Detecting vulnerability to foreign demand and supply: firm-level evidence from italy

Costa, Stefano and Sallusti, Federico and Vicarelli, Claudio and Zurlo, Davide

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Stefano Costa[*], Federico Sallusti[*], Claudio Vicarelli[*], Davide Zurlo[*]

ABSTRACT

By adopting a firm-level perspective, this paper delves into the dependence and vulnerability of Italian production system to foreign demand and supply. It introduces a novel, dual indicator of vulnerability, both to imports and exports, identifying the most vulnerable production segments, the specific countries, the relevant products and sectors involved.

Consistently with the current literature, this paper evaluates vulnerability focusing on the degree of (product and geographical) concentration of firms' international transactions and their level of engagement in international trade, measured by export propensity (firm's export-to-turnover ratio) and incidence (firm's import-to-intermediate costs ratio). Regarding import vulnerability, also the type of imported products, identifying "Foreign Dependent Products" (FDPs), is considered. Finally, some estimates measure the relative role of these components in determining firm vulnerability, by sector and country of destination and origin.

Our findings show that in 2022, a relatively small number of Italian firms were vulnerable to foreign demand, although they accounted for a significant share of value added and total exports. They are smaller and more export-oriented than their non-vulnerable counterparts, focusing on fewer products but exporting to a more diversified range of countries. Sectoral analysis highlights specific manufacturing industries with a higher incidence of export-vulnerable firms. United States and Germany emerge as the countries towards whose demand the largest number of Italian firms are vulnerable. On the import side, while the number of import-vulnerable firms is considerably lower than export-vulnerable ones, they are typically larger, more productive, and often part of multinational groups, accounting for a substantial portion of total imports. The primary origin countries for FDPs imports for the Italian production system are identified, with Germany being the leading supplier. Notably, the geographical distribution of FDPs imports has shown a trend towards greater concentration within EU countries.

KEYWORDS: Trade vulnerability, Foreign dependent products, HH index

JEL Classification: D22, F14, F61

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[*] Istat - Italian National Institute of Statistics. Via Cesare Balbo 16 - 00184 - Rome, Italy. Contacts: scosta@istat.it; fsallusti@istat.it; cvicarelli@istat.it; zurlo@istat.it.

1. Introduction

In recent years the structure, behaviour and performance of Italian firms have been largely affected by a rapidly changing set of events, such as the Covid-19 pandemic, the Russia's invasion of Ukraine and the Germany's recession. In the recent debate, these events have raised concerns that the characteristics of international trade – that is the factor which supported growth in many advanced countries for more than a decade – contain elements of potential vulnerability for the countries involved. During the pandemic, for instance, the difficulties of having a timely supply of essential goods such as medicines and specific medical devices became evident; the subsequent recover of international economic activity – with the consequent bottlenecks in global value chains – raised critical issues in the supply of intermediate goods from abroad; the energy crisis following the Russian invasion of Ukraine drew attention to the risks of excessive geographical concentration in the dependence on certain raw materials. These events led countries to review their supply chains to identify sources of strategic dependencies, i.e. products for which they depend on foreign suppliers in strategic ecosystems.

Furthermore, these recent events have fueled fears – already manifested over the last decade – of a reversal of the integration of international production systems, which gave rise to phenomena such as reshoring, nearshoring and friendshoring. Under the current circumstances, the integration process of production and trade, from being a significant factor of development and economic growth, may end up representing a factor of vulnerability. This is especially true for European Union countries, due to a trade openness four times greater than that of the United States and more than double that of China. Considering Italy, some further specific concerns emerge. First, the two-year recession of Germany (Italy's main trading partner) had a negative demand-side effect on the Italian economy.[1] Second, Italy is the second main EU country of origin for goods imported by the United States and, together with Germany, accounts for about two third of the entire EU trade surplus with the US; consequently, it would be directly (and dangerously) affected by the threatened US tariffs on import from EU. Third, a measure of the dependence of Italian sectors on foreign supply shows that the interdependence between Italian production processes and Rest of the world activities constantly increased over more than a decade (Istat, 2025). Finally, among the main European countries, Italy shows the greatest trade openness; in the last fifteen years, foreign demand has widely supported Italian economic growth, offsetting the negative effects of a weak or stagnant domestic demand.

The goal of this paper is to deeply dig into the potential vulnerability of firms to foreign demand and supply. In particular, referring to the Italian business system in 2022 (year of the latest available microdata), we propose new firm-level indicators to capture microeconomic characteristics of vulnerability. These are based on the level of concentration (in terms of geography and product) of firms' trade, their propensity to international trade and, only for the definition of import vulnerability, the identification of foreign-dependent products (FDPs), that is critical inputs that are scarce and hard to substitute.

Our results point out that in 2022 the Italian production system showed a limited vulnerability, with a very small number of units that resulted vulnerable to foreign dem9and and supply. However, economic relevance of vulnerable firms is not negligible: they represent a relevant share of exporting and importing firms and a large amount of the total value of imports and exports. Furthermore, their sectoral distribution is not homogeneous: the share of export-vulnerable firms is higher in many important industries of Italian specialization model; import-vulnerable firms show a high incidence in industries that are generally upstream of the supply chains, and therefore more sensitive to the supply of raw materials.

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[1] It has been estimated that the German recession reduced Italy's GDP growth rate by approximately 0.2 percentage points both in 2023 and 2024 (Istat, 2024 and 2025).

From a geographical perspective, on the export side, a more widespread vulnerability to the US demand emerges, followed by German demand. In light of the recent trade conflicts with the US, and the impact of the 2023-24 German recession on the Italian economy, these two elements are a cause for concern. On the import side, it is above all towards Germany – and in general towards EU markets – that the importing firms result most vulnerable, while in the case of supplies from non-EU countries the greatest number of vulnerable firms is observed towards China.

Our paper lies within the strand of literature that has dealt with the measurement of the trade dependence and vulnerability. Foreign dependencies indexes have been calculated, both for export and import transactions, at product level, especially on three areas prioritized by EU policymakers since the release of the EU's 2021 trade and industrial strategies (raw materials, semiconductors, technologies that play a central role in addressing climate change; Garcia and Ho, 2025).

More specifically on the export side, several works dealt with vulnerability at the macro level (see among other Hollweg et al., 2012). Export dependence of a country has been also widely analysed looking separately at geographical, sectoral or product concentration. In many cases, the concept of dependence and vulnerability of a country has been developed looking at specific sectors like agriculture (Civín and Smutka, 2020), energy (Nyga-Łukaszewska and Napiórkowski, 2022; Curtis and McLellan 2023; Mohammadi et al., 2023) or natural resources (Zarach and Parteka, 2023).

On the import side, the recent literature proposed several approaches for the detection of "Foreign dependent product" (FDP). The European Commission (2021) follow a bottom-up approach, identifying to identifies FDPs as a) inputs for which there are few suppliers, b) that are mostly imported from extra-EU countries and c) that are hard to substitute. A noteworthy characteristic of this approach, which has been adopted by the following literature (see e.g. Méjean and Rousseaux, 2024), is its EU-centric vision, in which products imported from EU countries are assimilated to goods produced internally (in line with the idea of a single European market). This means that, among the conditions for a product to be classified as FDP, its domestic supply (which includes both domestic production and imports from the EU) must not be sufficient to satisfy the demand.

Following this approach, Arriola et al. (2024) examine the nature and evolution of trade dependencies between the OECD countries and major non-OECD economies; dependence of a single EU country from China has also been analyzed (Germany dependence in Baur and Flach, 2022; France dependence in Bonenau and Nakaa, 2020 and in Jaravel and Méjean, 2021).

