Import Vulnerabilities in Production: Identifying and Simulating Belgium's Exposure

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Nederlandstalige Samenvatting

Dit rapport bestudeert de mate waarin België is blootgesteld aan de invoer van intermediaire goederen. Het identificeert hiervoor in eerste instantie de kwetsbare punten binnen internationale aanvoerlijnen en simuleert in tweede instantie de impact van verstoringen in diezelfde aanvoerlijnen op de output (de productie gewaardeerd in nominale termen) van de Belgische economie. De voorgestelde methodologie gaat uit van een zeer gedesaggregeerd niveau van analyse waardoor de resultaten operationele inzichten aanleveren voor zowel goederen als sectoren. Aan de basis van de benadering ligt een nieuwe gegevensbron die globale handelsstromen in individuele goederen tussen sectoren herneemt. Het is deze gegevensbron die onderzoekers toelaat om de omvang van de kwetsbaarheid van de Belgische economie voor verstoringen in internationale aanvoerlijnen op sectoraal niveau te kwantificeren.

De simulatie van de impact van dergelijke verstoringen op de output op korte en middellange termijn doet beroep op een model dat substitutiebeslissingen herneemt op drie hiërarchische en onderling verbonden niveaus van productie bij individuele ondernemingen, zie Bormans, Renneberg and Reynaerts (2025*b*, ECOOM-STORE-25-013) voor meer details. Om de mogelijkheden en aanwendingen van deze nieuwe benadering te illustreren, worden de gevolgen onderzocht van een fictieve reductie ten belope van 25% in de aanvoer van geavanceerde technologische goederen (*Advanced Technology Products*, ATP) afkomstig van de Verenigde Staten op de binnenlandse productie van de Belgische economie en haar samenstellende sectoren. Ook al liggen de Belgische kwetsbaarheden in lijn met deze van andere landen, geven de bevindingen aan dat de grootste Belgische industrieën diegene zijn die het meest zijn blootgesteld aan schokken in internationale aanvoerlijnen. Het resultaat van de simulaties, m.n. een omvangrijke reductie in de geaggregeerde Belgische output, is een combinatie van twee kenmerkende elementen, m.n. *(i)* de mate waarin specifieke sectoren zijn blootgesteld aan specifieke aanvoerschokken, en *(ii)* het aandeel van diezelfde sectoren in het geheel van de Belgische economie.

Abstract

This report investigates the exposure of Belgian production to imported intermediate products by first identifying vulnerabilities in international supplies and subsequently simulating the effects of supply chain disruptions. As these exercises are conducted at a highly disaggregated level, the results provide actionable insights at the product and sector level. This is enabled by a novel dataset covering global product-level trade flows of intermediate goods between sectors, which allows us to identify the extent of Belgium's vulnerability to international supply disruptions at the sector level. We then apply a model of production to simulate the short- and medium-term responses of output to supply disruptions. Specifically, we simulate how a 25% decrease in US exports of Advanced Technology Products (ATPs) would affect domestic production of Belgium and its sectors compared to other countries. This application is intended to highlight and illustrate the capabilities of the underlying framework, presented in detail by Bormans *et al.* (2025*b*, ECOOM-STORE-25-013). Findings show that although Belgium is not overly vulnerable to international supply shocks compared to other countries, its largest goods-producing industries are also among its most exposed. In our simulations, this results in large aggregate output losses, as some of Belgium's largest sectors are also its worst affected.

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1 Introduction

This report investigates the exposure of Belgian production to imported intermediate products by first identifying vulnerabilities in international supplies and subsequently simulating the effects of supply chain disruptions.[1] These exercises are conducted at a highly disaggregated level, building on a product-level dataset of global bilateral trade in intermediate goods between sectors. This level of granularity is essential for designing targeted and effective policy interventions, as dependencies may differ significantly between sectors within an importing country.

Identifying dependencies and vulnerabilities in global supply chains has been a central policy issues across the globe in recent years. Many countries have turned their attention to reducing the extent to which domestic production is dependent on imported intermediate inputs, a prominent example being the European Union's push for "open strategic autonomy" (European Commission, 2021; Bormans *et al.*, 2025*a*,*b*). To assess the extent to which Belgium is exposed to supply chain risks, this report identifies the number and (value) share of intermediate products for which Belgium and its most important goods-producing sectors are vulnerable to international supply disruptions. Findings indicate that Belgium's level of exposure is comparable to other countries, although its largest sectors are also among the most exposed.

We then simulate the effect on output of a fictitious shock reducing US exports of Advanced Technology Products (ATPs) by 25%. We present results for a short-term and a medium-term scenario. For each, we compare the shock's effect on different sectors within Belgium, on the same sector across countries, as well as on total output across countries. This application is intended to illustrate the capabilities of the underlying methodological framework. The framework is highly flexible in that it can capture a supply shock hitting any number of exporting countries, exporting sectors, and products. Results serve to quantify and compare how "dangerous" dependencies in supply chains may be for different importing sectors and countries.

The following section provides a brief overview of the methodology, with particular attention to the choices made in its application. Section 3, then, provides details on the country-product-sector level dataset of global trade in intermediate goods used in this report, along with information on the underlying datasets and practical considerations. Section 4 presents the results of our analysis of Belgium's import vulnerabilities, comparing across countries and sectors. Section 5 constitutes the centerpiece of this report, covering the results of our simulation framework. Section 6 concludes.

[1]This report is the second result of the ongoing development of simtool 1.0 "Globale schokken" as specified in the ECOOM annual plan 2025. The first outcome in 2025 was a methodology report (ECOOM-STORE-25-013) by Bormans *et al.* (2025*b*) which lays the foundation for this report.

2 Methodology and Parameter Choices

The methodology used throughout this report consists of three building blocks.[2] The first component is a technique to match product-level trade data with international input-output tables to obtain trade flows at the country-sector-product level. This technique hinges on a so-called proportionality assumption used to distribute product-level trade flows across importing sectors within a country. The subsequent section details the data used for this report and discusses practical concerns.

The second component to this report's methodology is a criterion indicating whether an importer is (highly) vulnerable to supply disruptions for a given product p. This criterion can be applied from the perspective of an importing country j or country-sector js. It consists of three metrics calculated for a given intermediate product: two Herfindahl-Hirschmann Indices (HHI), one for import concentration (HHI^M_{jp} or HHI^M_{jps}) and one for global export concentration (HHI^X_p), along with a binary variable verifying that the importing country is a net importer denoted net_M.[3] After calculating the three metrics, whether a product is a "vulnerability" to an importer depends on the thresholds chosen for the two HHIs. Common values in the literature range from 0.25 to 0.5 [4], with a higher threshold indicating a stricter definition of what qualifies as a vulnerability. Following Berthou *et al.* (2024), this report uses two sets of thresholds to differentiate between "vulnerable" and "highly vulnerable", with the threshold values summarized in Table 1. Section 4 applies this methodology to analyze the case of Belgium.[5]

Table 1: Threshold values used in identifying vulnerabilities

	Vulnerable	Highly Vulnerable
HHI^M	0.3	0.5
HHI^X	0.3	0.5
net_M	1	1

[2] For a detailed discussion of the methodology, readers may consult Policy Report ECOOM-STORE-25-013 by Bormans *et al.* (2025*b*).

[3] The underlying concept behind the binary variable is that net importers cannot meet domestic demand with their production and are hence exposed to international supply chain risk.

[4] Cf. European Commission (2021), Bonnet and Ciani (2023), Berthou *et al.* (2024), Dumont *et al.* (2024).

