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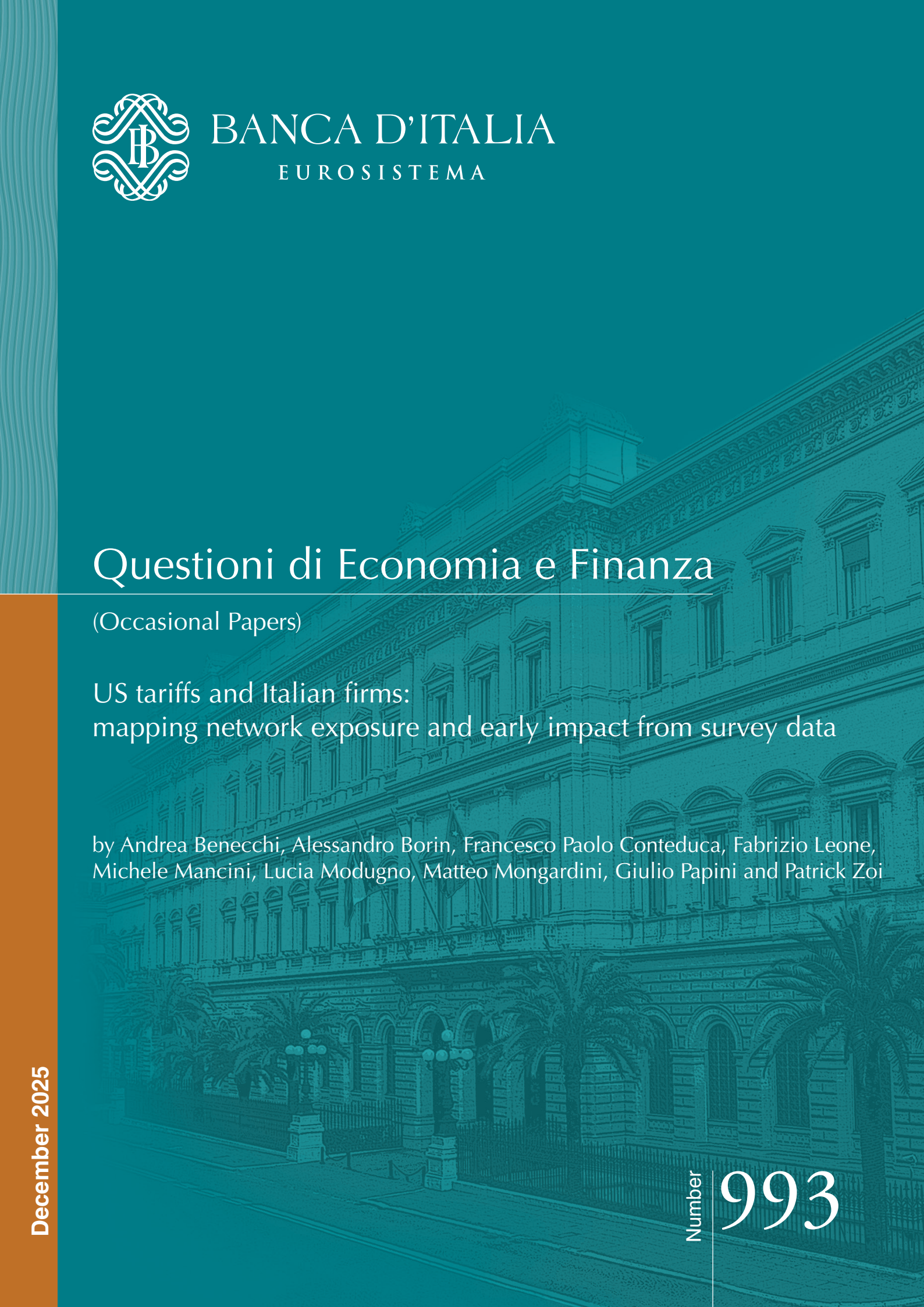

Questioni di Economia e Finanza

(Occasional Papers)

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by Andrea Benecchi, Alessandro Borin, Francesco Paolo Conteduca, Fabrizio Leone, Michele Mancini, Lucia Modugno, Matteo Mongardini, Giulio Papini and Patrick Zoi

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US TARIFFS AND ITALIAN FIRMS: MAPPING NETWORK EXPOSURE AND EARLY IMPACT FROM SURVEY DATA

by Andrea Benecchi*, Alessandro Borin*, Francesco Paolo Conteduca*, Fabrizio Leone*, Michele Mancini*, Lucia Modugno*, Matteo Mongardini*, Giulio Papini* and Patrick Zoi*

Abstract

This paper examines the exposure of Italian firms to the US market following the 2025 tariff shock and presents early evidence of its impact using business survey data. Leveraging a unique dataset that integrates domestic firm-to-firm transactions, customs records, firm registries, and employment data, we map the production network of 1.8 million firms and quantify both direct and indirect exposure to US sales. Exposure levels vary significantly across firms and regions, with some local labour markets considerably more vulnerable than the national average. Drawing on survey data from the Bank of Italy, we find that approximately 20% of firms reported sales declines driven by tariff-related disruptions during the first three quarters of the year, although often a moderate one, and 25% expected drops in the final quarter. Linking survey responses with firm-level exposure, we show that both direct and indirect measures significantly predict negative sales outcomes and expectations driven by tariff-related disruptions. These findings highlight the importance of accounting for domestic production networks when assessing the effects of trade shocks and designing targeted policy interventions to mitigate localized economic vulnerabilities.

JEL Classification: F14, R12, L14, F61, R15.

Keywords: trade shocks, tariffs, production networks, firm-level exposure.

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1. Introduction[1]

Italy's production system is deeply integrated into international trade and global value chains, which in recent years have been repeatedly strained by major external shocks. Events such as the COVID-19 pandemic and the Russian invasion of Ukraine have revealed the risks associated with a sudden interruption of international trade (Baldwin and Freeman, 2022). The latest shock comes from the US administration's new round of tariffs imposed in 2025, which targeted not only geopolitical rivals but also traditional allies, including Italy.

Since the beginning of 2025, the US administration has introduced new tariffs targeting specific sectors (steel, aluminium, automotive, copper, and pharmaceuticals) and countries—initially China, Mexico, and Canada, and later extended to nearly all others, including Italy—raising the average US effective tariff rate to 17 per cent in November 2025, up from about 3 per cent at the end of 2024. Regarding the EU, the agreement signed with the US on July 27 set a base tariff of 15 per cent on EU exports. Although this is lower than the 30-percentage-point increase initially announced by Washington in early July, it still represents a 13-percentage-point rise relative to the effective rate at the end of 2024, with potentially significant consequences for EU and Italian exporters, given the importance of the US market.

In this paper, we quantify Italian firms' direct and indirect exposure to sales in the US market and provide an early assessment of the impact of 2025 US tariffs and associated trade tensions. We combine mandatory business-to-business transaction records, covering all domestic trade, with customs data on foreign transactions, as well as firm balance sheet statements, employment data, and geographic classifications. This allows us to map the sub-national production network of about 1.8 million firms for 2022, the latest year for which reliable data are available. With this in hand, for each firm we trace the downstream stages of supply linkages leading to exports to the US, thereby quantifying firms' indirect exposure to the US market in addition to their direct export exposure. We then leverage on business survey data collected between September and October by the Bank of Italy to shed light on the self-reported impact of US tariffs and related trade tensions on firms' sales over the first nine months of the 2025, and the expected impact for the final quarter. Lastly, we examine whether and how self-reported effects are related to our measure of firms' direct and indirect exposure by linking survey responses with firm-level exposure data.

Even though the US is Italy's largest export market outside the EU, direct exports to the US represent a rather limited share of firms' total revenues, about 1.4%. However, such share more than doubles to 3.2% once indirect linkages through domestic supply chains are taken into account. Our analysis reveals substantial heterogeneity in US market exposure across Italian firms and regions, with some local labour markets

[1] The opinions expressed and conclusions drawn are those of the authors and do not necessarily reflect the views of the Banca d'Italia.

emerging as disproportionately at risk compared with the national average. Using survey data, we show that about one-fifth of Italian firms experienced a decline in sales during the first nine months of 2025 due to trade disruptions linked to US tariffs, although this was often moderate. Meanwhile, the proportion of firms anticipating a decline in sales during the final quarter increased to 25%. By linking survey data with firm-level measures of exposure, we show that these ex-ante measures, based on 2022 data, meaningfully predict firms' vulnerability to 2025 tariff-related tensions: even after controlling for firm size, sector, and geographical location, higher direct—and, to a lesser extent, indirect—exposure is associated with a sharper decline in total sales driven by tariff-induced trade disruptions. In addition, we find that first-tier indirect exposure is more strongly correlated with reported effects compared with indirect exposure that captures only the further downstream linkages of indirect sales to the US.

