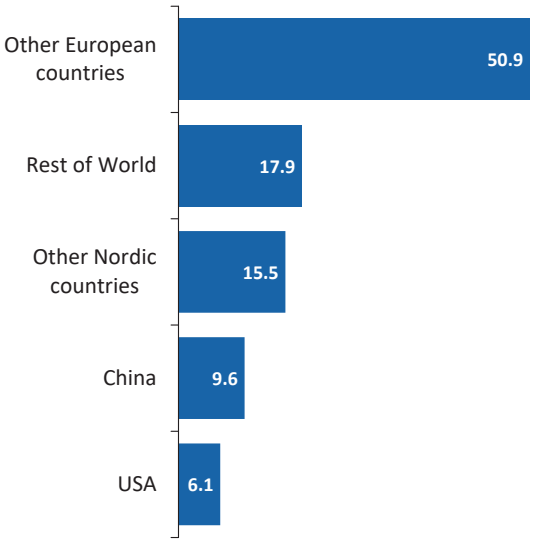
3.5 Sweden

First-tier analysis of the selected industries

The 246 enterprise groups in the selected industries in Sweden imported for 1578.6 million EUR intermediate goods directly from the other Nordic countries. This accounted for 11.5% of the total Swedish import of intermediate goods from the Nordic region, compared to 18.9% for all industries. Thus, the selected five industries rely less on intra-Nordic imports compared to all industries.

While Manufacture of pulp, paper, and paperboard sources 40.9% of its imports from other Nordic countries, the corresponding share for Manufacture of motor vehicles is only 7.2%. Thus, the role of the other Nordic countries varies substantially between the selected industries (Table 3.7).

Figure 3.5 Second tier import pattern for Nordic enterprise groups exporting to Sweden (2023)



Note: The figures indicate the proportion of total second-tier intermediate imports in the value chain originating from different regions.

Second-tier analysis of the selected industries

The Nordic enterprise groups exporting to the five selected industries in Sweden import themselves intermediate goods from different regions. Out of this second-tier imports, 15.5% was imported from Other Nordic countries and 50.9% from Other European countries. The remaining 33.6% was imported from countries outside Europe (Figure 3.5).

Among the Nordic enterprise groups exporting to Sweden, Danish groups accounted for the highest Nordic import share (23.0%). However, Danish enterprise groups also showed the largest share of imports from non-European countries, thus representing the highest potential value chain risk for the selected Swedish industries.

In 2023, the five selected Swedish industries imported 1578.6 million EUR worth of intermediate goods from the other Nordic countries. Our results (based on Equation 2) suggest that these imports include 13.3% worth

Table 3.7 Financial figures for selected Swedish industries (2023)

NACE 3-digit	NACE name	Nordic import, mio. EUR	Nordic import, %	Number of enterprise groups	Number of fulltime employees	Gross value added, mio. EUR
171	Manufacture of pulp, paper and paperboard	292.2	40.9	26	16,966	3,276.7
201	Manufacture of basic chemicals, fertilisers and nitrogen compounds, plastics and synthetic rubber in primary forms	391.7	27.6	52	6,693	1,381.8
259	Manufacture of other fabricated metal products	155.5	22.5	104	8,115	1,119.9
271	Manufacture of electric motors, generators, transformers and electricity distribution and control apparatus	218.1	12.6	46	14,372	1,877.8
291	Manufacture of motor vehicles	521.0	7.2	18	66,584	12,507.8
	Total selected industries	**1,578.6**	**11.5**	**246**	**112,730**	**20,164.0**

of intermediate goods that in the second-tier are imported outside Europe.

Looking at these non-European imports in more detail, approximately 28.6% originate from China, and an additional 17.5% come from other BRICS+ countries.

4 Conclusions and Discussion

Our analysis demonstrates that the perceived security of regional trade within the Nordic countries often masks a complex web of global dependencies. While friendshoring and intra-regional trade are frequently cited as pillars of economic resilience, the look-through approach reveals a fog of complexity at the second tier of the value chain. The central conclusion of this research is that regional sourcing does not equate to regional autonomy. This is due to dependencies on undesirable countries at the second tier of value chains or in subsequent stages.

Our analysis shows that, direct or first-tier imports from other Nordic countries include, on average, 10.8% worth of intermediate goods that in the second-tier are imported outside Europe. This non-European share is highest in Denmark (14.3%) and lowest in Finland (7.2%). Deeper analysis revealed that BRICS+ countries play an important role in second-tier imports. Out of second-tier non-European imports, China accounts for, on average, 27.1% and other BRICS+ countries an additional 16.3%.