[5] Dumont *et al.* (2024) use a related approach to analyze the non-EU dependence of Belgian imports, building on an HHI for import concentration along with the requirement that 50% of imports come from non-EU countries. In contrast, the criterion used here is designed to identify vulnerabilities to supply disruptions originating anywhere (including in EU countries). Moreover, it can differentiate between importing sectors, and accounts for both domestic production capacities and export concentration.

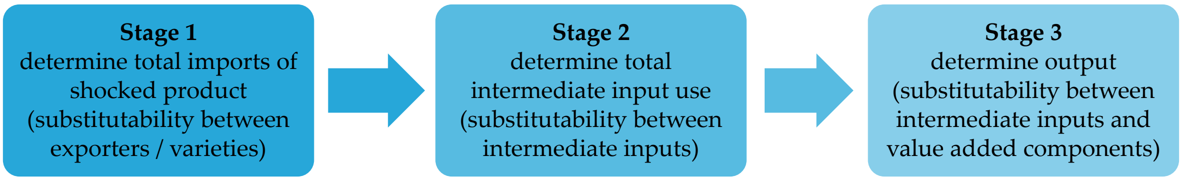

Figure 1: Stages of the nested CES simulation framework.

The third component to the methodology used here is a simulation framework capturing the effects of supply disruptions on the output of importing sectors. This framework can be used to simulate supply shocks hitting any number of exporting countries, exporting sectors, and products. Underlying this framework is a nested Constant Elasticity of Substitution (CES) model of production capturing three forms of substitution, illustrated in Figure 1. For a given shock to their imports, producing sectors first choose between suppliers of a product, then between intermediate inputs, and finally between intermediate inputs and value added components. The model captures *direct* effects, meaning it does not trace *indirect* effects on an affected importer's trade partners, and does not cover general equilibrium (GE) effects. For these reasons, the model is suitable for the analysis of short- to medium-term scenarios, defined as up to one year after the shock. In either scenario, we assume that producers have no stocks to bolster drops in import supplies. The distinction between short- and medium-term scenarios hinges on making careful parameter choices. We follow recent examples in the literature, summarized in Table 2. Importantly, for the medium-term elasticity of substitution between exporters, we use product-level estimates by Fontagné *et al.* (2022). Nevertheless, as the exact numerical results are sensitive to parameter choices, we see the value of this model in its ability to draw comparisons. Specifically, for a given disruption to the supply of certain products from certain countries, the model can compare how the output of importing countries, as well as importing sectors within and across countries, changes in response to the supply disruption in question. Section 5 presents an application of this framework.

Table 2: Elasticities used in simulations

Elasticity	Between exporters (ε)	Between int. inputs (σ)	Between int. inputs and value added (μ)
Short term	0.1	0.04	0.5
Medium term	Fontagné *et al.* (2022)	0.1	0.5

3 Data

The foundation of this report is a highly granular dataset covering global flows of intermediate goods. Specifically, this dataset covers intermediate goods trade between country-sectors at the product level for the year 2023. It is constructed by combining information on product-level trade from the BACI database (cf. Gaulier and Zignago (2010)) with sector-level information from the FIGARO input-output tables by Eurostat (cf. Remond-Tiedrez and Rueda-Cantuche (2019)).[6] The resulting dataset covers global trade in 3076 intermediate goods between 64 sectors in 49 countries, with the remaining countries grouped into a rest-of-world (ROW) aggregate.[7] For a detailed discussion of the general merging procedure, readers may consult Policy Report ECOOM-STORE-25-013. The remainder of this section highlights key advantages of the data sources used along with practical challenges in applying this procedure.

The two databases underlying our merged dataset are carefully chosen. The first one, CEPII's BACI data on trade flows, is often considered the benchmark for product-level trade flow data with global coverage. It builds and improves on the United Nations' (UN) Comtrade database, reconciling mismatched import and export values while taking into account the reliability of the reporting country. By providing clearly labeled releases, BACI also improves reproducibility compared to continuously updated databases like UN Comtrade. The second data source, Eurostat's FIGARO input-output table, has an advantage over many comparable datasets in that it is available for recent years, with the 2025 release covering up to and including 2023. It also explicitly includes all EU27 countries and most of Belgium's key non-EU trade partners. Lastly, FIGARO offers data created either by following NACE industry codes or CPA (Classification of Products by Activity) codes. Using the CPA codes is more appropriate in the context of this report: On the one hand, NACE industries may be selling products that they do not produce, which prevents assigning products uniquely to producing industries. On the other hand, NACE industries may be importing products that are not used directly or indirectly in production, which could jeopardize the effects of supply disruptions on output in our simulations. Both of these issues are alleviated by using CPA codes, yet CPA codes also map uniquely to NACE industry codes, allowing for easily interpretable results. To avoid confusion concerning the distinction between the CPA and NACE definitions, the remainder of this report simply speaks of "sectors".

The central practical challenge in merging the two datasets lies in assigning each

[6] The BACI data at the Harmonized System 6-digit (HS6) level for 2023 used here is version 202501 encoded to the HS's 2007 nomenclature. FIGARO input-output tables for 2023 are taken from the 2025 edition and use the product-by-product definition encoded to the CPA 2.1 standard.

[7] For an overview of the included countries and sectors, see Appendix Tables 3 and 4.

product uniquely to a producing sector. This is done by using concordance tables from Eurostat which assign Combined Nomenclature 8-digit (CN8) product codes to broader product categories ("sectors") following the CPA 2.1 standard used in the FIGARO tables. We first extract from the CN8 codes the corresponding HS6 codes, subsequently convert from the HS's 2022 nomenclature into the 2007 nomenclature, and finally match products in the BACI dataset to CPA 2.1 categories. For any products not uniquely assigned to a CPA 2.1 category, we additionally consult the OECD (2025)'s BTDIxE database, which has now been superseded by the Bilateral Trade in Goods by End-Use (BTiGE) database, to uniquely assign products to a producing sector. We use this same database to restrict our data to only intermediate goods by utilizing information on end use categories.

4 Identifying Granular Import Vulnerabilities

This section quantifies Belgium's supply chain risk by identifying how exposed Belgium is to international supply disruptions. To this end, we compute the number and share of goods for which Belgium and its sectors are (highly) vulnerable to supply shocks according to the criterion defined in Section 2. The focus of this analysis lies not on creating a list of products comparable to existing lists of strategic goods, such as critical raw materials or semiconductor-related products. This would require additional information, such as a product's substitutability in specific production processes and the strategic importance of the final goods it is used in. Instead, emphasis lies on assessing the extent of vulnerabilities by comparing across sectors and countries the number of products fulfilling the criterion and these products' (value) share in imports.

Before delving into results for Belgium, we first provide intuition for our approach. Figures 2 and 3 show how the two concentration measures used in identifying vulnerabilities behave. Using global trade flows, we find that imports of the vast majority of products exceed our thresholds and qualify as vulnerable (shown in blue) or highly vulnerable (shown in orange), when taking a simple average across importing countries. This highlights how for most products, importing countries rely only on a handful of key exporters to cover their import demand. Figure 3, then, suggests that for most products this is not driven by a lack of exporters: Less than 20% of products qualify as vulnerable and only a fraction of these in turn qualify as highly vulnerable, indicating that for many products importers have options to diversify their imports and hedge supply chain risks. Note, however, that this would likely induce search costs required to set up new trade connections and might require importers to partially move away from their lowest cost suppliers.

Restricting our analysis to Belgian product-level imports, we again find a similar pattern. In Figure 4, which maps global export concentration against Belgian import concentration, most products are positioned below the 45-degree line. For these products, Belgian imports are more concentrated than global exports. Moreover, the far right of the graph indicates that there are a number of products for which Belgium relies on a single exporter, yet only some of these products also have a high concentration of global exports. Using the definition of vulnerabilities laid out in Section 3, we identify 271 HS6 intermediate goods for which Belgium is vulnerable (in blue), and 59 for which it is highly vulnerable (in orange).[8] Taken together, these findings indicate

[8]To confirm that our merged dataset accurately captures Belgium's vulnerabilities, we create the same graph using our data instead of BACI and find very similar results (279 vulnerable and 59 highly vulnerable; s. Appendix Fig. 13).