Recent research on the 2025 tariff has primarily relied on simulations based on quantitative trade models, finding sizeable trade reallocation and welfare losses from 2025 US tariffs (Ignatenko et al., 2025; Bouet, 2025; Olarreaga and Santander, 2025; Conteduca et al., 2025).[2] Relying on aggregate trade statistics, Alfaro and Chor (2025) show that the April 2 measures accelerated US import substitution away from China and, more generally, from countries subject to higher tariff rates. Because real outcomes at the firm level materialize with a lag, early empirical evidence has turned to high-frequency financial data (Ali et al., 2025; Benguria and Saffie, 2025; Kaczmarek et al., 2025a,b; Piserà et al., 2025; Yilmazkuday, 2025). Direct firm-level evidence during the second Trump term is still scarce due to the lack of data. Our contribution addresses this gap by combining ex-ante firm-level exposure to US export markets with up-to-date Italian business-survey evidence, delivering an early assessment of how the 2025 tariff shock is perceived and transmitted across Italian firms.[3]

The remainder of the paper is organized as follows. Section 2 outlines the methodology used to measure firms' exposure to the US market. Section 3 describes the data sources employed in the analysis. Section 4 presents the results on sales exposure to the US—first at the aggregate level, and then across regions and local labour markets. Section 5 analyses the impact of US tariffs, drawing on evidence from business surveys. Section 6 links firm-level survey results with exposure measures. Section 7 concludes.

2. Measuring exposure

We assess the total exposure of an Italian firm to the US market following Dhyne et al. (2021).[4] This exposure comprises two components: a direct one and an indirect one.

[2] Instead, several papers have analyzed the aggregate, sectoral, firm-level impacts of the 2018-19 US-China trade war (for a review, see Fajgelbaum and Khandelwal, 2022).

[3] A complementary study (Federico et al., 2025) offers an ex-ante assessment of the impact of the US tariff hikes on Italian firms' sales and profits, using granular firm-level data but without accounting for the full network structure.

[4] For more information on the exposure measure, see Appendix B.

Direct exposure reflects a firm's sales to the US market and is measured as the share of its revenues generated from direct exports to the US. For instance, if a company earns 20% of its revenue from sales to US customers, its direct exposure is 20%. Indirect exposure, instead, captures a subtler channel. Even if a firm does not directly sell to the US itself, it may still supply goods or services to another firm that (again, directly or indirectly) does so. In this case, part of its revenue ultimately depends on US demand through its buyers. A similar logic applies when an Italian firm sells a good or a service to another Italian firm that does not directly export to the US, but in turn sells its good or service to another firm that sells to the US, and so on. In all these cases, part of the firm's revenues is subject to risk stemming from the US market, as a drop in downstream demand from its customers (and customers of their customers) can reduce upstream firm's revenues. To account for this channel, we need to map the network of business relationships among Italian firms. This allows us to keep track of how the exposure iteratively propagates through the domestic supply chains.

More formally, firm i's total exposure, $r^T_{i,US}$, can be defined recursively as

$$\begin{aligned} r^T_{i,US} &= r^D_{i,US} + r^I_{i,US} \\ &= r^D_{i,US} + \sum_{j \in B_i} r_{ij} r^T_{j,US}, \end{aligned} \tag{1}$$

where $r^D_{i,US}$ is the direct exposure of firm i, i.e., the share of revenues directly realized in the US market, $r^I_{i,US}$ is the indirect exposure of firm i, i.e., the share of revenues indirectly realized in that market, and r_{ij} is the share of revenues that firm i earns from sales to the customer j. In the second term, the summation is extended over all firms in the economy but $r_{ij} > 0$ only when j is a customer of i, i.e., when $j \in B_i$, where B_i is the set of i's customers.

Equation (1) represents a recursive expression. In particular,

$$\begin{aligned} r^I_{i,US} &= \sum_{j \in B_i} r_{ij}\, r^T_{j,US} = \\ &= \sum_{j \in B_i} r_{ij} \left(r^D_{j,US} + r^I_{j,US} \right) \\ &= \sum_{j \in B_i} r_{ij} \left(r^D_{j,US} + \sum_{k \in B_j} r_{jk} r^T_{k,US} \right) \\ &= \sum_{j \in B_i} r_{ij} r^D_{j,US} + \sum_{j \in B_i} r_{ij} \sum_{k \in B_j} r_{jk} r^T_{k,US} \\ &= \sum_{j \in B_i} r_{ij} r^D_{j,US} + \sum_{j \in B_i} r_{ij} \sum_{k \in B_j} r_{jk} \left(r^D_{k,US} + r^I_{k,US} \right) \\ &= \sum_{j \in B_i} r_{ij} r^D_{j,US} + \sum_{j \in B_i} r_{ij} \sum_{k \in B_j} r_{jk} r^D_{k,US} + \sum_{j \in B_i} r_{ij} \sum_{k \in B_j} r_{jk} \sum_{l \in B_k} r_{kl} r^T_{l,US} \ldots \end{aligned}$$

Such decomposition highlights the contribution of the higher-order terms comprising the indirect exposure. While these higher-order terms fade away, as r_{ij} is between 0 and 1, they do not vanish for a finite number of linkages.

The object of interest for our analysis is represented by $r^{T}_{i,US}$, which is the solution to a system of linear equations, which can be written in matrix form as

$$\mathbf{r^{T}_{US}} = \mathbf{r^{D}_{US}} + \mathbf{\Omega} \cdot \mathbf{r^{T}_{US}},$$

where $\mathbf{\Omega}$ represents the normalized matrix of domestic supply chain linkages, whose i, j element is r_{ij}.[5] After computing total exposure, indirect exposure is obtained as the residual from total minus direct exposure, which is given in the data. Aggregate direct, indirect, and total exposures by sector or region are then calculated as weighted average of the firm-level corresponding exposures, using firms' total revenues as weights.

The above framework relies on a key assumption, i.e. proportional pass-through, which is however standard in the literature (see Dhyne et al., 2021): if a customer derives 30% of its revenue from the US, then 30% of its purchases from suppliers are considered US-exposed. Other caveats are in place. Exposure measures are static ones; thus, they are computed assuming that firms do not alter their supply chains following the shock. The analysis can only account for exposure to the US due to the domestic network. As Italy is deeply integrated in the European supply chains, a non-negligible contribution to the exposure may derive from exporting goods to other European firms, which in turn export to the US.

3. Data

The dataset underlying the analysis integrates several administrative and registry sources. Domestic transactions come from FATTEL electronic invoicing data, covering all B2B and selected B2C invoices, while international transactions are captured through Customs (Dogane) data on imports and exports (excluding natural gas and electricity). We complement these with Cerved balance sheet data, Infocamere's firm registry (legal form, sector, location), and INPS employment records providing worker counts and their spatial distribution. Labor market areas are defined using ISTAT classification in 2019, the latest available edition, accounting also for changes to administrative units. Firm identifiers (VAT - Value-Added Tax - numbers and fiscal codes) are harmonized across datasets, and transactions are aggregated at the firm-pair level for 2022 – the latest year with complete and accurate data across the different sources–, consolidated at the group level for VAT groups. Revenues are defined as invoices plus exports. We deal with VAT groups and multiplant firms by imputing

[5] A unique solution to this system exists provided the spectral radius of $\mathbf{\Omega}$ is smaller than 1, which holds given the above normalization. Given the size of the system, inverting $\mathbf{\Omega}$ would be not feasible. Hence, we solve the system through an iterative procedure until convergence to the unique fixed point of the mapping, $\mathbf{r^{T}_{US}}^{*}$, is attained. Once we obtain $\mathbf{r^{T}_{US}}^{*}$, we can also compute $\mathbf{r^{I}_{US}}^{*}$.

local activity using employment data at the municipal level. The financial and insurance sectors are excluded from our analysis, as well as sole proprietorships due to data limitations.[6]

An observation in our transaction network dataset corresponds to a buyer–seller pair and the value of their transaction. Overall, the data comprise about 80 million observations involving 1.8 million firms (Table A.1 in Appendix A).[7] We observe more than 80,000 exporters (accounting for €555 billion in value), of which 30,000 sold to the US (corresponding to €60 billion) in 2022. For exports, our coverage relative to official figures is approximately 90%.[8] We discuss the limitations of the data in Appendix B.

