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competitiveness, energy intensity and supply bottlenecks

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EXPLORING THE RECENT RESILIENCE OF ITALY’S GOODS EXPORTS: COMPETITIVENESS, ENERGY INTENSITY AND SUPPLY BOTTLENECKS

by Simona Giglioli* and Claire Giordano*

Abstract

We explore three possible explanations of the recent resilience of Italy’s foreign sales in comparison with the other main euro-area economies, namely price-competitiveness dynamics, developments in energy-intensive (EI) and non-energy-intensive (NEI) manufacturing branches, the incidence of global supply bottlenecks. Price-competitiveness trends were particularly favourable in Italy. Furthermore, the composition of Italy’s manufacturing exports was not strongly tilted towards EI sectors and the decline in EI foreign sales was relatively contained, leading to a more limited negative contribution of these industries to aggregate export growth with respect to Germany. Finally, according to cross-country firm survey data, Italian manufacturing was significantly less affected by shortages of materials and equipment than the other three countries. A standard regression analysis of goods exports developments confirms that the above factors concurred in explaining Italy’s strong performance in 2022.

JEL Classification: F01, F10, Q41.

Keywords: goods exports, price-competitiveness, energy intensity, supply bottlenecks.

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1. Introduction¹

After the strong contraction linked to the first wave of the COVID-19 pandemic and subsequent factory shutdowns, goods trade both world-wide and in the euro area picked up rapidly. The recovery was however hampered by at least two factors. First, since mid-2021 Europe in particular has been hit by a severe energy crisis, fuelled by the sharp rebound in demand after the first year of the pandemic and by geopolitical tensions, exacerbated as of February 2022 by the Russian invasion of Ukraine; industrial production and goods exports of euro-area economies were strongly affected. Second, global supply bottlenecks and rising transport costs, in particular in shipping, linked both to rising demand and to COVID-19 outbreaks and subsequent strict containment measures in Asia, reined in external trade.

By contrast, the more decisive pace of monetary policy normalization in the United States relative to the euro area led to a strong bilateral depreciation of the single currency in most of 2022, enhancing price competitiveness of euro-area countries.

In this unprecedented and challenging external environment, after a strong rebound in 2021, in 2022 Italy's goods exports grew at a substantial rate (over 6 per cent), significantly outperforming its three main euro-area peers. Based on national accounts, international merchandise trade statistics (IMTS), physical energy flow accounts (PEFA) and firm survey data, this note explores three possible explanations of the recent resilience of Italy's foreign sales in comparison with the other main euro-area economies. In particular, it first describes price-competitiveness dynamics, by examining developments in the main components of real effective exchange rates (REERs). Next, it documents the sectoral heterogeneity underlying aggregate dynamics by distinguishing between energy-intensive (EI) and non-energy-intensive (NEI) manufacturing branches, with the former plausibly being more negatively affected by the energy crisis. Then, it reports the incidence of global supply bottlenecks over time and across sectors.

Italy's price-competitiveness developments were particularly favourable, matched only by Germany's dynamics; half of Italy's gain was explained by muted producer price dynamics relative to the country's main trading partners. Furthermore, the composition of Italy's manufacturing exports was not strongly tilted towards EI sectors and the decline in EI foreign sales was relatively contained, leading to a more limited negative contribution of EI industries to aggregate export growth with respect to Germany. Finally, according to cross-country firm survey data, Italian manufacturing was significantly less affected by shortages of materials and equipment, especially in comparison with Germany. A standard regression analysis of goods exports developments confirms that all the above determinants indeed contributed to Italy's strong external performance in 2022. The goodness of fit statistics however suggest that other factors were also at play in explaining the higher growth of Italian exporting firms' sales.