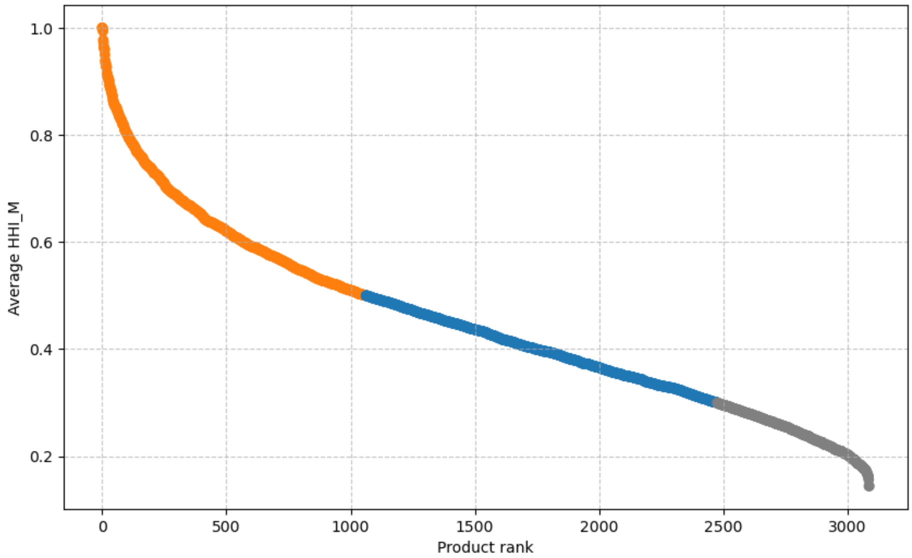

Figure 2: Global import concentration by product, calculated for each product as simple average over importing countries' HHI_{jp}^{M}. Colors follow the thresholds defined in Section 2: gray for $\overline{HHI}_{p}^{M} \leq 0.3$, blue for $0.3 < \overline{HHI}_{p}^{M} \leq 0.5$, and orange for $\overline{HHI}_{p}^{M} > 0.5$.
Source: Own calculations, BACI data.

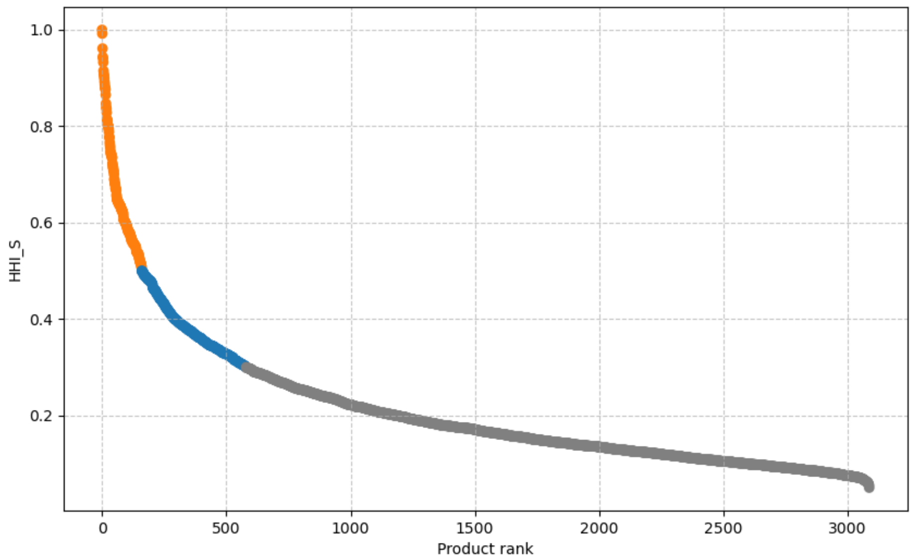

Figure 3: Global export concentration by product captured by HHI_{p}^{S}. Colors follow the thresholds defined in Section 2: gray for $HHI_{p}^{S} \leq 0.3$, blue for $0.3 < HHI_{p}^{S} \leq 0.5$, and orange for $HHI_{p}^{S} > 0.5$.
Source: Own calculations, BACI data.

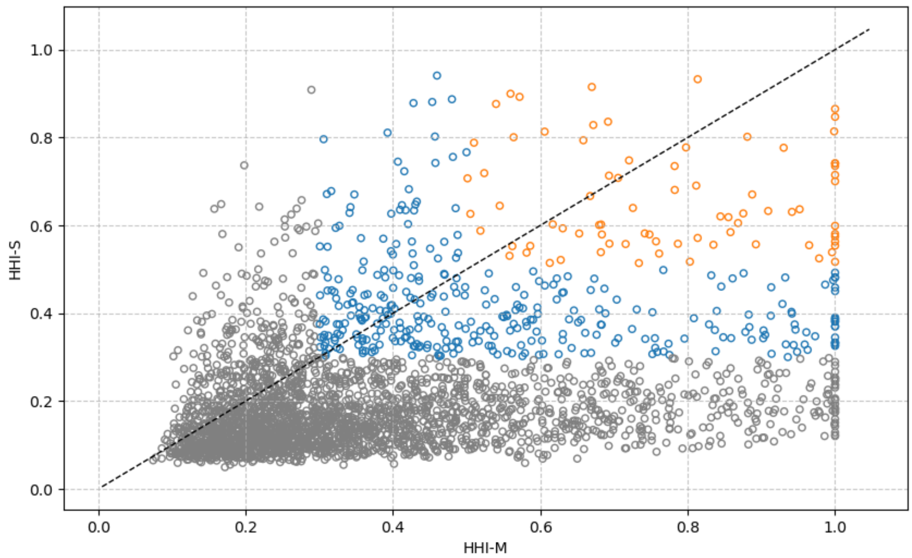

Figure 4: Global export concentration on the y-axis mapped against Belgian import concentration on the x-axis for all products imported by Belgium. Colors follow the thresholds defined in Section 2: gray for both HHIs $\leq$ 0.3, blue for 0.3 < both HHIs $\leq$ 0.5, and orange for both HHIs > 0.5.

Source: Own calculations, BACI data.

that for most products indicated as vulnerabilities, global export supplies would allow Belgium to diversify its imports. This may be done either preemptively, or in reaction to international supply shocks, a scenario investigated in more detail in Section 6.

Comparing Belgium to other countries[9], we find that Belgium is (highly) vulnerable for a similar share of imported products as are other European countries, as highlighted in Figure 5. The outliers in this graph are China and Russia: The former exhibits the lowest share of products for which it is vulnerable, yet the highest share of products for which it is highly vulnerable, hinting towards ingrained dependencies on certain imported products. The latter exhibits by far the highest share of vulnerabilities, accompanied by a sizable share of highly vulnerable products, suggesting that Russia in 2023 was struggling to source many intermediate goods internationally. Figure 6 uses the same structure but shows the share of (highly) vulnerable imported intermediate goods in the total value of imports. Immediately apparent is that China is by far the most vulnerable in terms of import value, indicating that China spends a disproportionate amount on products indicated as (highly) vulnerable. Noteworthy is also that

[9]The reference group of countries used throughout this section consists of Belgium (BE), China (CN), France (FR), Germany (DE), the Netherlands (NL), Russia (RU), the United Kingdom (GB), and the United States of America (US).