We combine these administrative sources with data from surveys conducted by Banca d'Italia. The main source is the Business Outlook Survey of Industrial and Service Firms (BOS). The BOS, carried out annually since 1993, collects qualitative information on firms' current performance and expectations regarding demand, investment, and employment. It covers industrial and service firms with at least 20 employees, drawn through stratified sampling based on sector, size, and geographical area, and is conducted by the Banca d'Italia's regional branches between September and October. The 2025 BOS comprises approximately 4,000 firms, with industrial (excluding construction) companies accounting for about two-thirds of the sample.[9] We validate findings from BOS using a second, higher-frequency source: the quarterly Survey of Inflation and Growth Expectations (SIGE). Each quarter, the survey collects information on firms' expectations for consumer price inflation, developments in their own selling prices, and their views on the macroeconomic outlook. The survey focuses on industrial (including construction) and service firms with 50 or more employees and is based on a panel of about 2,500 firms.[10]

[6] Appendix B reports additional information on the data and the cleaning procedure.

[7] Compared to other studies using similar data, the number of firms is roughly four times higher (for a survey, see Bacilieri et al., 2023).

[8] Export is lower than official figures because some categories of goods are not included in the data (onboard provisions, electricity, gas, monetary gold) and represent about 5% of the total export. Moreover, some transactions (around 6%) are referred to VAT codes of foreign firms that cannot be connected with the firm registry and with the occupational data.

[9] Within industry, roughly one-third of firms employ 20–49 workers, while one-quarter of firms employ 200 or more. The size distribution is similar in services, though with a slightly higher share of large-sized firms. Export orientation shows marked heterogeneity. Overall, about one-third of the firms do not export at all. Among exporters, most have a limited international presence, with more than 40% generating less than one-third of their turnover abroad. Larger firms tend to be more export-oriented than smaller ones, and manufacturing sectors—especially textiles and chemicals—display higher export intensity compared with services, where activities such as hotels and real estate remain predominantly domestic.

[10] In our analysis, we consider only industrial (excluding construction) and service firms, which together account for around 90% of the full sample. Half of the panel consists of industrial firms, most of which (three-quarters) have between 50 and 199 employees. More than half of the companies are located in northern Italy. Nearly half of firms do not export at all; among the remaining exporters, more than one-quarter produce over two-thirds of their total output for foreign markets.

4. Results on sales' exposure to US

The following subsections first assess the national direct and indirect exposure to sales to the US (Section 4.1) and then examine local exposure to uncover the substantial heterogeneity behind the national figures (Section 4.2).

4.1 Aggregate Results

Domestic supply linkages greatly amplify the exposure of Italian firms. Our analysis shows that overall exposure to US trade across the Italian economy amounts to 3.2% of Italian firms' revenues (Table 1). About 1.4% of the revenues depend on the export of goods to the US (direct channel), while 1.8% is due to sales to the US market through domestic supply chain linkages (indirect exposure; see table 1). First-order indirect exposure is sizable (0.7%), but higher-order linkages within the network of Italian firms account for a larger share of exposure. The relatively high exposure through the indirect channel, which captures the role of suppliers and upstream industries, highlights the importance of considering the full value chain when assessing trade risks.

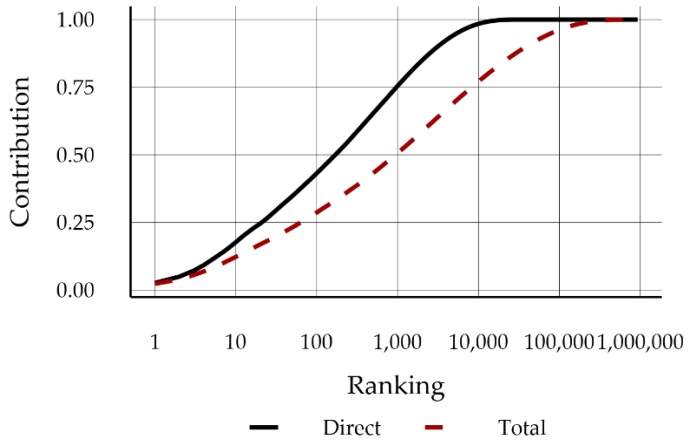
Table 1 – Direct and indirect exposure to the US

	Exposure (%)
Direct	1.4
Indirect	1.8
of which: first round	*0.7*
Total	3.2

Notes: national-level exposure to exports to the US. The *Direct* component corresponds to the weighted average of firms' exports to the US over total revenues in 2022, using revenue as weights. The *Indirect* component captures all higher-order terms defined in Equation (1), similarly aggregated using the revenues as weights. Within this indirect component, we also report the contribution of first-order linkages (*of which: first round*). The *Total* exposure combines both direct and indirect channels, again aggregated using revenues as weights.

Large exporters drive direct exposure, while contribution to indirect exposure is more evenly distributed. Figure 1 shows the cumulative contribution of Italian firms to overall exports to the US. About 10% of the revenues of the twenty most exposed firms depend on sales to the US, but in more than half of these cases, that share is equal to or greater than 25%. Notably, around 20 firms account for 25% of national direct exposure, fewer than 200 for 50%, and about 1,000 for 75% (Figure 1). Direct exposure is therefore highly concentrated among top exporters. At the same time, the contribution to total exposure is more evenly distributed. Approximately 1,000 firms account for 50% of it, while it takes 8,000 firms to reach 75%. Although the correlation between contributions to direct and indirect exposure is high (0.74), it is not perfect, highlighting that some firms with low-direct exposure may still exhibit high total exposure through domestic linkages.

Figure 1 – Cumulative contribution to exposures



Notes: cumulative percentage contribution of firm-level direct and total revenue exposures to exports to the US in 2022. Contributions are calculated as firm-level direct (black solid line) and total (red dashed line) weighted by the firm's revenue share of total revenues in 2022. The x-axis is shown on a log-10 scale.

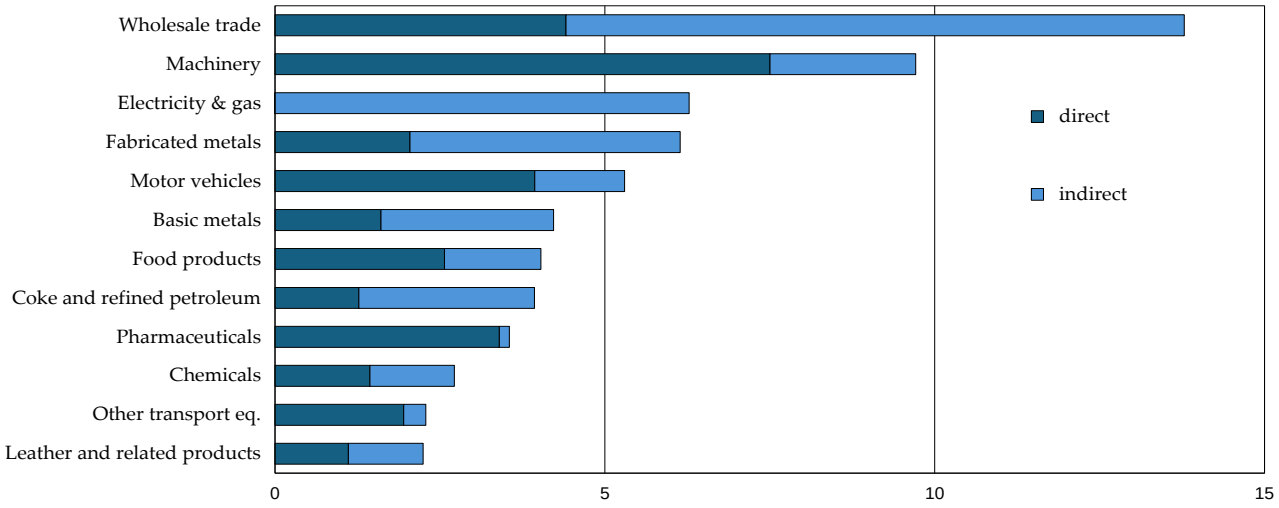
A few, key sectors drive the aggregate exposure. Figure 2 ranks 2-digit sectors according to their total exposure, distinguishing between the part that originates from exports to the US and the one coming from domestic supply-chain linkages. *Wholesale trade* emerges as the most affected sector, primarily indirectly but also with a non-negligible exposure coming from the direct channel. This reflects its dual role: wholesalers act both as a key channel for exports and as a pass-through sector for intermediate goods. Previous research shows that wholesalers are critical in global supply chains, connecting domestic producers to foreign markets and redistributing imported goods domestically (Crozet et al., 2013; Ganapati, 2025). Their ability to aggregate demand and manage logistics makes them central nodes in trade networks, so that shocks to US demand can propagate strongly through this sector. Indeed, in a counterfactual exercise based on the same business-to-business data, Borin et al. (2025) show that excluding wholesale firms directly trading with the US would reduce Italian exposure to exports to the US by about 10%.