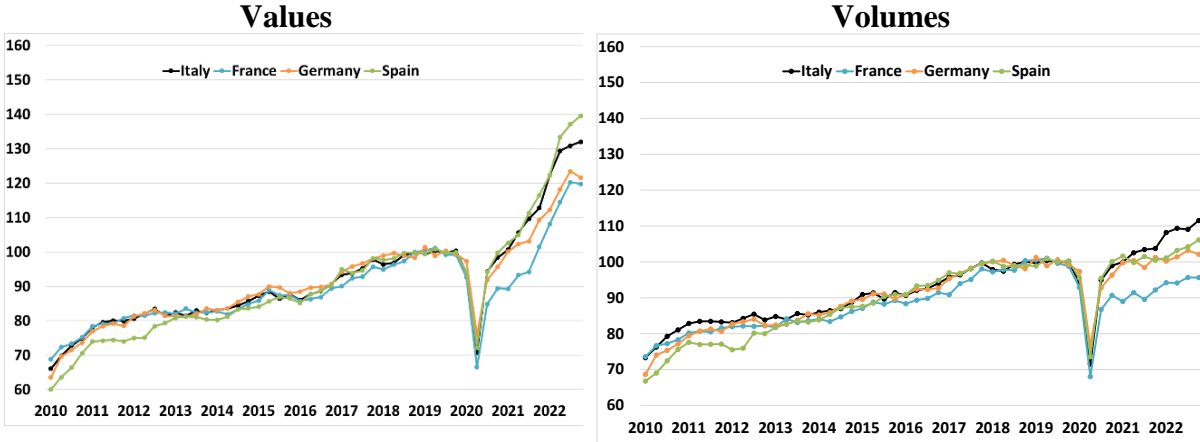
¹ We are grateful to Silvia Fabiani, Stefano Federico, Alberto Felettigh, Alfonso Rosolia and Silvia Vori for useful suggestions on a previous draft. The views expressed herein are those of the Authors and not of the institution represented. This note was based on data available on 12th May 2023.

Exploring these possible additional determinants, such as non-price competitiveness factors, requires micro-data and goes beyond the scope of this article.

2. Goods exports dynamics in the four main euro-area countries

The first wave of the COVID-19 pandemic in 2020 only temporarily interrupted the upward trend in Italy’s goods exports recorded in the previous decade (Fig. 1).² After a swift rebound in 2021, Italy’s export growth in 2022 outperformed Germany by 4.5 percentage points in volume terms and Spain by more than 3 points (Table 1); the positive differential relative to France was more contained, but only as a result of the delayed recovery of the latter country.³

Figure 1. Goods exports developments
(quarterly data; index 2019=100)



Source: Istat and Eurostat quarterly national accounts.

Table 1. Goods exports annual changes
(percentage changes; volumes)

	Italy	France	Germany	Spain
2019	1.1	1.8	0.6	0.8
2020	-9.2	-15.2	-8.3	-8.8
2021	13.8	7.2	10.3	10.6
2022	6.1	4.7	1.6	2.8

Source: Istat and Eurostat annual national accounts.

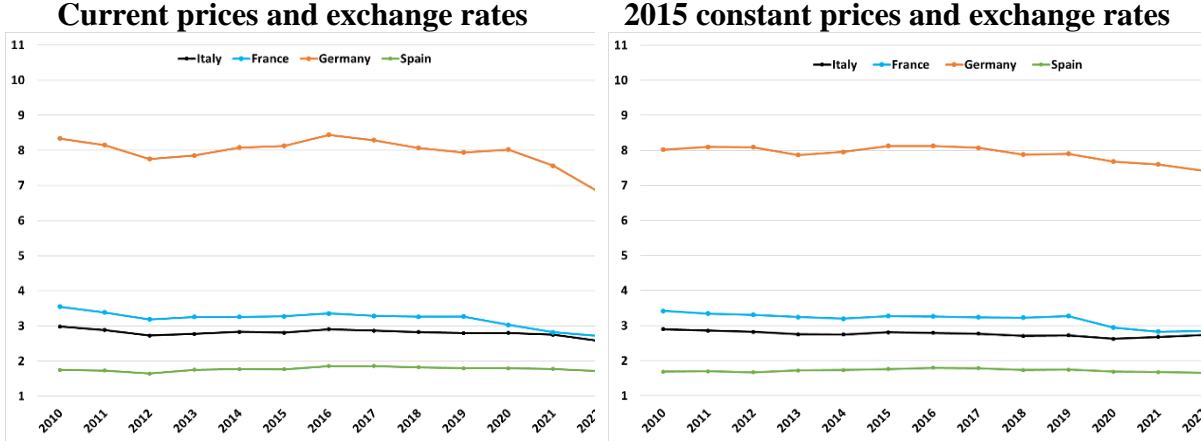
Despite falling moderately at current prices, Italy’s export market share in world markets in 2022 increased marginally at constant prices, against declines in the other countries (Fig. 2); the share in volume terms thus confirms Italy’s external sector’s broad resilience since 2010 despite the rise of new competitors such as China and Eastern Europe (Fabiani et al., 2019).