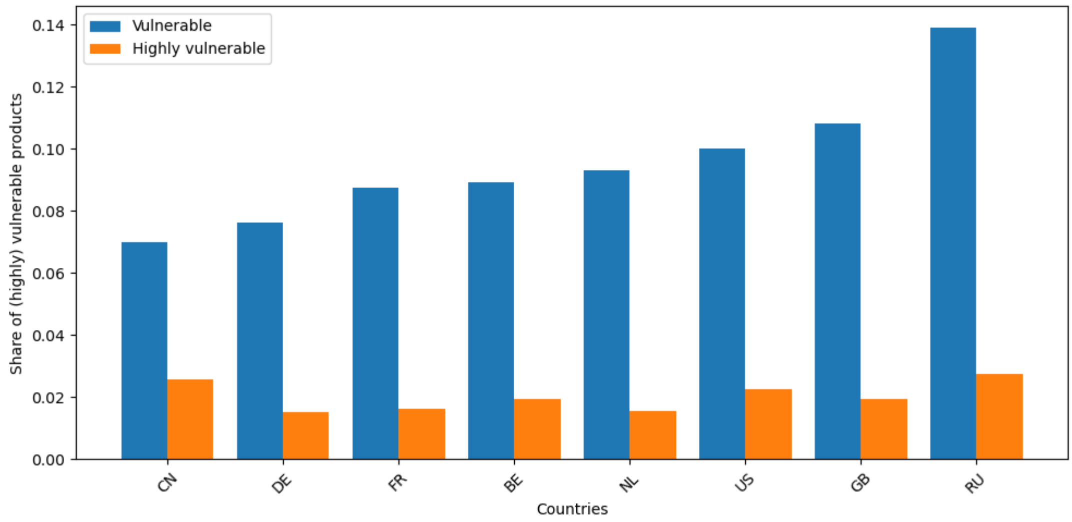

Figure 5: Share of products for which importing countries are (highly) vulnerable to international supply disruptions.
Source: Own calculations, BACI data.

Great Britain, the USA, and France now appear comparatively less exposed to supply chain risks than in Figure 5, indicating that these countries spend relatively smaller amounts on products for which they are vulnerable. For Belgium, the picture remains largely unchanged when comparing the two figures, with both indicating a level of exposure comparable to its European neighbors.

Lastly, we conduct a similar exercise for different sectors in Belgium to compare how vulnerable their production is to supply disruptions of imported intermediate goods. This analysis builds on our dataset of country-sector-product level trade flows outlined in Section 3 and focuses on the ten largest goods-producing sectors in terms of output, defined as the gross production by CPA code reported in FIGARO. As shown in Figure 7, most sectors are considered (highly) vulnerable for a similar share of imported products. This is expected given our data approach, as the proportionality assumption we implement leads to most sectors importing most products. Moving to the value share of vulnerable imports, however, reveals stark differences between the sectors. In Figure 8, value shares of vulnerable imports range from as little as 1% to around 14%, and from near zero to over 4% for highly vulnerable imports. Out of these large sectors, the agricultural sector (CPA code A01) along with the food, beverages, and tobacco sector (C10T12) are by far the most exposed, particularly when focusing on the value share of highly vulnerable imports. This suggests that international supply shocks could cause significant output losses in these sectors, which particularly for the food, beverages, and tobacco sector could mean large total output losses for Belgium. However, these sectors for the most part import products that are relatively

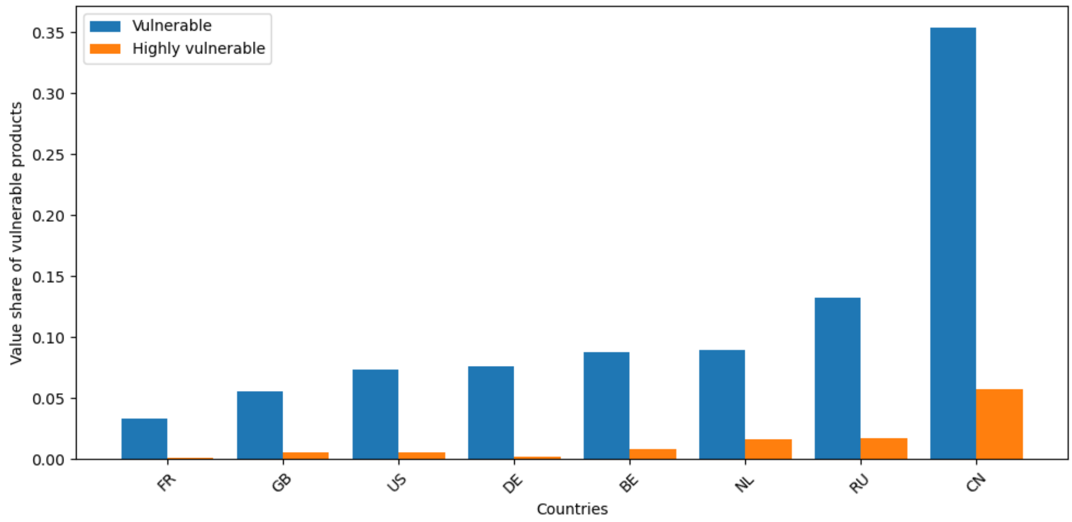

Figure 6: Value share of products for which importing countries are (highly) vulnerable to international supply disruptions.
Source: Own calculations, BACI data.

easy to produce, and vulnerabilities of these sectors are likely driven by high import concentration, not high export concentration. Strategically, the relatively high values of vulnerable imports of the chemical (C20) and pharmaceutical (C21) sectors therefore likely pose a larger threat. For parts of their production, these sectors rely on technologically advanced products or rare raw materials, which can reasonably be expected to make it more difficult to respond to international supply shocks or hedge supply chain risk by importing from more suppliers. On a more positive note, even these relatively exposed sectors spend at most 1% of their import budget on products for which they are highly vulnerable. Overall, while Belgium does not appear overly vulnerable to international supply shocks when compared to its peers, its largest goods-producing industries are also among its most exposed.

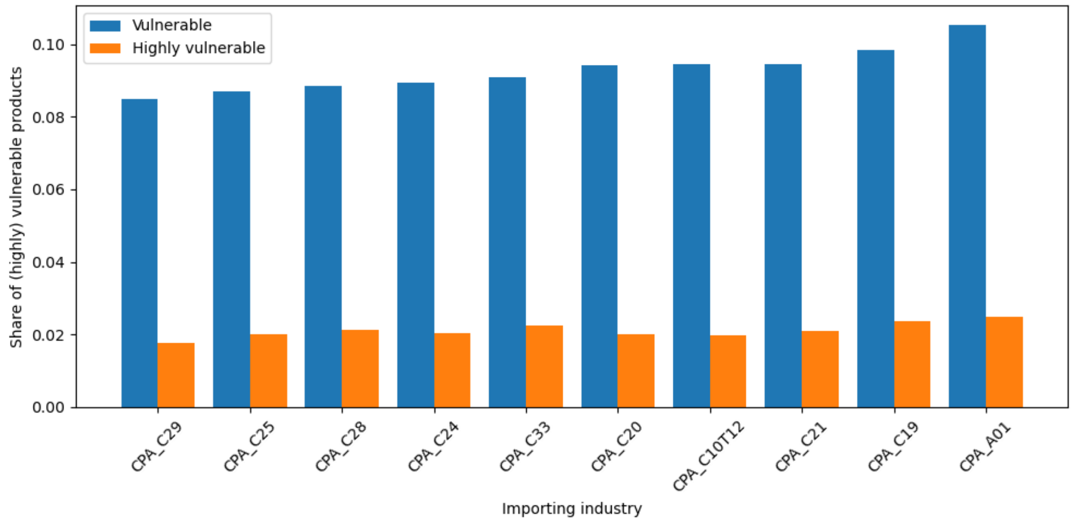

Figure 7: Share of products for which importing sectors in Belgium are (highly) vulnerable to international supply disruptions.
Source: Own calculations, merged dataset building on BACI and FIGARO.