Machinery and equipment, m*otor vehicles* and f*abricated metal products* follow as major contributors, both through direct exports, reflecting the importance of the US market for these sectors and through the indirect channel, likely due to the supply of capital goods to exporting firms. *Electricity and gas supply* stands out as being wholly dependent on the sale of its services to energy-intensive industries tied to exports and likely owes its large exposure also to the high energy-price inflation in 2022. The exposure

of *Pharmaceuticals* on the contrary is almost entirely due to the direct channel, which may also reflect the increased demand due to the COVID-19 pandemic, which was still partly ongoing in 2022. Finally, *Food manufacturing* exhibits a slight prevalence of direct exposure.

When interpreting the results in Figure 2, a few caveats are in order. The reference year may be a relevant factor: our analysis is conducted for 2022, a year characterized by distinctive trade patterns due to the energy price shock and the ongoing post-pandemic recovery. While our micro-level measures of exposure to US exports are conceptually related to those used in macro-level studies based on ICIO tables, several methodological differences call for caution when comparing the two approaches. First, our estimates abstract from indirect exposure transmitted through foreign value chains, which ICIO-based approaches explicitly capture. Second, gaps in customs records for non-resident VAT numbers may be particularly relevant in some highly US-exposed sectors, such as pharmaceuticals, so estimates for these sectors should be interpreted with caution. Third, ICIO tables assume all firms in a sector and region use the same input mix, ignoring the central role of large, trade-intensive firms with extensive buyer-supplier networks, and this mechanically tend to understate the indirect exposure via domestic supply chains, as shown in Borin et al. (2025). Finally, capital-goods purchases recorded at the firm level are attributed to final domestic demand in ICIO frameworks, further underestimating inter-firm linkages.

Figure 2 - Top sectors by contribution to the total exposure



Notes: sectors defined as the first 2-digit of the ATECO classification.

4.2 Regional and Local Labour Market Results

Regional exposure is higher in industrialized northern and central regions but with notable contributions from the South (Table 2). Tuscany (5.3%) and Emilia-Romagna (4.6%) emerge as the most exposed regions overall, reflecting the combined weight of wine, leather, and machinery clusters. Basilicata (4.1%) also ranks high, driven by spe-

cialized manufacturing and energy-related activities. Among northern regions, Piedmont (3.8%) and Lombardy (3.1%) show significant exposure, consistent with their role in mechanical and metalworking supply chains. In contrast, southern regions generally exhibit lower aggregate exposure.

While aggregate and even regional risks may appear moderate, exposure to sales in the US market are concentrated in specialized local labour markets (LLMs) and affect a significant share of their economic activity. Within each region, even those that present a relatively low level of exposure, risk tails are substantial, as several LLMs have a very high level of exposure (Table 2, columns 6-9).

Thirteen local labour markets —out of about 600 — are highly exposed, with at least 10% of their revenues deriving from sales to the US (Table A.2 in Appendix A). While exposure is concentrated in the North and Center, sectoral specialization in selected southern territories can generate local vulnerabilities comparable or even higher to those of major industrial regions.

Table 2 - Regional exposure to US exports

Region	Direct	Indirect	1st ind.	Total	50th	75th	90th	95th	Max
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Tuscany	3.1	2.2	1.1	5.3	3.3	5.2	7.9	9.7	16.4
Emilia-Romagna	2.7	2.0	0.9	4.6	4.3	6.4	8.1	9.7	13.8
Basilicata	1.9	2.1	1.1	4.1	1.6	3.6	7.0	7.5	7.7
Veneto	1.9	2.1	1.0	4.0	3.7	5.4	8.2	10.3	29.3
Piedmont	1.8	1.9	0.9	3.8	3.0	4.1	6.1	6.9	13.5
Abruzzo	2.0	1.7	0.8	3.7	2.5	3.1	7.1	8.3	8.7
Marche	1.6	2.0	1.0	3.6	3.9	5.1	6.6	8.1	14.7
Friuli-Venezia Giulia	1.6	1.9	0.9	3.5	2.8	4.1	6.4	7.8	10.1
Trento	1.7	1.7	0.7	3.4	2.9	3.9	5.1	5.6	6.0
Molise	2.0	1.4	0.6	3.4	1.6	3.0	4.1	4.2	4.3
Umbria	1.7	1.7	0.7	3.3	2.2	3.0	6.2	7.1	9.7
Lombardy	1.1	2.0	0.8	3.1	3.2	3.8	4.9	6.4	13.6
Sardinia	1.7	0.9	0.3	2.6	1.2	1.7	4.0	6.2	23.6
Liguria	0.8	1.6	0.5	2.4	2.3	3.3	5.9	7.8	12.3
Campania	1.0	1.3	0.5	2.3	1.6	2.3	3.6	4.6	6.9
Apulia	0.6	1.6	0.6	2.3	1.7	2.4	3.1	4.1	7.3
Bolzano	1.1	1.2	0.3	2.2	1.4	1.9	3.0	3.7	4.6
Aosta	1.1	1.0	0.4	2.1	0.7	1.9	2.2	2.4	2.5
Lazio	0.6	1.3	0.2	1.9	1.3	2.4	4.5	4.6	4.9
Sicily	0.8	1.0	0.3	1.8	1.1	2.1	3.0	4.1	8.5
Calabria	0.3	1.0	0.2	1.3	0.9	1.6	2.5	3.6	4.8

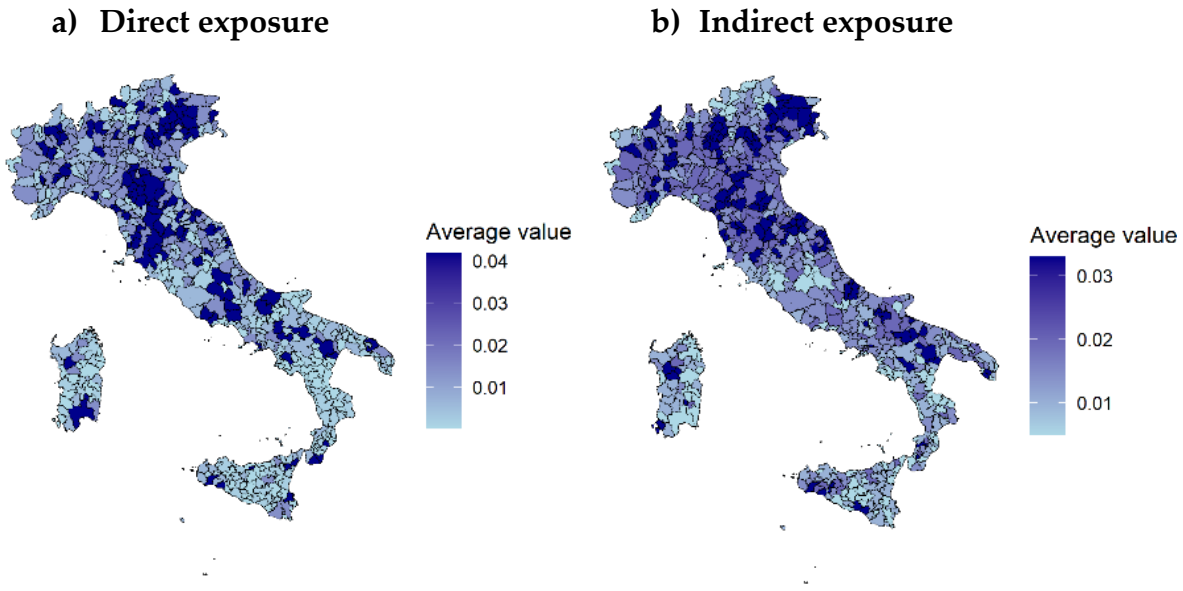
Notes: percentage values for direct, indirect, 1st round indirect, and total exposure are regional weighted averages of firm-level exposures, using firm revenues in 2022 as weights. For each region, we report the median, as well as the 75th, the 90th, the 95th percentiles, and the maximum of the distribution of total exposure across LLMs for each region.

Direct exposure is concentrated in highly specialized LLMs (Figure 2, panel a), where a single sector accounts for most of the export risk. In the North-East, *Eyewear and*

optical goods sector dominates the so-called *Distretto dell'occhialeria bellunese*: Agordo and Belluno, and Longarone, where direct exposure is 8%, represents over 90% of local trade flows. *Machinery and equipment* and *Motor vehicles* hubs such as Copparo, Sassuolo, and Modena likewise show strong export dependence on these sectors, reflecting their integration into global supply chains. These highly-specialized production structures are likely to amplify idiosyncratic market fluctuations. Another significant cluster emerges around *Food manufacturing* and *Beverages*: Canelli in Piedmont and Montalcino in Tuscany are notable for wine and beverage exports; while Zogno and Livigno and other agro-industrial LLMs combine food processing and trading (Thiesi for dairy products in Sardinia) with niche products. Other, though smaller, relevant contributions come from *Ceramics and building materials* in Emilia-Romagna and Marche, and from precision manufacturing in selected alpine and Apennine areas.