For the purposes of this paper, however, we modify this latter approach adopting an Italy-centric perspective; in particular, we consider as imported inputs (and therefore potentially FDPs) also the products that Italian firms import from EU countries. An advantage of this choice is that, as it has been observed in recent OECD works (Berthou et al., 2024), an EU-centric perspective ignores the effects of potential supply disruptions in value chains within the EU.

The common element of literature previously quoted is related to using fine-grained data to detect segments of trade that can include vulnerabilities. Different measures of the three elements proposed by European Commission (2021) to detect FDPs have been used in literature (see Vicard and Wibaux 2023 for a comparison). As for FDPs identification, in this paper we partially follow Borin et al. (2023); these authors identify FDPs for Italy and quantify the effect of any disruptions to those products. They follow basically European Commission (2021) approach, computing a concentration index, a scarcity index, and a substitutability index for each HS8 product imported by Italy.

We follow this approach, while introducing some important specificity. First, as mentioned, we adopt an Italy-centric point of view. This has some effects not only on the conceptual framework, but also on the definition of FDPs (see Section 2). Second, we consider firms' vulnerability both to export and import (rather

than only to foreign supply). Finally, we adopt a firm-oriented point of view: in our framework, the definition of FDPs is not a focus of the analysis, but is strictly instrumental to the definition of a vulnerable firm. In this vein, importing FDPs is a necessary – but not sufficient – condition for a firm to be vulnerable to foreign supply.

However, to the best of our knowledge, there is still a lack of empirical literature measuring trade vulnerability at firm level. This paper aims at filling this gap. It is organized as follows: Section 2 describes data and our conceptual framework to classify a firm as export- or import-vulnerable; Section 3 depicts the results regarding firms, sectors and geography; Section 4 estimates the relative role of components of indices in determining the firm vulnerability, by sector and country of destination and origin; Section 5 concludes.

2. Data and methodology

2.1. Data

The measurement of firms' vulnerability is based on a database which, referring to 2022 (last available year for firm-level structural analyses), integrates two business registers:

a) the so called ISTAT Coe-TEC which, for each business unit operating on international markets (about 128 thousand exporters and 98 thousand importers in 2022), reports information on foreign trade: type of exported and imported goods – at an eight-digit disaggregation level of the Combined Nomenclature – country where the goods are exported to and/or imported from, amount of the related transaction;

b) the Frame-Sbs Business Register, which for each of the over 4,6 million Italian firms reports, on annual basis, information regarding firms' structure and performance (employment, sector, group membership, main income statement items).[2]

2.2. Empirical strategy

Based on this set of information, in order to analyse the degree of firm vulnerability to foreign demand and supply, we adopt a differentiated approach for the definition of export and import vulnerability.

As for export, firm *i* is vulnerable to the foreign demand (or export-vulnerable firm – EVF) when its exports meet three conditions:

a. they are highly concentrated in terms of destination markets (i.e. the largest part of firm's export serves few markets). This is captured by the threshold of Herfindahl-Hirschman Index (HHI) usually associated to a condition of highly concentrated markets: $HHI_{ic}^{x} > 2,500$ (see, among others, Statistics Canada, 2018; Cavalleri *et al.*, 2019; US DoJ, 2023);

b. they are highly concentrated in terms of type of goods (i.e. the bulk of firms' exports depends on a limited variety of goods, at a 8-digit level of the Combined Nomenclature[3]): $HHI_{ip}^{x} > 2,500$;

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c. they account for a large share of firm's turnover: the value of export-to-turnover ratio of the firm is above the total average of the production system (23% in 2022).[4]

In other words, all other conditions being equal, a company is considered more vulnerable than another if it exports a narrower range of products to fewer markets, and obtains a higher share of its total turnover from foreign sales.

As for the import vulnerability, a firm *i* is vulnerable to the foreign supply (or import-vulnerable firm − IVF) when its imports meet four conditions:

1. they are highly concentrated in terms of country of origin (i.e. the bulk of firm's imports come from few markets): $HHI_{iC}^m > 2,500$;

2. they are highly concentrated in terms of type of goods (i.e. the largest part of firm's import involves a limited variety of goods, at a 8-digit level of the Combined Nomenclature): $HHI_{ig}^m > 2,500$;

3. they account for a large share of firm *i*'s intermediate costs: the value of import-to-intermediate costs ratio is above the average of the production system (19% in 2022);

4. they include at least one "Foreign Dependent Product" (FDP), here defined as one that for the Italian production system results scarce and not easily substitutable. These two conditions are approximated by the following circumstances: (a) the internal supply of a given good *g* fails to meet its demand (so that imports of *g* exceed exports: $\frac{import_{Sg}}{export_{Sg}} > 1$, where S is the whole production system); (b) overall imports of the good *g* are highly concentrated in terms of country of origin: $HHI_{gC}^m > 2,500$.

3. The export and import vulnerability of Italian firms

3.1. Vulnerability to foreign demand

Using the methodology described above, in 2022 Italian firms vulnerable to foreign demand were relatively few – just over 23,000, 0.5% of the total – but their weight within the production system was not negligible: they employed over 415,000 workers (2.3% of the total), accounted for 3.5% of total value added (about 36 billion euros) and represented 16.5% of total exports (about 87 billion euros, see Table 1).

As internationalised firms, these units are larger than average in size (over five times the overall average and double the manufacturing average). Consistently, also labour productivity and the incidence of multinational groups are significantly above the Italian average. Compared to non-vulnerable units, export vulnerable firms (EVFs) are generally smaller (employing on average half as many workers), with lower labour productivity and profitability (ROI is 4.7%, compared to 5.7% for non-vulnerable firms).[5]

The main reasons for their vulnerability, compared to other exporting companies, lie in a slightly higher concentration of products offered and, above all, the dependence on foreign demand for more than half of their turnover (whereas other exporters rely on it for just over one-fifth). In other words, within the exporting

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International Convention on the Harmonised Commodity Description and Coding System, i.e. the "Harmonised System" (HS). See https://taxation-customs.ec.europa.eu/customs-4/calculation-customs-duties/customs-tariff/combined-nomenclature_en.

[4] We choose a threshold referred to the entire system − rather than for instance opting for sector-specific thresholds, − because we are interested in having an absolute, and not relative, measure of business vulnerability.

business sector, companies identified as vulnerable to foreign demand tend to be smaller, more export-oriented, focused on fewer products, even though they serve a broader range of countries.

Table 1 - Characteristics of Italian firms, by vulnerability to foreign demand. Years 2022

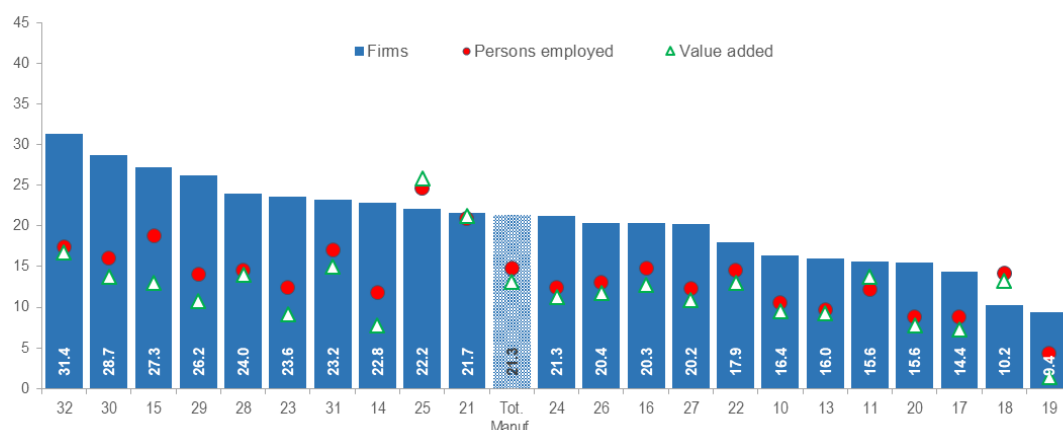| | 2022 | | | | | | | | | | | | | |
	Firms				Persons employed			Value added	Export	Productivity	ROI (a)	Export propensity	HHI - country	HHI - product
	N°	%	% out of exporters	% MNE (b)	N°	%	Average	%	%	(V.Add./Pers. Empl.; €)	(GOM/total assets; %)	(export / turnover)		
Vulnerable	23,016	0.5	17.9	9.8	415,243	2.3	18.0	3.5	16.5	86,814	4.7	52.7	6,545	6,922
Not vulnerable	105,302	2.3	82.1	12.5	3,975,369	22.3	37.8	38.9	83.5	99,918	5.7	21.0	6,653	6,678
Not exporters	4,520,005	97.2	0.0	0.6	13,461,415	75.4	3.0	57.1	0.0	43,302	3.1	-	-	-
Total	4,648,323	100.0	100.0	1.0	17,852,027	100.0	3.8	100.0	100.0	57,136	4.7	23.4	6,634	6,722