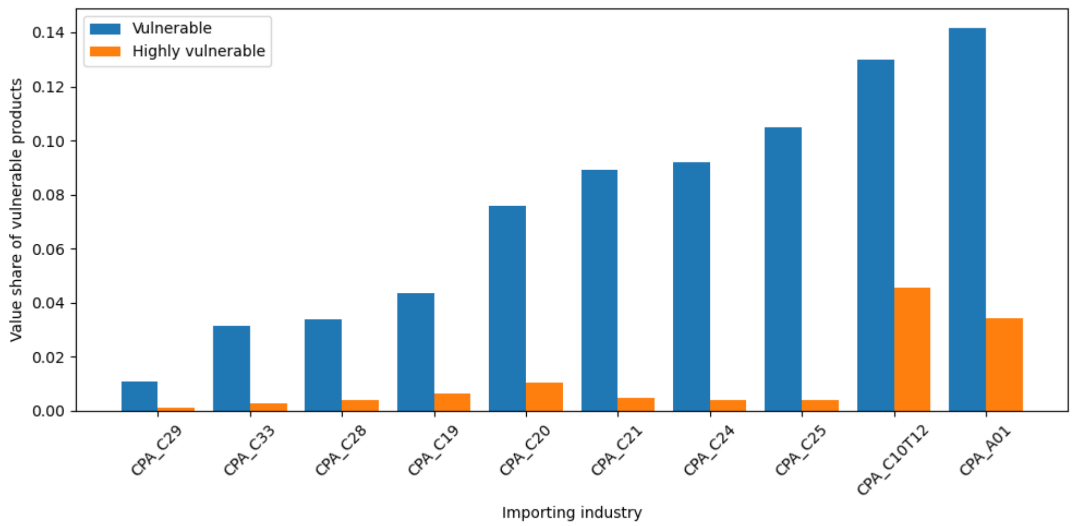

Figure 8: Value share of products for which importing sectors in Belgium are (highly) vulnerable to international supply disruptions.
Source: Own calculations, merged dataset building on BACI and FIGARO.

5 Simulating International Supply Shocks

This section aims to illustrate the capabilities of our simulation framework. To reiterate, the framework translates international product-level supply shocks into changes in importing sectors' output. It can trace international supply disruptions to any intermediate goods or countries in our merged dataset laid out in Section 3. For a given shock, the underlying model calculates how output changes for all importing sectors and countries who are not themselves the source of a supply disruption. As the model's calculations for short- and medium-term effects are sensitive to parameter choices, the value of our framework lies in its flexibility and the ability to compare results across countries and sectors.

The specific shock analyzed in this section is a fictitious reduction in US exports of Advanced Technology Products (ATPs)[10] by 25%. This exogenous shock can be thought of as a natural disaster or a shock to production technologies. We consider this shock to be a relevant test of the simulation framework for two reasons. First, the US is a key trade partner of Belgium (cf. Bormans *et al.* (2025*a*)). Second, ATPs are by definition technologically advanced and may therefore be difficult to produce domestically or source from other countries. These facts make the chosen scenario a suitable application for our framework, as we expect to observe significant disruptions to Belgian production, particularly in industries relying on high-tech intermediate inputs. We first present the results using our short-term specification, before turning to medium-term results and discussing how results differ depending on the chosen time horizon.

Within Belgium, we find large differences in how different sectors respond to a disruption to US ATP exports. As in Section 4, we focus on the ten largest sectors in terms of output, defined as the gross output per CPA code based on FIGARO data. Note that this definition of output does not coincide with gross domestic product (GDP) or other value added measures, but rather refers to the gross value of production of goods and services that fall under a given CPA code. It therefore aligns with this report's focus on the resilience of domestic production capacities. Aside from the ten largest sectors, the graphs also include the strategically important computer, electronic and optical products sector (CPA code C26). All figures in this section present the output after a shock relative to baseline, meaning an indicated value 0.98 refers to a 2% loss in output.

[10] To define ATPs, we use 2024 ATP-HS concordance files for exports published by the United States Census Bureau at `https://www.census.gov/foreign-trade/reference/codes/atp/index.html`. The list covers over 500 products using the US 10-digit classification. Restricting the list of ATPs to the HS 6-digit level and converting to the 2007 HS nomenclature used in our merged dataset leaves us with 225 product codes.

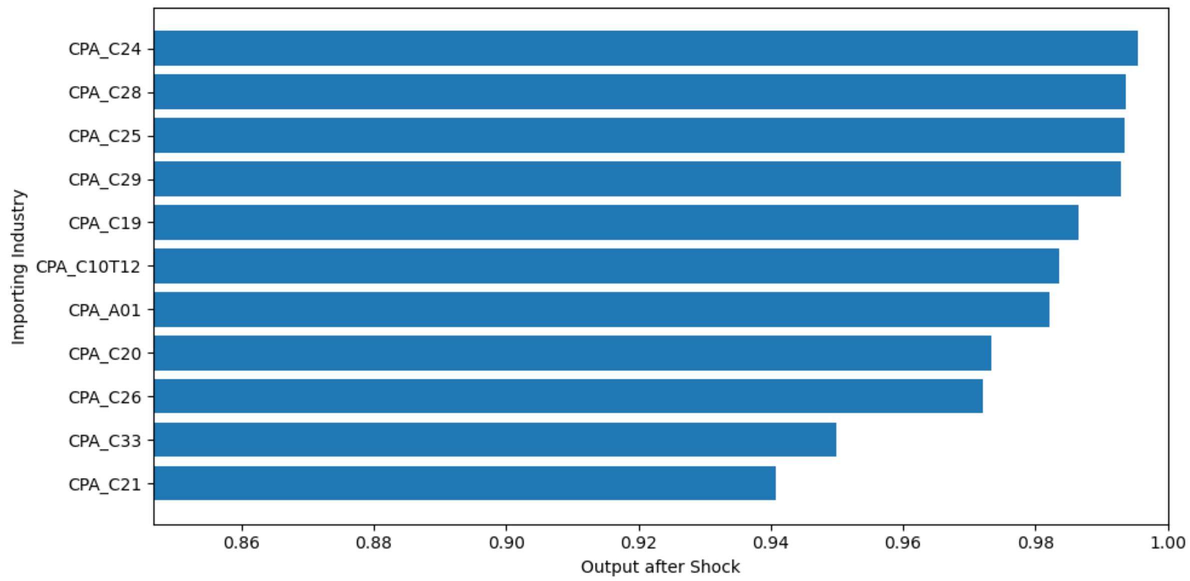

Figure 9: Simulation: short-term output response of Belgian sectors to a shock reducing US exports of Advanced Technology Products by 25%.
Source: Own calculations, merged dataset building on BACI and FIGARO.

At the top of Figure 9 are the sectors least affected in terms of output. Among these are basic metals (C24) and fabricated metal products (C25). This result is expected, as these sectors plausibly do not require high tech intermediate inputs in their production. Generally, there is a smooth progression of sectors experiencing increasing output losses when reading the graph from top to bottom. The exception are the final two sectors: repair and installation services of machinery and equipment (C33) and the pharmaceutical sector (C21) take a far larger hit to output than other sectors. This is evidence for these sectors relying disproportionately on imported high tech products from the US, which renders them susceptible to the supply disruption in question.