Many LLMs that appear insulated from foreign shocks due to their low degree of direct exposure can nonetheless be affected indirectly through domestic supply chains and network effects. Indirect exposure exceeds direct exposure for nearly 80% of LLMs. Risks travel far within the domestic network, as Italian firms are most likely to trade with partners in distant LLMs, followed by those within their own LLM, and least with firms in neighboring areas. This organization of domestic production networks implies that geographically localized shocks can travel substantial distances, shaping exposure patterns across regions well beyond their point of origin. Borin et al. (2025) show that for exports to the US, about 70% of indirect exposure stems from non-neighboring LLMs, with the share particularly high among LLMs with limited direct exposure. By contrast, only 19% of indirect exposure arises within the same LLM—consistent with the structure of integrated local production districts—while neighboring LLMs contribute just 11%.

Figure 3 – Exposure by Local Labour Market



Notes: LLMs are divided into quintiles according to the respective exposure. Exposure is computed weighting firm exposure and turnover by the number of its employees located in each LLM, and then aggregating across all firms present in the LLM. Lighter (darker) colors denote lower (higher) exposure.

While direct exposure appears to follow the standard North-South divide characterizing economic performance of the country (Figure 3, panel a), indirect exposure is more widespread (Figure 3, panel b). In the North-East, the main contributor remains eyewear production, with an indirect exposure of about 7%, followed by wholesalers' activity. In other parts of the Centre-North, mechanical, metals and related intermediates become more prominent: Rivarolo Canavese and Ceva in Piedmont, Urbania in the Marche for metal products; Pievepelago for car parts in the Modena Apennines. These LLMs show sizable indirect shares from parts and sub-assemblies feeding export-oriented producers. In the Center–South, indirect exposure concentrates in agrifood (Nurri, Thiesi, and Bono in Sardinia; Casalnuovo Monterotaro in Apulia) and leather–footwear chains (San Miniato in Tuscany, and Montegranaro in the Marche). In Tuscany, the area of Carrara is highly indirectly exposed due to marble extraction and distribution. The high exposure of Sciacca, a coastal area in Sicily, reflects wholesale distribution of olive oil and underlines the role of trade intermediation and logistics as indirect channels in territories where trade connects production to export markets.

While the correlation between direct and indirect exposure at the LLM level is large and positive (0.42), some LLMs with low direct exposure exhibit a high indirect exposure (and vice versa). A few LLMs, that are barely exposed directly to exports to the US move to the right tail of the distribution through the domestic supply chain linkages. For example, Casalnuovo Monterotaro, Pievepelago, and Bono rank in the bottom 10% by direct exposure but, due to their high indirect exposure, rise to the top 25% of the most overall exposed LLMs in Italy.

5. Results on the impact of US tariffs

In this section, we draw on business survey data to provide an early assessment of the impact of US tariffs and related trade disruptions. Survey evidence is essential at this stage, as trade data are not yet informative for evaluating these effects.

Aside from the sectoral tariffs on automotive, steel, and aluminium that have applied to all countries since the end of the first quarter, the US introduced a broader 10-percentage-point tariff increase on EU and therefore also Italian products in April. Since August, following the US–EU agreement, the tariff rate has been set at 15%, after earlier threats to raise it by 30 percentage points. This complex timeline makes it very difficult to assess the impact of these tariff increases on Italian trade flows. First, before the imposition of broad-based tariffs in April, substantial front-loading of shipments occurred, distorting the dynamics of subsequent months. Second, the April tariffs and the ensuing threats heightened uncertainty and may have delayed shipments or

prompted additional front-loading also in the second quarter, particularly in sectors where tariffs were postponed, such as pharmaceuticals. Third, too few post-agreement data points—still affected by earlier front-loading—are currently available to evaluate the actual impact of the new tariff regime.[11]

In the 2025 wave, the BOS included a special section aimed at assessing the effects of the new tariffs introduced by the US and the related uncertainty over trade policies.[12] Around one fifth of firms reported a negative effect on their overall sales during the first nine months of 2025, though most described the impact as moderate. As shown in Figure 4, the incidence of negative effects was markedly higher (46%) among firms exporting to the US. This figure is based on self-reported data from the survey, which indicates that around one fifth of all firms and 45% of exporters are affected. Furthermore, it was observed that this proportion increases with the share of exports to the US. 16% of other exporters and 12% of firms operating exclusively in the domestic market reported negative effects. The impact was particularly pronounced in export-intensive industries, such as manufacturing (especially the fashion and metalworking sectors), while it remained limited in energy and service activities, which were not directly targeted by tariffs (Figure 5). Sales expectations for the fourth quarter were more pessimistic than the assessments referring to the first nine months of the year. The share of firms that anticipated a decline linked to the tariff hike rose to 25%, although the increase was largely driven by responses indicating a moderate direct or indirect impact.

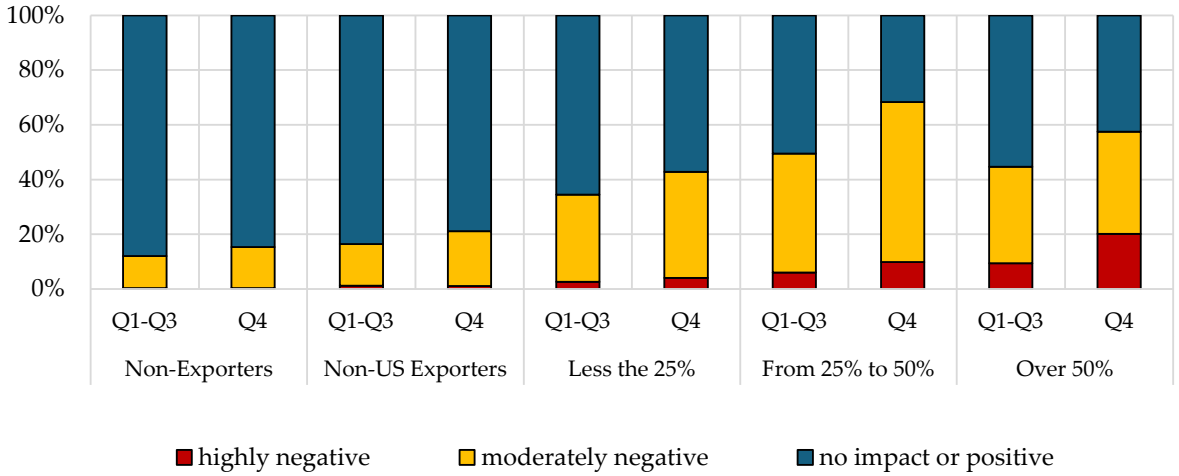
Focusing only on the effects of tariffs on firms directly exporting to the US, nearly half expected a contraction in US sales in the Q4 due to the introduction of tariffs, mostly moderate in size. Among these, two fifths believed the decline would not be compensated by sales in other markets—domestic or foreign—while another two fifths anticipated only a partial recovery, mainly through exports to other foreign markets. Among firms affected by tariff increases on their products (57% of US exporters), only one quarter planned to reduce selling prices in Q4 to offset the impact of tariffs.

Findings on the overall impact of tariff-related disruptions are validated by the SIGE. In the first quarter of 2025, 13% of companies were affected by negative effects on demand for their products and services due to the introduction of US tariffs; this share increased in Q2 and Q3, reaching around one-quarter and then stabilizing in the second half of the year (a similar percentage was observed in the BOS among firms with 50 or more employees). It is worth noting that, as early as March 2025, about one-quarter of firms anticipated a negative impact for the following twelve months.

[11] Trade flows following the front-loading phase could have been subdued as orders were brought forward in the previous months. As of the time of writing, Italian exports to the US are available up to September.

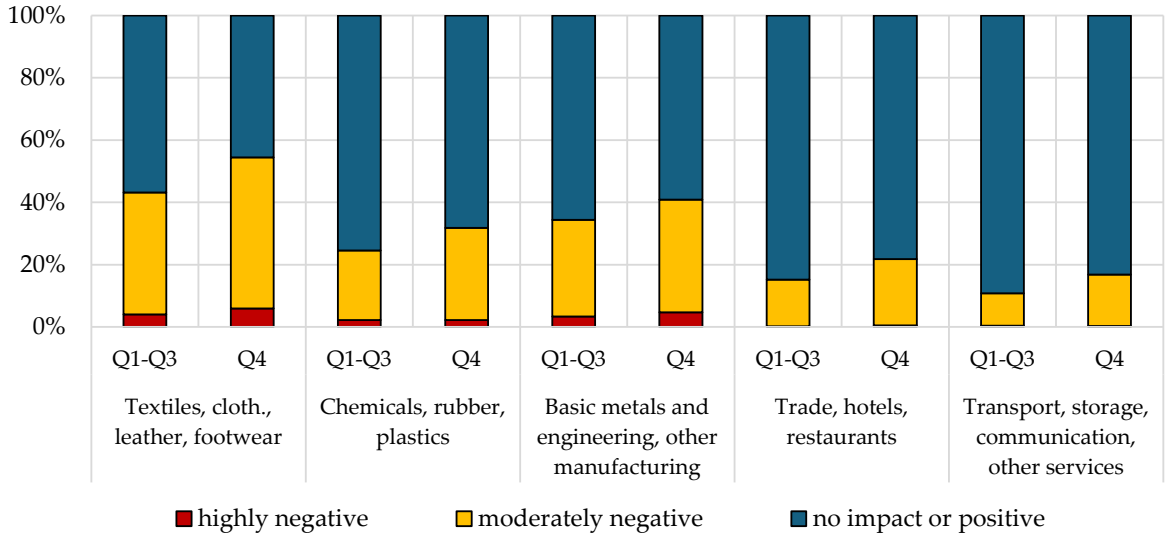
[12] See Appendix C for the exact wording of the questions included.