Source: Authors' calculations on ISTAT data.
(a) Only incorporated companies (see Note 5 *above*).
(b) Multinational corporations.

At the sectoral level, considering manufacturing activities,[6] the highest incidence of EVFs out of the total number of exporting enterprises can be found in the Other Manufacturing sector,[7] with a share over 31% (Figure 1). A high incidence of EVFs characterises also some relevant sectors of the Italian specialisation model: Transport equipment (28.7%), Leather (27.3%), Motor Vehicles (26.2%), Machinery (24.0%). In Metal Products (22.2%) and Pharmaceuticals (21.7%), the share of export-sensitive companies in the total number of exporting companies in the sector is just above the national average (21.3%); in these two sectors, however, the weight of EVFs, in terms of employees (24.7 and 21.0%) and value added (25.9 and 21.3%), is the highest of all manufacturing. Most of the traditional sectors (Food, Beverages, Textiles) have a share of vulnerable exporters below the average (16.4, 15.6 and 16.0% respectively); among the less exposed sectors, Coke (9.4%) and Printing (10.2%, but with a high incidence of added value and employees) stand out.

Figure 1 - Export-vulnerable firms (EVFs), in terms of units, employees, value added and exports, on the total number of exporting firms. Manufacturing sector. Year 2022 (percentage values) (a)

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[6] In 2022 the manufacturing sector accounted for about 80% of total export of Italian enterprises and 50% of total import of Italian business system.
[7] In 2022 in Italy this sector was mainly characterised by firms producing medical and dental instruments and supplies (over 56% of total units and 26% of total export), and by firms producing jewellery (about 20% of total units, 47% of total export).
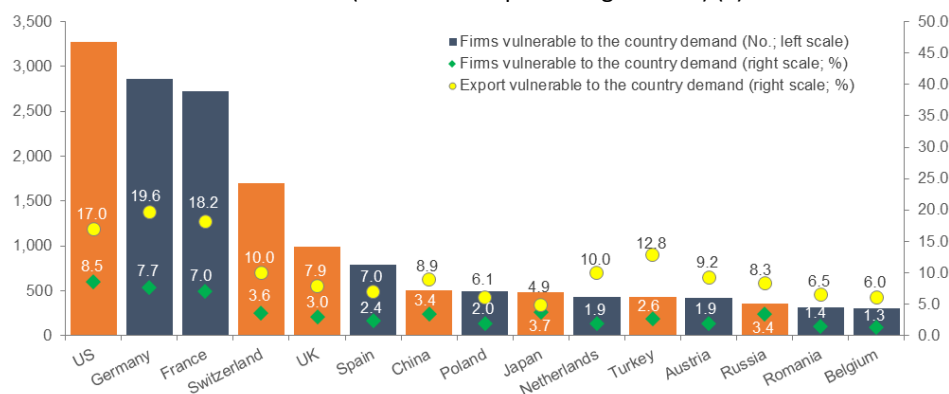
(a) 10=Food; 11=Beverages; 13=Textiles; 14=Clothing; 15=Leather; 16=Wood; 17=Paper; 18=Printing; 19=Coke and petroleum; 20=Chemicals; 21=Pharmaceuticals; 22=Rubber and plastics; 23=Non-metallic minerals; 24=Basic metals; 25=Metal products; 26=Electronics; 27=Electrical equipment; 28=Machinery; 29=Motor vehicles; 30=Transport equipment; 31=Furniture; 32=Other manufacturing.

As far as the destination markets are concerned, it is worth noticing that, in 2022 the country whose demand posed the greatest vulnerability for the largest number of Italian firms was the United States (almost 3,300 firms), followed by Germany (over 2,800) (Figure 2). In a context where the US market has become increasingly important for Italian exports, increasing its share on the export of nearly all manufacturing sectors (Istat, 2025), in the years to come it will be interesting to replicate this analysis to assess the impact of the tariffs imposed by the United States on the vulnerability of Italian companies most exposed to this market.

Firms vulnerable to US demand export to that market goods worth over €9.6 billion, mainly pharmaceutical products, mechanical goods (turbojets and turboprop engines), jewellery, food products (wines and oils), and furniture. As for Germany, the total export value of firms vulnerable to German demand amounts to around €13.6 billion and consists mainly of motor vehicle parts, energy goods (gas), electrical materials (wires and cables), metal products (such as screws and bolts), and aluminium workpieces (bars and profiles).

Figure 2 - Number and weight (in terms of units and exports) of firms vulnerable to foreign demand by main destination market. Year 2022 (absolute and percentage values) (a)

3.2. Vulnerability to foreign supply

Considering the import side, according to the indicators proposed here, in 2022 in Italy the number of import vulnerable firms (IVFs) was much lower than that of EVFs (Table 2). It consisted of just under 4,600 units (a mere 0.1% of the total), employing over 400,000 workers (2.8% of the total), generating 5.7% of added value, and accounting for 23.8% of total imports.

Table 2 - Characteristics of Italian firms, by vulnerability to foreign supply. Years 2022 (absolute and percentage values)

|	2022														
	Firms				Persons employed			Value added	Imports	Productivity	ROI (a)	Import incidence	HHI - country	HHI - product	FDPs
	No.	%	% out of importers	% MNE	No.	%	Average	%	%	(V.Add./Per s.Empl.; €)	(GOM/Total assets; %)	(import / interm. costs)			Average
Vulnerable	4,594	0.1	4.7	31.8	398,232	2.8	86.7	5.7	23.8	119,317.7	8.2	52.6	6,193	3,609	2.5
Not vulnerable	93,171	2.0	95.3	14.9	3,926,380	27.8	42.1	46.8	76.2	98,669.6	7.9	20.6	8,040	6,747	0.1
Non-importers	4,550,558	97.9	0.0	0.6	9,803,300	69.4	2.2	47.5	-	40,104.6	3.4	-	-	-	-
Total	4,648,323	100.0	100.0	1.0	14,127,913	100.0	3.0	100.0	100.0	58,613.6	4.3	24.1	7,953	6,599	0.2

Source: Authors' calculations on ISTAT data.
(a) Only incorporated companies (see Note 5 *above*).
(b) Multinational corporations.

IVFs tend to be relatively large (87 persons employed, more than twice as many as non-vulnerable firms) and display very high labour productivity (20% higher than non-vulnerable firms), combined with slightly higher profitability. In line with these characteristics, also the incidence of units belonging to multinational groups is significant (almost 32%), predominantly Italian-controlled. This outcome reflects, at least in part, the intra-group trade flows between controlling entities in Italy and their controlled units abroad, particularly within the European Union.[8] As with exports, the import vulnerability of companies depends not so much on the degree of product and geographical concentration of foreign purchases (even lower than that of other importers), but rather on the considerable differences in terms of imported FDPs and import incidence – this latter averaging over 50% of total intermediate costs.