With the pharmaceutical sector being both the worst hit and one of the largest goods-producing sector in Belgium, we now turn towards comparing it internationally to the pharmaceutical sectors in other countries. As evident from Figure 10, Belgium is part of a group of three European countries at the bottom of the graph, with its output losses in the pharmaceutical sector (ca. -6%) only topped by Germany (ca. -8%). At the other end of the graph, Russia experiences by far the smallest output losses, in line with the expectation that its industries have largely decoupled from US imports. Surprisingly, China fares worse than France and Great Britain, indicating that its pharmaceutical sector depends on the US for a sizable share of its imported high-tech intermediate inputs. The US is shown in gray as it is the source of the disruption and therefore excluded from calculations.

Figure 11, then, shows how countries' total output changes in response to the sup-

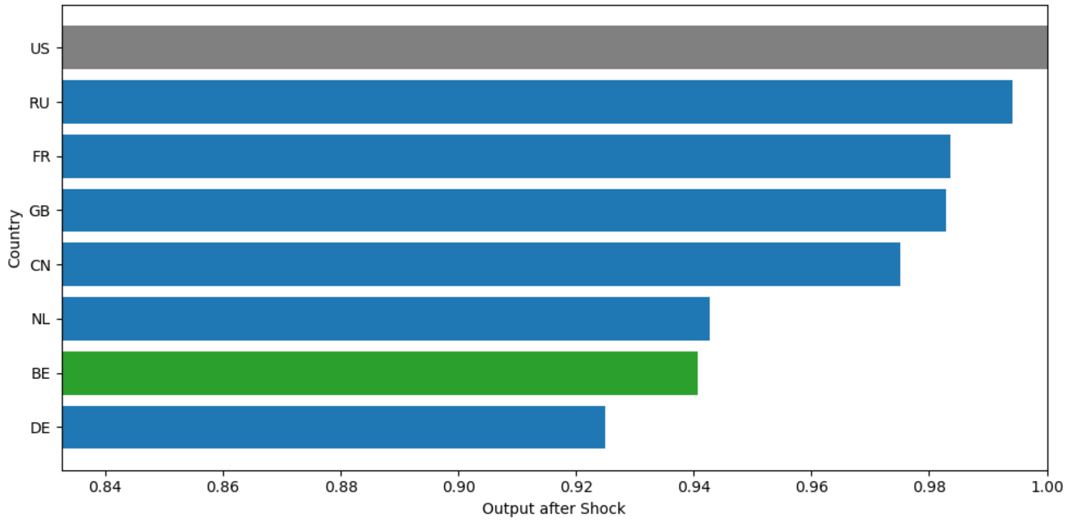

Figure 10: Simulation: short-term output response of the pharmaceutical sector (C21) in different countries to a shock reducing US exports of Advanced Technology Products by 25%.
Source: Own calculations, merged dataset building on BACI and FIGARO.

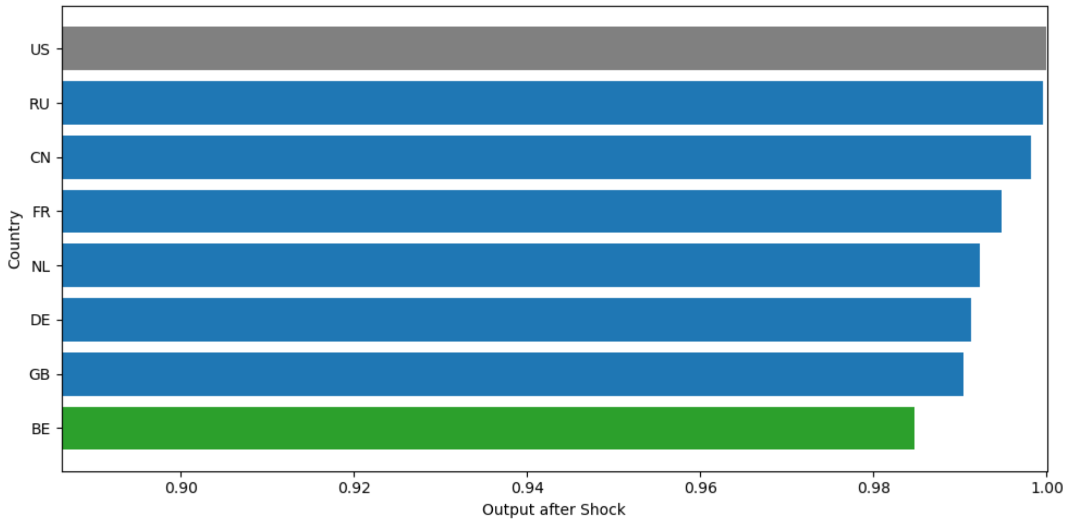

Figure 11: Simulation: short-term aggregate output response of different countries to a shock reducing US exports of Advanced Technology Products by 25%.
Source: Own calculations, merged dataset building on BACI and FIGARO.

ply disruption.[11] While Russia as the least affected country remains at the top of the graph, other countries swap places compared to Figure 10 depending on how their other domestic industries fare in response to the shock. Notably, China is now also at the top of the graph, indicating that its other sectors depend less on US ATP exports. All European countries in this comparison are affected worse than Russia and China. Importantly, Belgium is now at the bottom of the graph, experiencing by far the largest output losses (ca. -1.5%). This is driven by the fact that its pharmaceutical sector is not only among the worst affected in the cross-country comparison (Fig. 10), but is also one of Belgium's largest goods-producing sector in terms of output.

Contrasting these findings for the short term with results obtained using the model's medium-term specification, output losses are far smaller in the medium term. The driving force behind this is the increased substitutability between different exporters of a given product, as well as between different products in an importing producer's intermediate input mix. In terms of cross-sector and cross-country comparisons, however, the general picture remains very similar when moving from short to medium term. Figure 12 repeats the setup of Figure 9, comparing the reaction of different sectors in Belgium. Again, the pharmaceutical sector (C21) is found to suffer the largest output losses. However, in the medium term its output losses are more than twice as large as those of the second-worst hit sector, indicating that other Belgian sectors have more options to substitute US ATP exports in their production, for instance due to the exact mix of ATPs they use.

Compared to other countries in the reference group, Belgium's pharmaceutical sector can accommodate the shock slightly better than the Netherlands when moving from short to medium term (cf. Fig. 10 and Appendix Fig. 14). While the sector-specific results still show the largest output losses for Belgium, the Netherlands, and Germany, Belgium's pharmaceutical sector now fares slightly better than its Dutch counterpart. However, the three countries' relative gap to other countries in the comparison widens.

Finally, comparing total country-level output in the medium-term (Appendix Fig. 15), Belgium suffers the largest output losses (ca. 0.2% compared to ca. 1.5% in the short term). Similar to the short-term results (Fig. 11), this is driven by the pharmaceutical sector's large share in Belgian output. Moreover, the order of countries in the graph and the relative differences in output losses remain very similar. Overall, these findings highlight that Belgium's pharmaceutical sector, and in turn Belgium as a whole, is

[11] To go from sector-level to country-level output changes, we utilize the information on sectors' share in their country's output (i.e., gross production) calculated directly from the FIGARO input-output tables. Taking the sum of post-shock output relative to baseline across sectors within a country, weighted by their pre-shock shares in output, yields country-level output after a shock.