Figure 4 – Distribution of the effects on sales by share of exports to the US



Notes: direct exports to the US as a percentage of total exports, based on BOS. The share of exports to the US is taken from the Survey of Industrial and Service Firms, which uses the same panel of companies as the BOS. Data were collected last spring and refer to 2024.

Figure 5 – Distribution of the effects on sales by branch of activity



Notes: the energy and extraction sector is not included in the chart, based on BOS.

6. Linking business survey responses with firm-level exposure

Building on the evidence presented in Section 5, this section examines whether perceptions from BOS are systematically related to firms' actual exposure to the US mar-

ket. We link BOS responses to our firm-level exposure measures using fiscal identifiers, achieving near-complete coverage of 97%. The share of firms reporting a drop in firms' sales (Figure 6a) or expecting a drop in sales (Figure 6b) due to tariff-related disruptions is increasing in the level of exposure. A clear hierarchy emerges, particularly when exposure levels exceed the median: firms with high direct exposure to the US market are more likely to report or expect sales declines, followed by those with high first-order indirect exposure, and then by firms with high higher-order indirect exposure. At first glance, this evidence suggests that our exposure measures are effective in assessing the potential sales disruptions caused by tariff-related tensions—despite being based on data from 2022. More generally, it indicates that firms' perceptions, as reported in the surveys, are well founded, as their assessments relates with our data-driven exposure measures.

Figure 6a – Share of firms reporting negative effects on sales in 2025Q1-2025Q3 and exposure levels

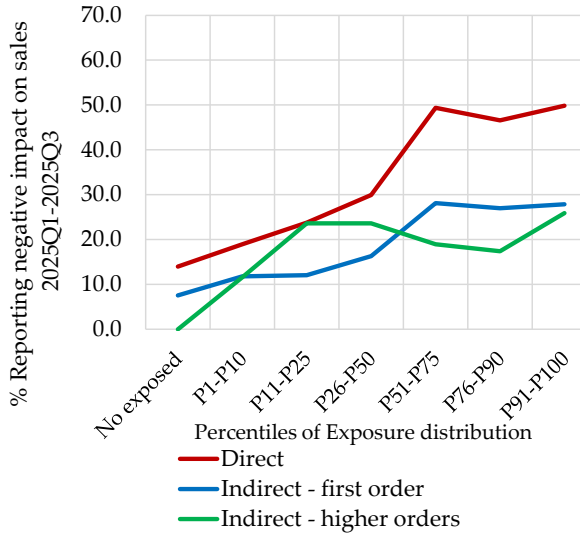
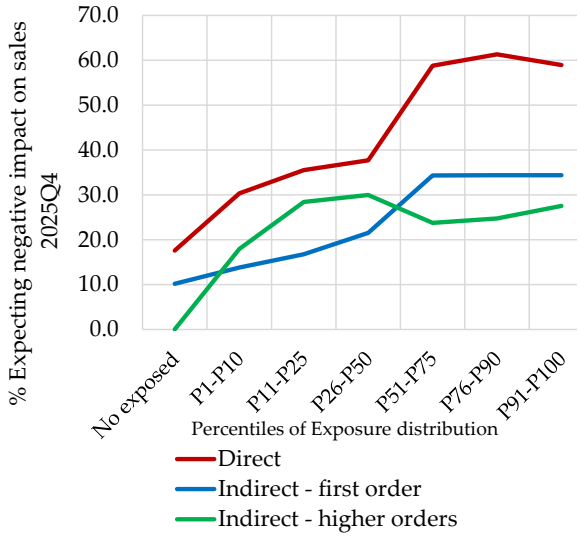


Figure 6b – Share of firms expecting negative effects on sales in 2025Q4 and exposure levels



Notes: Percentiles are calculated only among companies with exposure greater than 0, those not exposed are included in an ad hoc class ("No exposed"); weighted by the number of employees.

To formally assess how exposure to the US market relates to the reported impact of tariff-related trade tensions on firms' total sales in 2025, we estimate an ordered probit model. Based also on the descriptive analysis provided above, we expect that firms directly or indirectly exposed to the US market are more likely to suffer more severe sales losses, for example due to lower demand or higher trade uncertainty. The dependent variable of the model is the self-reported effect of the US tariff-related tensions on total sales (from 1 = very negative to 5 = very positive) over the first three quarters of 2025 (columns 1–3) and over the last quarter of 2025 (columns 4–6). The key regressors are measures of export exposure to the US. Columns 1 and 4 relate sales

outcomes to total exposure; columns 2 and 5 decompose this into direct and indirect exposure; and columns 3 and 6 further split the indirect component into first-order and higher-order network exposure. In each specification, we control for bins of firm size, as well as NUTS1 region and sector fixed effects.[13]

For sales in the first three quarters of 2025, firms with higher overall export exposure to the US market report more negative effects of US tariff-related trade tensions on total sales (column 1). This correlation reflects both direct exporting to the US and indirect exposure through domestic customers and suppliers (column 2). The role of indirect exposure is driven mainly by first-order linkages, whereas higher-order connections do not appear to matter (column 3). The size dummies display a hump-shaped pattern: relative to firms with 0–49 employees, medium-large-sized firms (100–499 and 500–999 employees) report significantly more negative effects, while smaller firms with 50–99 employees and very large firms (with more than 1,000 employees) appear less affected. In addition, as exposure increases, larger firms appear to be less adversely affected by tariffs (see Table A3 in the Appendix). A possible explanation is that highly exposed large firms may have foreign operations in the US or can more easily adopt other mitigation strategies as tariff-jumping, that help cushion the impact.

A similar picture emerges for expected future sales. In column 4, higher overall exposure is again associated with significantly more pessimistic assessments: more exposed firms are more likely to report negative rather than neutral or positive expected effects on total sales. When we decompose exposure in column 5, both the direct and indirect components are negatively and significantly correlated with expected sales, indicating that tariff-related trade tensions are perceived as a shock not only for firms trading directly with the US, but also for those connected indirectly through domestic customers and suppliers. Column 6 shows that this negative association is entirely driven by first-order indirect exposure, while higher-order exposure is small and statistically not different from zero. The size dummies again exhibit a hump-shaped pattern similar to that observed for realized sales.

The persistence of the negative correlation between exposure to the US and total sales even after controlling for firm size, sector, and geographical location is far from trivial. This pattern suggests that our exposure measures meaningfully predict firms' vulnerability to tariff-related tensions. Regarding indirect exposure, the estimates in Table 3 indicate that only first-order indirect exposure significantly correlates with reported and expected sales losses. This result may reflect a mitigation of the negative impact as the shock propagates along the production chain. However, it could also indicate that firms have limited ability to perceive the effects of shocks occurring further downstream in the supply network. The future availability of post-shock data on exports and inter-firm transactions will be crucial to assess the relevance of these alternative explanations.

[13] We cannot include fixed effects at the LLM level due to their large number and because some LLMs contain too few firms to support such estimation.