Consistently, IVFs are especially prevalent in the Pharmaceutical sector (where nearly 20% of importing firms are vulnerable), or in sectors generally positioned upstream in supply chains, such as Wood (16.4% of importers are vulnerable), Coke (13.5%), and Chemicals (9.7%) (Figure 3). In terms of employment, partly due to the larger average size of the firms involved, around 30% of the employees in pharmaceutical importing firms and over a quarter of those in importing firms in the Transport equipment are exposed to foreign supply vulnerabilities.

Figure 3 – Import vulnerable firms (IVFs), in terms of units, employees, value added and imports, on the total number of importing firms. Manufacturing sector. Year 2022 (percentage values) (a)
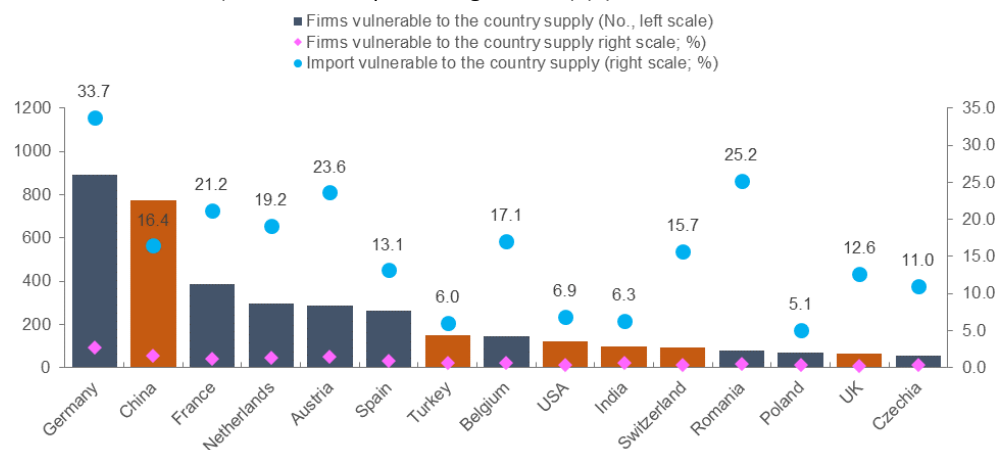

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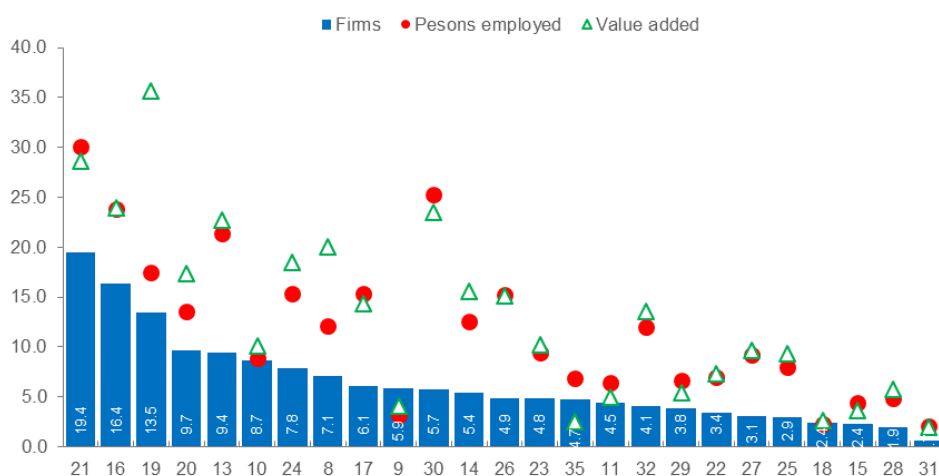
[8] The European Union, after all, is the main destination area for foreign subsidiaries of Italian multinationals, both in terms of units involved (46.2% of total foreign subsidiaries) and in terms of persons employed (40.8%; ISTAT 2024).

(a) 10=Food; 11=Beverages; 13=Textiles; 14=Clothing; 15=Leather; 16=Wood; 17=Paper; 18=Printing; 19=Coke and petroleum; 20=Chemicals; 21=Pharmaceuticals; 22=Rubber and plastics; 23=Non-metallic minerals; 24=Basic metals; 25=Metal products; 26=Electronics; 27=Electrical equipment; 28=Machinery; 29=Motor vehicles; 30=Transport equipment; 31=Furniture; 32=Other manufacturing.

Finally, with reference to the geographic dimension of vulnerability to imports, Italian importing firms appears mostly vulnerable to Germany (891 units) and in general the EU markets (Figure 4) while, considering non-EU countries, the highest number of IVFs is observed towards China (773 units). However, the involvement of a small share of companies does not necessarily corresponds to an equally limited share of vulnerable trade: in 2022 one third of the total import from Germany was vulnerable to German supplies. Similarly, a share between 17% and 24% of imports from France, the Netherlands, Belgium and Austria were vulnerable, 16.4% of those from China, 6.9% of those from the US.

Figure 4 - Number and weight (in terms of units and exports) of firms vulnerable to foreign supply by main origin market. Year 2022 (absolute and percentage values) (a)

3.3. Import of FDPs by Italian firms

As mentioned above, the vulnerability to foreign supply depends also on the presence of Foreign Dependent Products (FDPs) among the input imported by firms. In order to delve into this aspect of import-vulnerability, it is necessary to consider also a product-level view.

On the basis of the methodology described in Section 2, in 2022 Italian firms imported 1,434 FDPs, amounting to just over €15 billions (3.1% of total imports). In terms of import value, these goods mainly consisted of fuels (mineral and oil-based), metal raw materials (pig iron, iron and steel), and pharmaceutical products.

These products are relatively scarce for the Italian production system – they are largely purchased from a small number of countries, including EU member states – and difficult to replace, as Italian imports far exceed exports.

Looking at the main origin countries of FDPs (Figure 5),[9] in 2022 the main source markets for scarce and non-substitutable products for the Italian production system were: Germany (the leading supplier of 343 FDPs, primarily in pharmaceuticals, the automotive sector, and metallurgy); France (179 FDPs, mainly food and organic chemistry); Spain (172 FDPs, especially mineral fuels and chemical products); The Netherlands (156 FDPs, predominantly edible animal products); China (91 FDPs, mostly mechanical products and yarns; this country is the leading non-EU FDP supplier). The United States, the second-largest non-EU supplier, was the main country of origin for 52 FDPs, mostly mechanical and aerospace-related products.

Figure 5 - Main markets of origin of FDPs imported by Italian firms. Year 2022 (a)
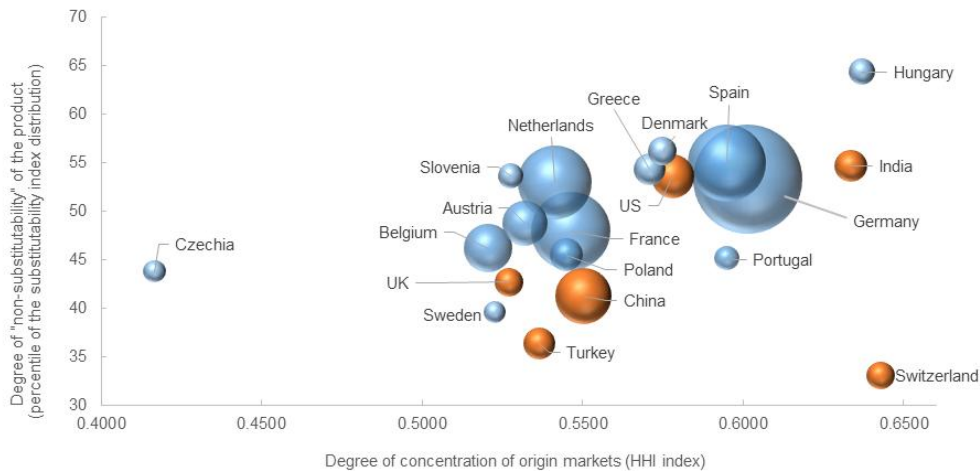
Source: Authors' calculations on ISTAT data.
The Figure reports the countries that represent the main origin market of at least 10 FDPs. The size of the bubbles is proportional to the number of FDPs for which the respective country is the main origin market for Italian firms. EU countries are indicated in blue; non-EU countries are indicated in orange.