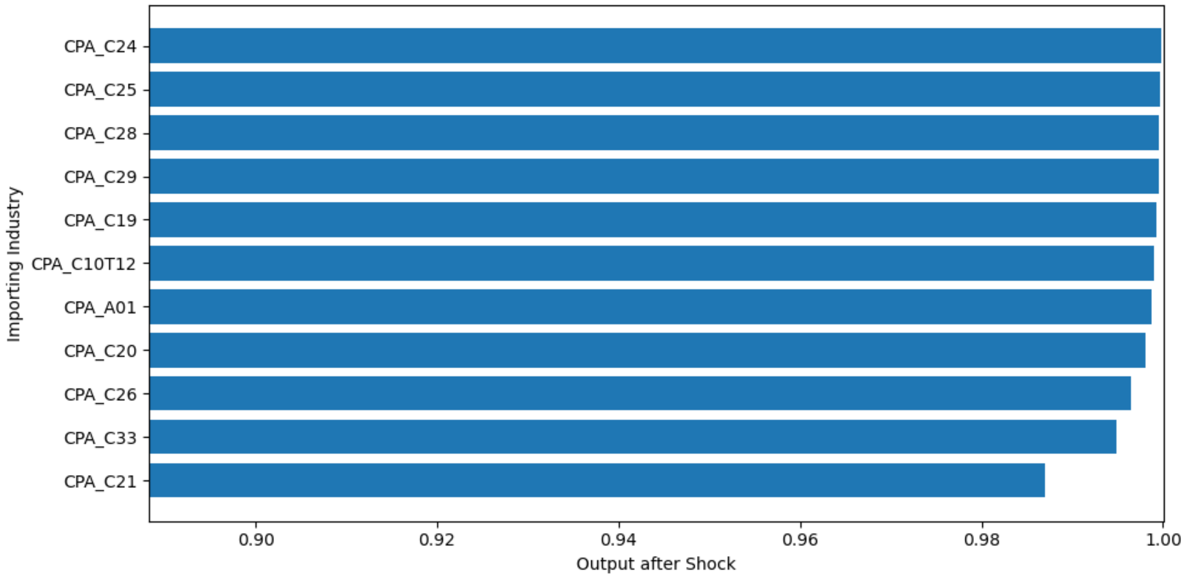

Figure 12: Simulation: medium-term output response of Belgian sectors to a shock reducing US exports of Advanced Technology Products by 25%.
Source: Own calculations, merged dataset building on BACI and FIGARO.

highly dependent on US exports of ATPs when compared to other countries. Whether this constitutes a strategic threat is outside of the scope of this model: This decision crucially depends on which sectors are considered strategically important and on how probable the simulated shock is. Nevertheless, the example of a 25% drop in US exports of ATPs clearly illustrates how the simulation framework at hand can be used to assess and compare supply chain risks. In particular, it highlights the framework's exceptional granularity, being able to translate product-level shocks into sector-level output changes.

6 Conclusion

This policy report assesses Belgium's vulnerability to disruptions of international product supplies and simulates the output response of Belgian sectors to a hypothetical shock to US exports of Advanced Technology Products. In doing so, this report implements the methodology outlined in Policy Report ECOOM-STORE-25-013 by Bormans *et al.* (2025*b*), leading to a contribution that is threefold: *(i.)* We create a dataset covering global trade in intermediate goods at the product level between country-sectors for the year 2023, building on high quality data sources. This dataset provides an exceptional combination of granularity, coverage and recency, at the cost of building on a proportionality assumption on how imported products are distributed across importing sectors. *(ii.)* We assess Belgium's vulnerability to international supply disruptions by applying a criterion consisting of three descriptive metrics. This criterion is used to evaluate the absolute and relative number of intermediate products for which Belgium and its domestic sectors are considered (highly) vulnerable to supply disruptions, as well as these products' share in total import value. The results are then compared across sectors and countries. We find that although Belgium is not overly vulnerable to international supply shocks when compared to a group of relevant reference countries, its largest goods-producing industries are also among its most exposed. Future analysis could dissect these findings in more detail, for instance by focusing on a single sector and reporting the products identified as vulnerabilities along with their import values and supplying exporters. *(iii.)* The final and central contribution of this report is the application of our simulation framework laid out in the preceding methodology report. We simulate how a 25% decrease in US supplies of Advanced Technology Products would affect Belgium and its sectors compared to other countries. Using two different model specifications, focused on either short-term or medium-term analysis, results show that within Belgium the pharmaceutical sector is expected to suffer the largest output losses. Belgium's neighbors Germany and the Netherlands are predicted to incur similar output losses in the pharmaceutical sector in response to the shock in question, indicating a similar dependence on US high tech products. However, the model predicts Belgium's aggregate output losses to significantly exceed those of its neighbors. This is due to the central role of the pharmaceutical sector in Belgian output. Aside from Belgium, the presented findings also allow conclusions on the extent to which countries like Russia and China are exposed to supply disruptions arising from the US. These results and the accompanying discussion are intended to illustrate the capabilities of this framework. Generally, the framework may be used to simulate the output response of importing countries and sectors to an arbitrarily large supply disruption affecting any number and combination of intermediate goods and exporting countries. This allows for targeted research, in turn providing product- and industry-specific, actionable policy insights.

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Table 3: Countries included in the 2025 release of FIGARO

Code	EU27	Code	Non-EU / region
BE	Belgium	NO	Norway
BG	Bulgaria	CH	Switzerland
CZ	Czech Republic	UK	United Kingdom
DK	Denmark	ME	Montenegro
DE	Germany	MK	North Macedonia
EE	Estonia	AL	Albania
IE	Ireland	RS	Serbia
EL	Greece	TR	Türkiye
ES	Spain	AR	Argentina
FR	France	AU	Australia
HR	Croatia	BR	Brazil
IT	Italy	CA	Canada
CY	Cyprus	CN	China
LV	Latvia	ID	Indonesia
LT	Lithuania	IN	India
LU	Luxembourg	JP	Japan
HU	Hungary	KR	South Korea
MT	Malta	MX	Mexico
NL	Netherlands	RU	Russia
AT	Austria	SA	Saudi Arabia
PL	Poland	US	United States
PT	Portugal	ZA	South Africa
RO	Romania	FIGW1	Rest of the world
SI	Slovenia		
SK	Slovakia		
FI	Finland		
SE	Sweden		

Table 4: CPA products and services

Code	**Description**
CPA_A01	Products of agriculture, hunting and related services
CPA_A02	Products of forestry, logging and related services
CPA_A03	Fish and other fishing products; aquaculture products; support services to fishing
CPA_B	Mining and quarrying
CPA_C10T12	Food, beverages and tobacco products
CPA_C13T15	Textiles, wearing apparel, leather and related products
CPA_C16	Wood and of products of wood and cork, except furniture; articles of straw and plaiting materials
CPA_C17	Paper and paper products
CPA_C18	Printing and recording services
CPA_C19	Coke and refined petroleum products
CPA_C20	Chemicals and chemical products
CPA_C21	Basic pharmaceutical products and pharmaceutical preparations
CPA_C22	Rubber and plastic products
CPA_C23	Other non-metallic mineral products
CPA_C24	Basic metals
CPA_C25	Fabricated metal products, except machinery and equipment
CPA_C26	Computer, electronic and optical products
CPA_C27	Electrical equipment
CPA_C28	Machinery and equipment n.e.c.
CPA_C29	Motor vehicles, trailers and semi-trailers
CPA_C30	Other transport equipment
CPA_C31_32	Furniture and other manufactured goods
CPA_C33	Repair and installation services of machinery and equipment
CPA_D35	Electricity, gas, steam and air conditioning
CPA_E36	Natural water; water treatment and supply services
CPA_E37T39	Sewerage services; sewage sludge; waste collection, treatment and disposal services; materials recovery services; remediation services and other waste management services
CPA_F	Constructions and construction works
CPA_G45	Wholesale and retail trade and repair services of motor vehicles and motorcycles
CPA_G46	Wholesale trade services, except of motor vehicles and motorcycles
CPA_G47	Retail trade services, except of motor vehicles and motorcycles
CPA_H49	Land transport services and transport services via pipelines
CPA_H50	Water transport services
CPA_H51	Air transport services
CPA_H52	Warehousing and support services for transportation
CPA_H53	Postal and courier services
CPA_I	Accommodation and food services
CPA_J58	Publishing services