Table 3 – Tariff-related trade tensions impact on total sales in 2025

	Reported impact on sales (2025Q1-Q3)			Expected impact on sales (2025Q4)		
	(1)	(2)	(3)	(4)	(5)	(6)
Total exposure	-0.11***			-0.15***		
	(0.03)			(0.04)		
Direct exposure		-0.09***	-0.09***		-0.14***	-0.14***
		(0.03)	(0.03)		(0.04)	(0.04)
Indirect exposure		-0.08**			-0.08**	
		(0.03)			(0.03)	
Indirect (1st order)			-0.06*			-0.07**
			(0.03)			(0.03)
Indirect (higher orders)			-0.05			-0.03
			(0.03)			(0.04)
50-99 employees	-0.08	-0.08	-0.08	-0.07	-0.07	-0.07
	(0.07)	(0.07)	(0.07)	(0.06)	(0.06)	(0.06)
100-199 employees	-0.16**	-0.16**	-0.17**	-0.18***	-0.18***	-0.18***
	(0.07)	(0.08)	(0.08)	(0.06)	(0.06)	(0.06)
200-499 employees	-0.27***	-0.28***	-0.28***	-0.38***	-0.38***	-0.38***
	(0.07)	(0.07)	(0.07)	(0.06)	(0.06)	(0.07)
500-999 employees	-0.11	-0.12	-0.13	-0.27***	-0.27***	-0.27***
	(0.12)	(0.13)	(0.13)	(0.09)	(0.09)	(0.09)
Above 1000 employees	-0.12	-0.13	-0.14	-0.16**	-0.17**	-0.16**
	(0.11)	(0.11)	(0.11)	(0.07)	(0.07)	(0.07)
Sector fixed effects	YES	YES	YES	YES	YES	YES
Region fixed effects	YES	YES	YES	YES	YES	YES
Observations	3,439	3,439	3,439	3,364	3,364	3,364

Notes: This table reports ordered probit estimates where the dependent variable is the self-reported effect of tariff-related trade tensions on firms' total sales during 2025Q1-Q3 (columns 1-3) and 2025Q4 (columns 4-6). The main explanatory variables are the measures of total, direct and indirect exposure to the US (total, direct, indirect, first-order indirect and higher-order indirect), which are standardized to have mean zero and unit standard deviation. The omitted size class is "20–49 employees". Observations are weighted by total employment. Standard errors clustered by strata (size class × sector) are reported in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.10.

7. Conclusion

Motivated by the widespread tariff increases by the US administration in 2025, in this paper we measure Italian firms' direct and indirect exposure to the US market and provide an early assessment of the impact of the tariff increases and related trade tensions.

Our analysis integrates business-to-business domestic transaction records with customs data on foreign transactions, firm balance sheets, employment information, and geographic classifications for the universe of Italian firms in 2022, the latest year with complete data. We quantify each firm's direct exposure to the US as the share of total sales exported there, and its indirect exposure as the share of sales to firms that themselves sell—directly or indirectly—to the US. We then merge these administrative data with a Bank of Italy survey conducted in September–October 2025 to assess the self-reported impact of tariff-related tensions on firms' sales in the first nine months of 2025 and their expectations for the final quarter.

Direct exposure accounts for less than half of total exposure once indirect channels through domestic supply chains are accounted for. Exposure is unevenly distributed across firms, sectors, and regions. A small number of large exporters and specialized production districts dominate direct exposure, whereas indirect exposure is more widely diffused. Sectoral and geographic patterns highlight Italy's dual risk profile: automotive, pharmaceuticals, and machinery lead direct exposure, while wholesale trade, basic metals, and fabricated metal products are central to indirect exposure. Industrialized regions in the North and Center remain the most exposed, but specialized clusters in the South show vulnerabilities comparable to those of traditional export hubs. We also show that our exposure measures based on 2022 data are good predictors of actual vulnerability in 2025: even after controlling for firm size, sector, and location, higher direct—and, to a lesser extent, indirect—exposure is associated with a higher probability of tariff-related declines in sales. This underscores the value of our measures for assessing current and future risks from international trade disruptions.

Overall, our findings highlight the need for policymakers to account for the geography of domestic production networks when evaluating external shocks and designing mitigation strategies. Economic resilience depends not only on direct foreign-market exposure but also on firms' and regions' roles within national supply chains, where risks can be highly concentrated despite moderate aggregate exposure.

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Appendix A: Additional tables and figures

Table A.1 - Descriptive statistics of the final sample

a) Summary of Firm-Level Coverage

	Number	Value (EUR bn)
Firms	1.8 million	3,941.4
Exporters	83,190	555.2
Exporters to the US	29,585	59.8

b) Sales and Buyer Distribution

	Percentile							
	5th	10th	25th	50th	75th	90th	95th	Mean
Buyers	1	1	2	8	31	100	194	63
Sales	5	15	61	230	822	2,686	5,735	3,122

Notes: Panel a) reports the coverage of the dataset across different sources and subsamples. Panel b) reports selected percentiles (5th to 95th) and the mean of the firm-level number of buyers and sales value (in thousands of euros).

Table A.2 – Top exposed Local Labor Markets

Labor Market Area	Region	Exposure (%)		
		Total	Direct	Indirect
Agordo	Veneto	29.3	13.7	15.6
Nurri	Sardegna	24.6	6.4	17.2
Thiesi	Sardegna	20.4	15.1	5.3
Siena	Tuscany	16.5	14.7	1.8
Urbino	Marche	15.7	12.3	2.4
Copparo	Emilia-Romagna	14.7	11.9	1.8
Canelli	Piedmont	14.5	9.3	4.2
Montalcino	Tuscany	12.4	9.4	3.0
Belluno	Veneto	12.4	7.1	5.3
Zogno	Lombardy	12.0	10.3	1.7
Pieve di Cadore	Veneto	11.1	2.4	8.7
Carrara	Tuscany	10.4	4.6	5.8
Sassuolo	Emilia-Romagna	10.3	7.5	2.8
Modigliana	Emilia-Romagna	9.9	6.3	3.6
Umbertide	Umbria	9.7	7.4	2.3
Lumezzane	Lombardy	9.5	5.3	4.2
Castagneto Carducci	Toscana	9.3	6.7	2.6
Montevarchi	Tuscany	8.6	6.3	2.3
Longarone	Veneto	8.5	6.0	2.5
Avezzano	Abruzzo	8.5	7.2	1.3

Notes: percentage values of direct, indirect, and total exposure are weighted averages of firm-level exposures at the LLM level, using firm revenues in 2022.

Table A3 – Tariff-related trade tensions impact on total sales in 2025 and firm size

	Reported impact on sales (2025Q1-Q3)			Reported impact on sales (2025Q4)		
	(1)	(2)	(3)	(4)	(5)	(6)
Total exposure	-0.19***			-0.24***		
	(0.04)			(0.03)		
Direct exposure		-0.16***	-0.16***		-0.25***	-0.25***
		(0.05)	(0.05)		(0.06)	(0.06)
Indirect exposure		-0.10***			-0.08***	
		(0.03)			(0.03)	
Ind (1st round)			-0.08***			-0.08***
			(0.02)			(0.03)
Ind (higher orders)			-0.04			-0.01
			(0.03)			(0.03)
50-99 employees	-0.07	-0.06	-0.07	-0.06	-0.05	-0.05
	(0.07)	(0.07)	(0.07)	(0.06)	(0.06)	(0.06)
100-199 employees	-0.16**	-0.16**	-0.17**	-0.17***	-0.17***	-0.17***
	(0.08)	(0.08)	(0.07)	(0.06)	(0.06)	(0.06)
200-499 employees	-0.26***	-0.26***	-0.28***	-0.37***	-0.36***	-0.37***
	(0.07)	(0.08)	(0.08)	(0.07)	(0.07)	(0.07)
500-999 employees	-0.11	-0.13	-0.09	-0.28***	-0.28***	-0.23**
	(0.13)	(0.14)	(0.12)	(0.09)	(0.10)	(0.11)
Above 1000 employees	-0.12	-0.12	-0.11	-0.16**	-0.14*	-0.13
	(0.12)	(0.11)	(0.11)	(0.08)	(0.08)	(0.08)
50-99 employees#Direct		0.06	0.06		0.07	0.07
		(0.06)	(0.06)		(0.07)	(0.07)
100-199 employees#Direct		0.02	0.02		0.08	0.08
		(0.09)	(0.09)		(0.08)	(0.08)
200-499 employees#Direct		0.04	0.02		0.07	0.05
		(0.07)	(0.07)		(0.10)	(0.09)
500-999 employees#Direct		0.10	0.14*		-0.06	-0.00
		(0.09)	(0.08)		(0.10)	(0.08)
> 1000 employees#Direct		0.12**	0.10*		0.18***	0.17***
		(0.06)	(0.06)		(0.06)	(0.06)
50-99 employees#Indirect		-0.07			-0.06	
		(0.06)			(0.06)	
100-199 employees#Indirect		0.13**			0.07	
		(0.06)			(0.06)	
200-499 employees#Indirect		0.08			0.02	
		(0.09)			(0.09)	
500-999 employees#Indirect		-0.05			-0.15	
		(0.24)			(0.20)	
> 1000 employees#Indirect		0.08			0.09	
		(0.31)			(0.29)	
50-99 employees#Total	0.01			0.01		
	(0.06)			(0.05)		
100-199 employees#Total	0.08			0.09		
	(0.08)			(0.06)		
200-499 employees#Total	0.06			0.05		
	(0.06)			(0.07)		
500-999 employees#Total	0.09			-0.12		
	(0.11)			(0.14)		
> 1000 employees#Total	0.15***			0.17***		
	(0.05)			(0.04)		
50-99 employees#Indirect (1st)			-0.08			-0.04
			(0.06)			(0.06)
100-199 employees#Indirect (1st)			0.11**			0.06
			(0.05)			(0.05)
200-499 employees#Indirect (1st)			0.15***			0.08**
			(0.04)			(0.04)
500-999 employees#Indirect (1st)			-0.24			-0.32**
			(0.19)			(0.17)
> 1000 employees#Indirect (1st)			0.40			0.35
			(0.35)			(0.31)
50-99 employees#Indirect (higher)			0.02			-0.05
			(0.06)			(0.05)
100-199 employees#Indirect (higher)			0.04			0.03
			(0.07)			(0.10)
200-499 employees#Indirect (higher)			-0.17			-0.14
			(0.12)			(0.15)
500-999 employees#Indirect (higher)			0.31*			0.29
			(0.17)			(0.22)
> 1000 employees#Indirect (higher)			-0.22			-0.18
			(0.18)			(0.15)
Sector fixed effects	YES	YES	YES	YES	YES	YES
Region fixed effects	YES	YES	YES	YES	YES	YES
Observations	3,439	3,439	3,439	3,364	3,364	3,364