In some cases, there are notable differences in how the system sources its imports. Imports of FDPs from Hungary were highly concentrated and difficult to substitute (placing the country high and to the right in Figure 5), indicating a high level of vulnerability to the availability of this type of product – mainly meat and sugar. Meanwhile, goods imported from Switzerland (mostly organic chemicals and basic metal products) tend to come almost exclusively from that country, but exhibit a higher degree of substitutability (the bubble is positioned low and far to the right).

All in all, a micro-founded map of the vulnerability of the Italian production system to foreign demand and supplies highlights how the phenomenon involves a rather limited number of companies, although it concerns a non-negligible part of employment and value added. This appears more evident in relation to vulnerability to imports, where there is a tendency to strengthen supply relations within the European Single Market.

4. The relative importance of the determinants of vulnerability

We have shown that the incidence and weight of both EVFs and IVFs is highly heterogeneous across Italy's sectors and partner countries. In this section a further step is developed, looking at the relative importance of the components of export and import vulnerability across sectors and countries.

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[9] Here we take into account countries such that each of them is the main market of origin of at least 10 FDPs.

In doing so, we firstly estimate, by sector, the effects of each component of the export and import vulnerability on the probability for a firm to be EVF or IVF; then we estimate the effects of the same components on the probability of being vulnerable to the demand and the supply from a certain country.

With refer to the export vulnerability, we estimate the following probit model:

$$Prob\left(EVF_{i,s} = 1 | HHI_{isC}^{x}, HHI_{isP}^{x}, EP_{i,s}, G_{i,s}, S_{i,s}, R_{i,s}\right) = \Lambda(\alpha_1 HHI_{isC}^{x} + \alpha_2 HHI_{isP}^{x} + \alpha_3 EP_{i,s} + \alpha_4 G_{i,s} + \alpha_5 S_{i,s} + \alpha_6 R_{i,s})$$

[1]

where Λ is the cumulative distribution of the probit function, α_j are estimated parameters, HHI_{isC}^{x} is the Herfindahl-Hirschman index measuring the degree of concentration of export destination markets for the firm i in sector s; HHI_{isP}^{x} is the Herfindahl-Hirschman index indicating the degree of concentration of products (at a 8-digit level of the Combined Nomenclature) exported by firm i in sector s; EP is the firm's i export propensity, in terms of export-to-turnover ratio; $G_{i,k}(k = 1, \dots 4)$ is a set of control dummies referring to four forms of group membership, taking value 1 for firms not belonging to a group, 2 for firms belonging to domestic groups, 3 for firms belonging to Foreign multinational groups, 4 for firms belonging to Italian multinational groups (non-group firms are the benchmark); S is a set of control dummies referring to firm size class (1-9; 10-49, 50-249, 250+ persons employed); R is a set of control dummies referring to firm location (NUTS-1 regions). All variables are standardized.

The results are reported in Table 3. In general, referring to 2022, among the determinants of export vulnerability, the element that most influences the likelihood of being vulnerable to foreign demand is the propensity to export: a 1% increase in the ratio of exports to turnover increases the likelihood of being vulnerable by 13 percentage points, a value more than a fifth higher than the effect of geographical concentration and almost four times that of product concentration. In this context, belonging to multinational groups, whether Italian or foreign, appears as an element of lower risk: with respect to units not belonging to groups, the probability of being vulnerable to exports decreases by 3.4 percentage points for foreign-controlled multinationals and by 4.1 points for Italian-controlled multinationals.

These results, however, conceal sectoral heterogeneity. Not surprisingly, the top sectors of the Italian specialisation model (Machinery, Automotive, Metals products), in addition to Pharmaceuticals, are those for which the share of exported turnover has the greatest impact on the likelihood of being vulnerable to exports. Machinery and Automotive, moreover, are also the sectors in which vulnerability to foreign demand depends on a greater geographical concentration of exports, while the role of the product concentration of exports, in increasing the likelihood of vulnerability.

Table 3 – The effects of export vulnerability components on the probability of being EVF, by manufacturing sectors. Year 2022 (Marginal effects; Percentage points) (a) (b)

	All manufacturing sectors	Food	Beverages	Textile	wearing apparel	Leather	Wood	Paper	Printing	Chemicals	Pharmaceutics	Rubber and plastic	Non metallic mineral prod.	Basic metals	Metal prod.	Electronics	Electrical equip.	Machinery	Motor vehicle	Other transport equip.	Furniture	Other manuf.
HHI_country	0.108***	0.078***	0.044***	0.075***	0.069***	0.082***	0.069***	0.059***	0.049***	0.099***	0.112***	0.099***	0.102***	0.094***	0.113***	0.153***	0.129***	0.158***	0.149***	0.176***	0.103***	0.147***
	-0.002	-0.006	-0.012	-0.009	-0.007	-0.008	-0.013	-0.014	-0.011	-0.01	-0.029	-0.008	-0.009	-0.014	-0.005	-0.012	-0.01	-0.005	-0.017	-0.019	-0.009	-0.009
HHI_product	0.035***	0.020***	0.036***	0.051***	0.099***	0.062***	0.016	0.017	0.001	0.01	0.075**	0.018**	0.004	0.082***	0.011**	-0.002	0.018*	0.006	0.058***	0.013	0.039***	0
	-0.002	-0.005	-0.011	-0.008	-0.006	-0.008	-0.011	-0.013	-0.009	-0.008	-0.031	-0.007	-0.008	-0.013	-0.004	-0.012	-0.009	-0.005	-0.016	-0.019	-0.007	-0.009
Export propensity	0.128***	0.066***	0.120***	0.102***	0.117***	0.155***	0.066***	0.107***	0.037***	0.148***	0.182***	0.152***	0.124***	0.167***	0.113***	0.171***	0.159***	0.220***	0.210***	0.211***	0.140***	0.133***
	-0.001	-0.002	-0.004	-0.004	-0.002	-0.003	-0.003	-0.007	-0.003	-0.006	-0.019	-0.004	-0.003	-0.008	-0.002	-0.007	-0.005	-0.004	-0.01	-0.008	-0.004	-0.002
Domestic group membership	0.005	0.004	-0.013	0.019	-0.009	0.012	0.034	0	-0.027*	0.032*	-0.057	0.003	0.011	0.017	0.003	0.013	0.009	-0.004	-0.016	0.005	-0.015	-0.048**
	-0.004	-0.012	-0.022	-0.018	-0.018	-0.021	-0.026	-0.022	-0.015	-0.018	-0.067	-0.014	-0.019	-0.025	-0.009	-0.024	-0.02	-0.01	-0.032	-0.037	-0.018	-0.022
Foreign MN group membership	-0.034***	-0.049***	-0.016	-0.013	-0.015	-0.093**	0.164	0.015	-0.045***	-0.019	0.027	-0.03	-0.052	-0.048	-0.029*	0.003	-0.012	-0.033**	-0.009	-0.098***	-0.134***	-0.082**
	-0.006	-0.018	-0.047	-0.04	-0.051	-0.038	-0.126	-0.044	-0.021	-0.023	-0.077	-0.021	-0.035	-0.041	-0.017	-0.033	-0.029	-0.016	-0.045	-0.047	-0.044	-0.038
Italian MN group membership	-0.041***	-0.013	-0.037	0.047	-0.028	-0.061**	-0.057**	-0.054**	-0.039**	-0.021	-0.008	-0.02	-0.077***	-0.026	-0.056***	0.003	-0.063***	-0.050***	-0.023	-0.038	-0.060**	-0.032
	-0.005	-0.015	-0.032	-0.03	-0.027	-0.029	-0.027	-0.025	-0.018	-0.02	-0.076	-0.017	-0.023	-0.03	-0.01	-0.027	-0.02	-0.012	-0.038	-0.046	-0.025	-0.031
Size controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NUTS-2 controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo_R2	0.312	0.378	0.303	0.286	0.327	0.353	0.483	0.384	0.548	0.334	0.291	0.298	0.413	0.312	0.401	0.269	0.265	0.251	0.258	0.393	0.336	0.355
Observations	60,414	4,765	1,254	2,354	4,318	2,837	1,523	1,023	1,158	2,070	277	3,551	2,805	1,185	9,167	1,753	2,558	9,927	984	721	3,017	3,064