Code	Description
CPA_J59_60	Motion picture, video and television programme production services, sound recording and music publishing; programming and broadcasting services
CPA_J61	Telecommunications services
CPA_J62_63	Computer programming, consultancy and related services; Information services
CPA_K64	Financial services, except insurance and pension funding
CPA_K65	Insurance, reinsurance and pension funding services, except compulsory social security
CPA_K66	Services auxiliary to financial services and insurance services
CPA_L	Real estate services
CPA_M69_70	Legal and accounting services; services of head offices; management consultancy services
CPA_M71	Architectural and engineering services; technical testing and analysis services
CPA_M72	Scientific research and development services
CPA_M73	Advertising and market research services
CPA_M74_75	Other professional, scientific and technical services and veterinary services
CPA_N77	Rental and leasing services
CPA_N78	Employment services
CPA_N79	Travel agency, tour operator and other reservation services and related services
CPA_N80T82	Security and investigation services; services to buildings and landscape; office administrative, office support and other business support services
CPA_O84	Public administration and defence services; compulsory social security services
CPA_P85	Education services
CPA_Q86	Human health services
CPA_Q87_88	Residential care services; social work services without accommodation
CPA_R90T92	Creative, arts, entertainment, library, archive, museum, other cultural services; gambling and betting services
CPA_R93	Sporting services and amusement and recreation services
CPA_S94	Services furnished by membership organisations
CPA_S95	Repair services of computers and personal and household goods
CPA_S96	Other personal services
CPA_T	Services of households as employers; undifferentiated goods and services produced by households for own use
CPA_U	Services provided by extraterritorial organisations and bodies

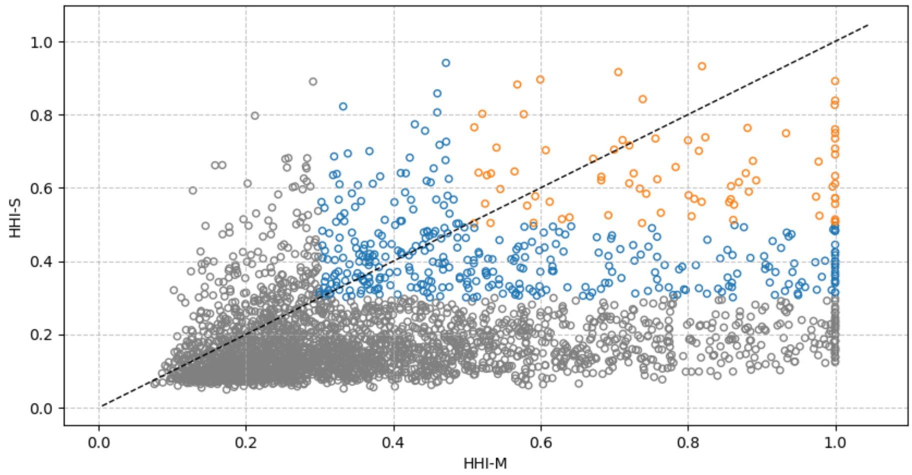

Figure 13: Global export concentration on the y-axis mapped against Belgian import concentration on the x-axis for all products imported by Belgium. Colors follow the thresholds defined in Section 2: gray for both HHIs $\leq$ 0.3, blue for 0.3 < both HHIs $\leq$ 0.5, and orange for both HHIs > 0.5.
Source: Own calculations, merged dataset building on BACI and FIGARO.

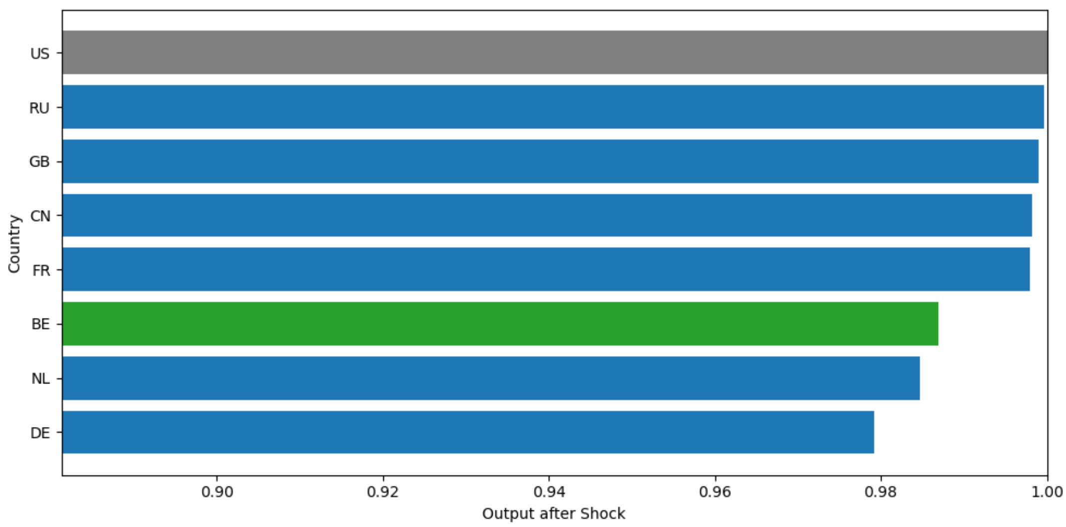

Figure 14: Simulation: medium-term output response of the pharmaceutical sector (C_21) in different countries to a shock reducing US exports of Advanced Technology Products by 25%.
Source: Own calculations, merged dataset building on BACI and FIGARO.

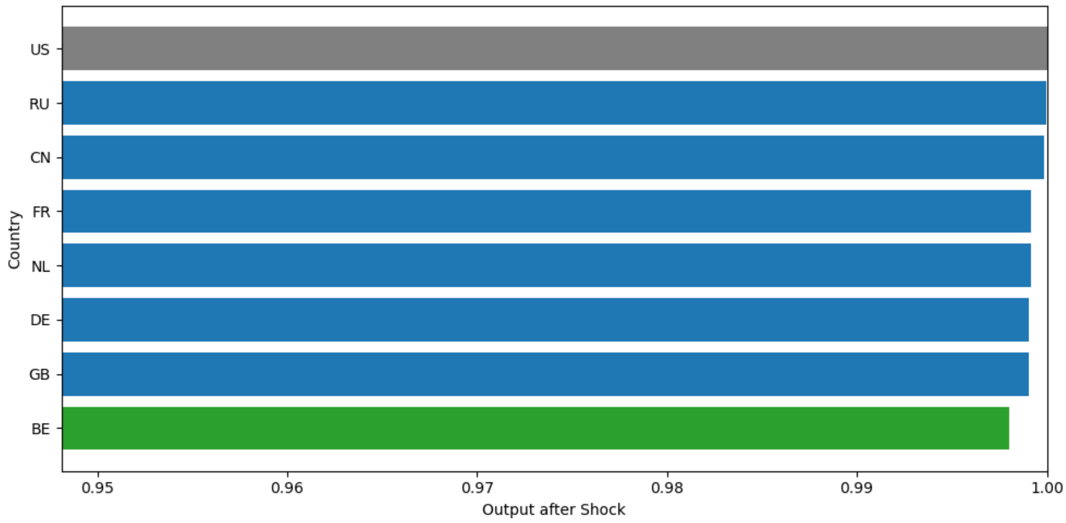

Figure 15: Simulation: medium-term aggregate output response of different countries to a shock reducing US exports of Advanced Technology Products by 25%.
Source: Own calculations, merged dataset building on BACI and FIGARO.