This means that imports from other Nordic countries include value added originate not only from non-Nordic but also from non-European countries, representing a hidden potential vulnerability that standard Tier 1 analysis fails to capture.

A critical implication of this report is the widening wedge between private firm-level risk evaluation and public national security interests. While individual firms may prioritize just-in-time production and low-cost sourcing from non-European markets to remain competitive, they often remain blind to the origins of their Tier 2 and Tier 3 components. However, the aggregate cost of a value chain failure in strategic sectors like healthcare, energy, or defense is far higher than any single company's bottom line.

Our contribution to value chain analysis is methodological, based on cooperation between national statistical authorities. We mirror the import data of one country within the export data of the partner country. This enables us to analyze the imports of that exporting country, which represent second-tier links. For example, we identify the enterprise groups in Finland that import intermediate goods from Danish, Icelandic, Norwegian, and Swedish suppliers, and then analyze the regions from which these suppliers import their own intermediate inputs. From the Finnish perspective, these imports represent the second tier of the value chain.

The Nordic region's economic security depends not just on whom its companies buy from, but on whom those suppliers buy from. Only by piercing the veil of the second tier can Nordic policymakers ensure that regional trade remains a source of strength rather than a hidden channel for systemic risk.

Because this methodology has not been utilized before, we focused on a limited number of industries (five in each Nordic country) instead of the entire economy. In the future, a similar analysis could be expanded to cover the aggregate economy. From a European perspective, the ambition could be set even higher: to map the second tier of the value chain on a pan-European scale. This would require the participation of statistical authorities from all European countries, rather than just the Nordic region.

Appendix

Micro Data Linking and Nordic Databases

The foundation of the project rests on national register databases established across the Nordic national statistical institutes (NSIs). These databases contain harmonized statistical variables and enterprise populations covering a range of annual business and trade statistics. The registers cover all active enterprises in the non-financial business economy (NACE Rev. 2 sections B to N, excluding K) for the period 2022–2024, the latter being the most recent year for which synchronized annual business and trade statistics are available across the Nordic countries.

Core to micro data linking (MDL) is the unique enterprise ID, which serves as the key for identifying identical enterprises across different statistical registers—such as Structural Business Statistics (SBS) and International Trade in Goods Statistics (ITGS)—and for matching data between them. To the extent possible, the project's tailored MDL databases utilize 2022–2024 input data from the SBS, ITGS, and the Statistical Business Register of each Nordic country.

Annual micro-level datasets are constructed from these sources. To ensure smooth data processing, annual datasets are stored for each reference year and register included in the MDL database. These datasets are maintained locally at each NSI, and no identifiable data will be exchanged.

Shared Syntax

One of the major benefits of this applied design and the coherent MDL databases across the Nordic NSIs is the possibility of executing centrally scripted SAS syntax locally at each institute. This ensures a harmonized approach to tailoring panel data for each country, resulting in consistent output. The method applied is further described in Chapter 2.1.

Endnote

[1] We do not observe a complete match between the import and export information.

Literature

Ali-Yrkkö, J. & Bøegh Nielsen, P. (2026). The Value Chains of the Nordics – Tracking Resilience and Vulnerabilities. Nordic Council of Ministers.

Baldwin, R., Freeman, R. & Theodorakopoulos, A. (2022). Horses for courses: measuring foreign supply chain exposure. Bank of England Staff Working Paper, 996, 1–60.

Baldwin, R., Freeman, R. & Theodorakopoulos, A. (2023). Hidden exposure: Measuring US supply chain exposure to China. Brookings Papers on Economic Activity, 2, 81–143.

Berenschot (2024). Dependencies, risks and measures regarding the use of critical raw materials within the Dutch Defence Industry Strategy areas. Berenschot, Netherlands.

European Commission (2023). Critical raw materials for the EU 2023. European Commission Reports, 1, 1–230.

Paes, L., Gjesvik, L. & Melchior, A. (2024). Norway's strategic dependencies in global supply chain networks. NUPI Report, 1, 1–35.

ETLA

Elinkeinoelämän tutkimuslaitos

ETLA Economic Research

ISSN-L 2323-2447,
ISSN 2323-2447,
ISSN 2323-2455 (Pdf)

Kustantaja: Etlatieto Oy

Puh. 09-609 900
www.etla.fi
etunimi.sukunimi@etla.fi

Arkadiankatu 23 B
00100 Helsinki