(a) Marginal effects are reported. Standard errors in italics. *** p<0.01, ** p<0.05, * p<0.1
(b) The table does not include the sector of Coke and refined oil product due to insufficient number of observations.
Source: Authors' calculations on Istat data

To complete the analysis of the profiles of EVFs, we assess how the components of export vulnerability change depending on the destination country to which the firms are export-vulnerable. To do so, we focus on the three countries towards which, as we have showed, the number of EVFs is highest: Germany, France and United States. In this way we evaluate to what extent a given component characterizes the vulnerability to the demand of a specific country with respect to the export-vulnerability towards the two other countries and the rest of the world.

In this regard, we estimate the following multinomial logit model:[10]

$$\text{Prob}\big(C_i = j \mid HHI_{iC}^x, HHI_{iP}^x, EP_i, G_i, S_i, R_i\big) = \frac{\exp\big(\alpha_{ij} + \alpha_{ij2}HHI_{iC}^x + \alpha_{ij3}HHI_{iP}^x + \alpha_{ij4}EP_i + \alpha_{ij5}G_i + \alpha_{ij6}S_{i,s} + \alpha_{ij7}R_{i,s}\big)}{1 + \sum_{m=2}^{J} \exp\big(\alpha_{im2}HHI_{iC}^x + \alpha_{im3}HHI_{iP}^x + \alpha_{im4}EP_i + \alpha_{im5}G_i + \alpha_{im6}S_{i,s} + \alpha_{im7}R_{i,s}\big)} \qquad [2]$$

where C_i is a categorical variable referring to the market towards which the firms are export-vulnerable. It takes value 1 for Germany; 2 for France; 3 for United States; 4 for the Rest of the world (taken as a benchmark) and $HHI_{iC}^x, HHI_{iP}^x, EP_i, G_i, S_i, R_i$ are the same set of covariates as in equation [1].

The results (Table 4) show a heterogeneity, with respect to the destination market, in the role played by each variable in contributing to export vulnerability. Vulnerability to the United States of Italian firms, for example, implies a higher geographic concentration than vulnerability to all other world markets; conversely, vulnerability to Germany and France implies a lower geographic concentration than the incidence of this same element in vulnerability to the rest of the world. On the contrary, export vulnerability to Germany and France is associated with a higher product concentration, while vulnerability to the United States implies a lower level than to all other destination markets.

A much smaller role, on the other hand, is played by the export propensity; it plays a marginally higher role in the export vulnerability of Italian firms to Germany and France than to other markets, while it is not statistically significant in the case of vulnerability to the United States.

As for multinational group membership, firms vulnerable to the United States show on average, compared to vulnerability to all other countries, a higher incidence of companies belonging to Italian-controlled groups; for companies vulnerable to Germany and France, on the contrary, the relevance of belonging to a multinational group (Italian-controlled in the case of Germany, foreign-controlled in the case of France) is less relevant.

Table 4 - The effects of export vulnerability components on the probability of being export-vulnerable to the country. Year 2022 (Percentage points) (a) (b)

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[10] This choice stems from the fact that the export-vulnerability status to each of the three countries can expressed through a qualitative variable that has a finite number of modalities without an evident ordering (nominal polytomous variable), This type of models allows to estimate the effect of a vector of explanatory variables of interest (x) on the probability of observing each outcome, $\text{Prob}(y = j \mid x)$, $j = 2, …, J$. Since the sum of the probabilities is unitary, it follows that $\text{Prob}(y = j \mid x)$ is known once the probabilities for the remaining modes ($j = 2,…,J - 1$) are known. Letting $j = 1$ be the reference category, the probability of $j=i$ is therefore given by $\text{Prob}(y = j \mid x) = \frac{\exp(x\beta_i)}{1 + \sum_{m=2}^{J} \exp(x\beta_m)}$, $j > 1$, where x is a vector of explanatory variables and β_m is the vector of parameters for the type m ($m = 2,…, J$).

VARIABLES	Germany	France	United States
HHI_country	-0.048***	-0.016***	0.024***
	-0.004	*-0.003*	*-0.004*
HHI_product	0.040***	0.022***	-0.050***
	-0.003	*-0.003*	*-0.004*
Export propensity	0.004***	0.003***	0.001
	-0.001	*-0.001*	*-0.001*
Domestic group membership	0.013**	0.000	-0.009
	-0.006	*-0.006*	*-0.007*
Foreign MN group membership	-0.003	-0.020**	0.013
	-0.010	*-0.010*	*-0.014*
Italian MN group membership	-0.035***	-0.009	0.039***
	-0.007	*-0.008*	*-0.012*
Size controls		Yes	
NUTS-2 controls		Yes	
Prob>Chi2		0.000	
Pseudo_R2		0.076	
Observations		23,016	

(a) Marginal effects are reported. Standard errors in italics. *** p<0.01, ** p<0.05, * p<0.1
(b) Germany, France and United States are the countries towards which the number of EVFs is highest (see Figure 2).
Source: Authors' calculations on Istat data.

As for the import vulnerability, analogously to the export vulnerability, we apply the following probit model:

$$Prob\ (IVF_{i,s} = 1|HHI_{isC}^m, HHI_{isP}^m, IP_{i,s}, FDP_{i,s}, G_{i,s}, S_{i,s}, R_{i,s}) = \Lambda(\alpha_1 HHI_{isC}^m + \alpha_2 HHI_{isP}^m + \alpha_3 IP_{i,s} + \alpha_4 FDP_{i,s} +$$
$$\alpha_5 G_{i,k,s} + \alpha_6 S_{i,s} + \alpha_7 R_{i,s})\quad [3]$$

where C_i is a categorical variable referring to the market towards which the firms are export-vulnerable. It takes value 1 for Germany; 2 for China; 3 for the Rest of the world (taken as a benchmark); IP_i is the firm's i import propensity, in terms of import-to-intermediate costs ratio; FDP_i is the number of FDPs imported by the firm; HHI_{isC}^m is the Herfindahl-Hirschman index measuring the degree of concentration of import origin markets for the firm i in sector s; HHI_{isP}^m is the Herfindahl-Hirschman index indicating the degree of concentration of products (at a 8-digit level of the Combined Nomenclature) imported by firm i in sector s; , G_i, S_i, R_i are the same set of controls as in equation [1].