Notes: This table reports ordered probit estimates where the dependent variable is the self-reported effect of tariff-related trade tensions on firms' total sales during 2025Q1-Q3 (columns 1-3) and 2025Q4 (columns 4-6) interacted with firm size. The main explanatory variables are the measures of total, direct and indirect exposure to the US (total, direct, indirect, first-order indirect and higher-order indirect), which are standardized to have mean zero and unit standard deviation. The omitted size class is "20–49 employees". Observations are weighted by total employment. Standard errors clustered by strata (size class × sector) are reported in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.10.

Appendix B: Additional information on data sources and processing

Fattel (Electronic Invoicing Data): Data are provided by SOGEI S.p.A. and cover all the domestic B2B and B2C transactions for which an electronic invoice is required. The dataset contains the total taxable value of invoices issued in each quarter, broken down by seller and buyer. For confidentiality, the transactions that involve sole proprietorships or consumers are aggregated at sector level (NACE 2-digit). Outliers are identified and flagged by the data provider.

Dogane (Customs Transactions): Includes export and import flows of physical goods, at the firm-level broken down by product code (8-digit of the Combined Nomenclature), partner country, Italian province of origin provided by the Italian Customs Agency (*Agenzia delle Dogane e dei Monopoli*). Customs microdata are filtered according to EUROSTAT's International Trade in Goods Statistics guidelines, removing non-relevant transactions such as deposits, transits, triangular operations, certain customs regimes, and excluded product codes. The filtered data are then benchmarked against ISTAT *Commercio con l'estero* official trade statistics at the month–product–country level to ensure consistency. Additional steps replicate ISTAT's quality checks, including reclassification of product codes and counterpart countries, and detection/removal of outliers caused by declaration errors. Finally, specific products (e.g., natural gas, electricity, ship supplies) are excluded based on ISTAT practices that use alternative data sources.[14]

Cervedx (Balance Sheet Data): reclassified financial statements of Italian corporations enriched with additional employment data from the national social security institute INPS. Partnerships are excluded from the dataset.

Infocamere (Firm Registry): legal form, sector classification (NACE), location, and the spatial distribution of employees detailed at the municipal level.

ISTAT (Local Labor Markets): mapping of municipalities into local labor markets identified by the national institute of statistics.

Data Processing Steps

To perform our analysis, we require a matrix of firms' sales to other firms and to final consumers, including exports. We use Cervedx to integrate Fattel and Dogane in order to address potential biases due to data limitations, in particular: (i) transactions do not distinguish ordinary business activities from disinvestments; (ii) a number of transactions to individuals/final consumers are not observed because they are not recorded; and (iii) imports and exports of services cannot be tracked.[15] These limitations imply

[14] Natural gas in gaseous form and electricity account for 0.4% of Italian exports and 9.8% of imports in 2022.

[15] In 2022, the export of services from Italy, excluding travel, financial, and insurance services, was approximately €70 billion, whereas for imports is €90 billion.

that, in many cases, total revenues from Cervedx exceed the value of observed sales.[16] Less frequently, the inclusion of disinvestments may lead to an overestimate of total revenues.

First, we construct a firm-level identifier and sector classification by merging Fattel and Dogane with Cervedx's registry, which provides fiscal codes, VAT numbers, NACE codes, and flags for participation in VAT groups. This step harmonizes the three sources at the fiscal code level and allows all entities that belong to the same VAT group to be collapsed into a single economic unit, so that both sales and cross-border flows are consistently attributed to the group rather than to individual legal positions.[17]

We then build a base transaction matrix from Fattel, aggregating all electronic invoices issued in 2022 into seller–buyer pairs and adding a residual node for final consumers. Because invoices to individuals are often recorded without a valid identifier, we treat sales that cannot be matched to a firm as sales to a representative consumer node, which captures domestic B2C transactions observed in the e-invoicing system.

To incorporate exports of goods, we use customs records to measure each firm's annual export flows by destination country and map them to the fiscal code using VAT and VAT group identifiers from Cervedx. These flows are appended to the Fattel matrix as additional rows, distinguishing between exports to the United States and exports to the rest of the world, so that foreign demand enters the matrix alongside domestic firms and final consumers.

Import flows from Dogane are treated symmetrically in terms of identification and aggregation, but they are not added as extra sales in the matrix; instead, they are used as a component of the firm's input cost structure. For each firm, we compute the value of imported goods and combine it with domestic intermediate purchases inferred from Fattel (i.e. invoices received from other firms) to obtain a measure of total intermediate inputs. We further complement these input measures with an estimate of labor costs sourced from Infocamere, again matched at the fiscal code level.

Summing domestic intermediate inputs, imports of goods, and estimated labor costs yields a proxy for total costs, which provides an economically meaningful lower bound for plausible firm-level turnover. Balance sheet information from Cervedx is then used to reconcile tracked turnover with reported accounting revenues. For firms with an available non-IAS balance sheet and not belonging to a VAT group,[18] we compare total revenues to the turnover observed in Fattel (including exports); whenever balance sheet revenues exceed observed invoiced sales, we treat the difference as

[16] This pattern is particularly common in some sectors, such as retail trade, since transactions with consumers are generally not subject to electronic invoicing requirements.

[17] Based on 2022 balance-sheet data, Italian corporations belonging to VAT groups account for approximately 6% of total revenues.

[18] VAT groups and enterprises following IAS financial rules are excluded from this correction step since their turnover is calculated using different criteria that make direct comparison impossible.

"other revenues" that are not captured by the e-invoicing and customs data and interpret these as B2C flows.

For firms without balance sheet information, we rely on a cost-based correction in several NACE sectors where the coverage of e-invoicing is known to be limited. In these sectors, for each firm, if the estimated total costs exceed the observed turnover, we impute additional revenues up to the level of costs and record them as "other revenues," thereby enforcing the accounting restriction that revenues should not fall below basic input costs.

Finally, we exclude financial intermediaries as sellers from the matrix and collapse their demand into a single financial sector buyer, given the specific reporting practices and accounting rules in this sector.

The resulting dataset is a harmonized firm by client matrix of sales that combines electronic invoices, customs records, and balance sheet and cost information, and is designed to minimize biases arising from missing B2C transactions, incomplete coverage of international trade in services, and the presence of VAT groups.

Appendix C: Questions included in Business Outlook Survey of Industrial and Service Firms (BOS)

How would you assess the impact of the trade tensions connected with US tariff increases on your firm's overall sales …in the first 9 months of 2025?/ ...in the last 3 months of 2025? *Answers: 1 = highly negative; 2 = moderately negative; 3 = no impact; 4 = moderately positive; 5 = highly positive; 9 = do not know, no answer.*

How will the new US tariffs on products purchased from the EU affect your exports to the US in the last 3 months of 2025 compared with the same period in 2024? *Answers: 1=significant reduction; 2=moderate reduction; 3=no impact; 4=moderate increase; 5=significant increase; 9=do not know, no answer.*

Will the reduction in your exports to the US be offset by higher sales elsewhere (including in Italy) in the last 3 months of 2025? *Answers: 1=no; 2=yes, to some extent, especially by sales in Italy; 3=yes, to some extent, especially by sales to other foreign markets; 4=yes, fully, especially by sales in Italy; 5=yes, fully, especially by sales to other foreign markets; 9=do not know, no answer.*

If you have higher tariffs since September 2025: Are you planning to lower the selling price of your main export to the US by the end of the year, in order to offset the tariff increase? *Answers: 1=no; 2=yes, in an effort to offset a small part of the increase; 3=yes, in an effort to offset a large part of the increase; 4=yes, in an effort to fully offset it; 9=do not know, no answer.*