The results are reported in Table 5. Firstly, estimates confirm that in 2022 in the Italian manufacturing sector, import vulnerability was primarily linked to the number of FDPs purchased from abroad (a 1% increase in this number increases the probability of being import-vulnerable by about 2 percentage points) and, secondarily, to the import incidence (+1.4 percentage points). A higher geographical concentration of imports is also associated with a greater probability of being vulnerable (+1.1 points), while conversely – consistently with the descriptive evidence in Section 3 – import vulnerability is accompanied by a lower product concentration of import. Finally, belonging to groups, including multinational ones, does not significantly affect the probability of being vulnerable to foreign supply.

As in the case of export vulnerability, however, some sectoral heterogeneity emerges, although in the vast majority of sectors import vulnerability appears to be driven by the need for FDPs and by a high reliance on imports for the supply of raw materials and intermediate goods. In particular, the number of FDPs is the main determinant of the probability of being import-vulnerable in 14 out of 22 manufacturing sectors, and is higher

in sectors relatively upstream in the production chains, such as Textiles, Wood, Basic Metals (with marginal effects on the probability of vulnerability ranging between +4.6 and +7 percentage points).

Also the import incidence plays an important role: it gives the highest contribution to the probability of being IVF in sectors strongly integrated into international value chains – such as Chemicals, Pharmaceuticals, Other Transport Equipment – and it is the only component of vulnerability contributing significantly to the import vulnerability of firms in the Beverages sector. In turn, the product and geographical concentration of imports, as mentioned, plays a lesser role than the other two components of vulnerability, but in some cases this is relevant: concentrating imports of raw materials and intermediate goods in a few countries, for example, increases the probability of being import-vulnerable in the Food, Paper, Non-metallic mineral products, Motor Vehicles and, again, Other transport equipment sectors. Conversely, an increase in the product concentration of imports is associated with a greater probability of being vulnerable only in the Furniture sector, where it is also the main determinant of import vulnerability (it increases the probability by about 28 percentage points).

Finally, the effect of belonging to multinational groups on import vulnerability is also to be noted: it represents a factor of lower vulnerability for firms in Beverages (regardless of Italian or foreign nationality), Leather (for foreign-controlled multinational firms), and Metal Products (for Italian-controlled multinational firms), while belonging to an Italian multinational group increases the probability of import vulnerability for companies in Motor Vehicles and Wearing Apparel.

Table 5 – The effects of import vulnerability components on the probability of being IVF, by manufacturing sectors. Year 2022 (Marginal effects; Percentage points) (a) (b)

	All manufacturing sectors	Food	Beverages	Textile	wearing apparel	Leather	Wood	Paper	Printing	Chemicals	Pharmaceutics	Rubber and plastic	Non metallic mineral prod.	Basic metals	Metal prod.	Electronics	Electrical equip.	Machinery	Motor vehicle	Other transport equip.	Furniture	Other manuf.
HHI_country	0.011***	0.056***	-0.021	0.017*	0.018**	-0.005	0.068***	0.045***	0.005	0.040***	0.075**	0.014***	0.025**	0.026*	0.008**	0.013**	0.003	0.006**	0.044***	0.018	-0.009	0.001
	-0.002	*-0.008*	*-0.029*	*-0.009*	*-0.008*	*-0.006*	*-0.017*	*-0.016*	*-0.01*	*-0.012*	*-0.033*	*-0.006*	*-0.011*	*-0.013*	*-0.004*	*-0.006*	*-0.005*	*-0.003*	*-0.017*	*-0.017*	*-0.008*	*-0.005*
HHI_product	-0.017***	-0.054***	0.010	-0.014*	-0.016**	0.001	-0.041***	-0.019	0.007	-0.096***	-0.017***	-0.017*	-0.040***	-0.011***	-0.014***	-0.001	-0.004*	-0.046***			0.016**	-0.002
	-0.002	*-0.008*	*-0.024*	*-0.008*	*-0.006*	*-0.005*	*-0.016*	*-0.014*	*-0.008*	*-0.012*	*-0.036*	*-0.006*	*-0.009*	*-0.013*	*-0.003*	*-0.006*	*-0.005*	*-0.002*	*-0.017*	*-0.015*	*-0.007*	*-0.004*
Import incidence	0.014***	0.020***	0.040***	0.024***	0.011***	0.009***	0.031***	0.036***	0.005***	0.055***	0.136***	0.011***	0.011***	0.034***	0.005***	0.019***	0.011***	0.007***	0.028***	0.019***	0.003***	0.008***
	0.000	*-0.001*	*-0.016*	*-0.003*	*-0.001*	*-0.002*	*-0.003*	*-0.005*	*-0.001*	*-0.005*	*-0.017*	*-0.002*	*-0.001*	*-0.005*	*-0.001*	*-0.002*	*-0.002*	*-0.001*	*-0.006*	*-0.005*	*-0.001*	*-0.001*
Number of FDPs	0.019***	0.021***	0.032*	0.061***	0.034***	0.013**	0.076***	0.034***	0.009***	0.028***	0.028	0.018***	0.022***	0.046***	0.015***	0.025***	0.015***	0.008***	0.013***	0.008*	0.002**	0.041***
	-0.001	*-0.004*	*-0.018*	*-0.005*	*-0.003*	*-0.002*	*-0.007*	*-0.006*	*-0.002*	*-0.005*	*-0.02*	*-0.002*	*-0.003*	*-0.006*	*-0.001*	*-0.003*	*-0.002*	*-0.001*	*-0.004*	*-0.004*	*-0.001*	*-0.003*
Domestic group membership	0.000	-0.004	-0.082**	0.019	0.012	-0.004	-0.023	0.013	-0.006	-0.015	-0.04	0.004	-0.001	-0.004	-0.003	0.017	0.006	-0.001	0.03	0.012	-0.007	-0.004
	-0.002	*-0.012*	*-0.032*	*-0.014*	*-0.011*	*-0.008*	*-0.023*	*-0.019*	*-0.01*	*-0.018*	*-0.089*	*-0.008*	*-0.014*	*-0.019*	*-0.005*	*-0.011*	*-0.008*	*-0.004*	*-0.025*	*-0.025*	*-0.008*	*-0.006*
Foreign MN group membership	0.003	0.047*	-0.121***	-0.011	0.003	-0.017**	-0.001	-0.040***	-	0.018	-0.121	0.011	0.003	0.002	0	0.016	0.016	0.005	0.035	0.037	-	-0.023***
	-0.003	*-0.025*	*-0.037*	*-0.021*	*-0.028*	*-0.007*	*-0.108*	*-0.013*	*-*	*-0.021*	*-0.081*	*-0.012*	*-0.017*	*-0.028*	*-0.007*	*-0.012*	*-0.011*	*-0.004*	*-0.022*	*-0.034*	*-*	*-0.007*
Italian MN group membership	0.002	-0.012	-0.115***	-0.003	0.034*	0.012	-0.01	0.060*	0.017	-0.016	-0.025	-0.004	0.006	-0.013	-0.010**	0.013	0.013	0.004	0.052**	-0.024	-0.004	-0.003
	-0.003	*-0.015*	*-0.027*	*-0.015*	*-0.018*	*-0.013*	*-0.035*	*-0.031*	*-0.022*	*-0.019*	*-0.088*	*-0.008*	*-0.017*	*-0.022*	*-0.005*	*-0.01*	*-0.009*	*-0.004*	*-0.023*	*-0.022*	*-0.011*	*-0.008*
Size controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NUTS-2 controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prob>Chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo_R2	0.366	0.307	0.700	0.475	0.447	0.509	0.357	0.439	0.485	0.347	0.350	0.411	0.429	0.382	0.524	0.524	0.509	0.552	0.375	0.327	0.621	0.822
Observations	37,282	2,213	222	1,887	2,463	1,543	1,119	715	639	1,531	268	2,337	1,189	837	4,906	2,031	2,219	6,423	583	604	703	2,038

(a) Marginal effects. Standard errors in italics. *** p<0.01, ** p<0.05, * p<0.1
(b) The table does not include the sector of Coke and refined oil products due to insufficient number of observations.
Source: Authors' calculations on Istat data

Finally, also in analyzing the import vulnerability, it is important to assess how its components change depending on the origin country to which the firms are import-vulnerable. To do so, as in the export-vulnerability case, we focus on the countries towards which the number of IVFs is highest: Germany and China.

In particular, we estimate a new multinomial logit model, which takes the following specification:

$$\text{Prob}\big(C_i = j \mid HHI_{iC}^m, HHI_{iP}^m, IP_i, FDP_i, G_i, S_i, R\big) = \frac{\exp\big(\alpha_{ij} + \alpha_{ij2}HHI_{iC}^m + \alpha_{ij3}HHI_{iP}^m + \alpha_{ij4}IP_i + \alpha_{ij5}FDP_i + \alpha_{ij6}G_{i,s} + \alpha + \alpha_{ij7}S_{i,s} + \alpha_{ij8}R_{i,s}\big)}{1 + \sum_{z=2}^{J} \exp\big(\alpha_{iz2}HHI_{iC}^m + \alpha_{iz3}HHI_{iP}^m + \alpha_{iz4}IP_i + \alpha_{iz5}FDP_i + \alpha_{iz6}G_{i,s} + \alpha_{iz7}S_{i,s} + \alpha_{iz8}R_{i,s}\big)} \quad [4]$$

where C_i is a categorical variable referring to the market towards which the firms are export-vulnerable. It takes value 1 for Germany; 2 for China; 3 for the Rest of the world (taken as a benchmark) and $HHI_{iC}^m, HHI_{iP}^m, FDP, IP_i, G_i, S_i, R_i$ are the same set of covariates as in equation [3].

The results are reported in Table 6. First of all, while the IVFs which are vulnerable to Germany and China tend to have a lower product concentration of their import, their vulnerability to these two countries is characterized by a higher geographical concentration: an increase of 1% in the HHI index increases by 9.1 percentages points the probability of being vulnerable to China and 3.3 percentage points that of being vulnerable to German supply. However, this vulnerability is barely linked to the import incidence, whose effect is less than 1 percentage points, even though it is positive for Germany and negative for China. Interestingly, the number of FDPs does not significantly affect import vulnerability towards these two countries. The effect of the presence of these products in the basket of imported goods is very limited in the case of Germany and even negative (-5.8 percentage points) for China. Finally, firms vulnerable to German supply tend to belong to Italian domestic groups or foreign-controlled multinational firms, while vulnerability to Chinese supplies is mostly associated with belonging to Italian multinational groups. Conversely, belonging to foreign multinational groups significantly reduces (-9.4 percentage points) the probability of being vulnerable to Chinese supplies.

In sum, firms vulnerable to imports from Germany appears to be characterized by units belonging to Italian groups or foreign-controlled multinational groups; their imports are distributed across many products but include relatively few FDPs and tend to concentrate in Germany. On the other hand, the group of companies vulnerable to Chinese supplies seems to be mostly determined by units belonging to Italian multinational groups that have diversified imports by product, import few FDPs, but strongly concentrate their purchases in China.

Table 6 - The effects of import vulnerability components on the probability of being import vulnerable to the country. Year 2022 (Marginal effects; Percentage points) (a)

VARIABLES	Germany	China
HHI_country	0.033***	0.091***
	-0.01	-0.01
HHI_product	-0.045***	-0.100***
	-0.01	-0.01
Import incidence	0.007***	-0.004***
	-0.001	-0.001
Number of FDPs	0.006*	-0.058***
	-0.004	-0.008
Domestic group membership	0.047***	-0.009
	-0.016	-0.015
Foreign MN group membership	0.070***	-0.094***
	-0.019	-0.015
Italian MN group membership	-0.026	0.048**
	-0.018	-0.022
Size controls	Yes	
NUTS-2 controls	Yes	
Prob>Chi2	0.000	
Pseudo_R2	0.076	
Observations	4,954	

(a) Marginal effects. Standard errors in italics. *** p<0.01, ** p<0.05, * p<0.1
(b) Germany and China are the countries towards which the number of import-vulnerable firms is highest (see Figure 4).
Source: Authors' calculations on Istat data

5. Conclusions

In this paper we propose a novel firm-level indicator of firms' vulnerability to foreign demand and supply. To do so we focus on the Italian case because, in addition to the series of shocks that hit the main world economies in sequence since 2020, many characteristics of the Italian business system could prove to be further potential factors of vulnerability, both to imports and exports.

In this context, it is important to detect which segments of the production system are most exposed to risk factors. In doing so, we partially departed from the recent literature, especially by adopting an Italy-centric view of vulnerability, rather than a EU-centric one. This has some conceptual consequences, particularly on the import vulnerability side, because it means that what Italian firms import from a EU country is treated like imports from non-EU countries, leading to a different definition of "foreign dependent product" (FDP, i.e. scarce and not easily substitutable).

Our results show that in Italy in 2022 the number of firms that were vulnerable to foreign demand (EVFs) was quite small (about 23,000; 0.5% of the total), but these units had a relevant economic weight, accounting for significant shares of exporters (18%), export (16.5%) and total value added (3.5%). In comparison with non-vulnerable exporters, they were also smaller (their size was half the non-vulnerable exporters' one) and more export-oriented (their export-to-turnover ratio is over 52%), with higher diversification of destination markets and higher concentration of exported products.

Sectoral analysis highlights that the EVFs are more numerous in some activities characterising the Italian specialisation model, such as Transport equipment, Leather, Motor vehicles, Machinery. This means that possible shocks involving EVFs in these sectors may have serious consequences on the overall amount of Italian export and can negatively affect activities across the business system through domestic inter-sectorial transactions. A further element of export vulnerability – with specific refer to these last years – lies in the geographical aspect: in 2022 Italian exporters were mostly vulnerable to Germany and USA. Estimates show that the export vulnerability towards these two markets has different characteristics; in particular, the exporters vulnerable to Germany are characterised by a higher product concentration of exports and a lower geographical concentration, also as a result of the progressive enhancement of the EU single market (to a lesser extent this applies also to EVFs to France). The vulnerability towards USA, conversely, is driven by a higher geographical concentration of exports, accompanied by a lower product concentration.

On the import side, the number of IVFs is even lower than EVFs' one (less than 4,600, about 0.1% of the total), but they have also a higher economic relevance, in terms of imports (almost 24%), value added (5.7%) and productivity (about twice the total average), and they are more numerous in the Pharmaceuticals (about 20% of importing firms), or in sectors generally positioned upstream in supply chains (16.4% for Wood, 13.5% for Coke, 9.7% for Chemicals). Italian IVFs are mostly vulnerable to supply from Germany and China, with an important difference in the role of FDPs: while the purchase of these products does not affect the vulnerability towards Germany, importers vulnerable to China import on average less FDPs from that country with respect to importers vulnerable to the rest of the world (Germany – along with France, Spain and Netherlands – is the main supplier of FDPs for Italy).

To sum up, we have provided a snapshot of the import and export vulnerability of the Italian production system in 2022 The significant economic weight of vulnerable firms suggests that if the extent or intensity of vulnerability should increase, significant systemic effects could be recorded. Moreover, the events following the years considered here – in particular the 2023-2024 German recession and the tariffs imposed by the US administration from 2025 – will make it opportune to measure whether, and to what extent, these events could change the map of the Italian production system's vulnerability to foreign supply and demand.

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