² Only Spain recorded a significantly higher increase in the 2010s relative to Italy, also owing to the completion of the former country’s catching-up process (Bugamelli et al., 2018).

³ France suffered the largest contraction in 2020 as a whole (-15 per cent, against slumps in a range of -8 and -9 per cent in the other three countries) due to its unfavourable specialization in sectors that were hardest hit by negative demand shocks, such as the aviation industry; moreover, it was the only country amongst the four here considered that had not fully recovered pre-pandemic volumes of exported goods by 2021.

According to Bank of Italy estimates, in 2022 Italy’s real goods export growth outpaced that of its potential foreign demand by about half a percentage point; this outcome was due to higher-than-demand growth in both euro-area and, to a lesser extent, non-euro area markets.

Figure 2. Export market shares in world markets
(annual estimates; percentage shares)



Source: Bank of Italy calculations on Eurostat and IMF-WEO data.

At the geographical level, export growth in 2022 involved all main markets, with the exceptions of Russia, where sales fell drastically after the invasion of Ukraine and the consequent sanctions, and China, where demand was impaired by the COVID-19 pandemic containment measures throughout most of the year (Fig. 3).⁴ Türkiye and the United States were among the destinations to which Italy’s exports increased the most; sales to the former country were boosted by the expansion in minerals and fuels and those to the latter economy benefited from the depreciation of the euro *vis-à-vis* the US dollar during most of 2022, two factors we will come back to.

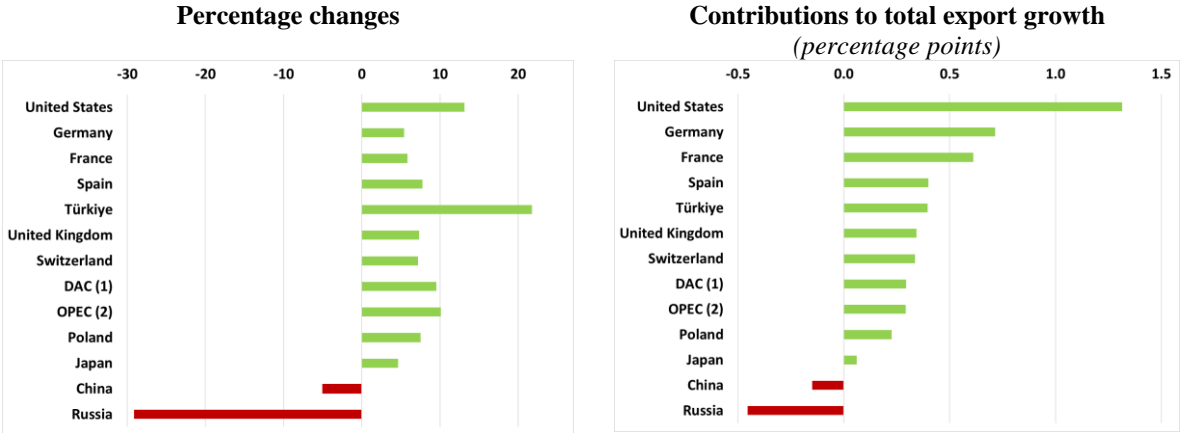
According to Istat’s national account data broken down by macro-sectors, Italy’s export growth in volume terms in 2022 was rather broad-based, with the exceptions of “metals and metal products”, chemicals and agriculture, whose contributions were negative, and machinery and equipment and “non-metallic minerals, rubber and plastic”, in which exports stagnated (Fig. 4). The largest boost to export dynamics stemmed from petroleum products,⁵ driven by the expansion in production; the latter was in turn sparked by the robust recovery in world demand after 2020, in a context of uncertainty surrounding Russian supplies due to the war in Ukraine

⁴ One possible explanation of Italy’s more favourable export performance relative to Germany in particular is the former country’s lower export exposure to the Chinese market: in 2021 Italy sold 3.0 per cent of its goods to China against a share of 7.6 per cent for Germany (Table A1 in the Annex). According to back-of-the envelope calculations based on China’s national account data sourced from IMF-WEO, we estimate that the contraction in China’s overall goods imports in 2022 hindered Italy’s export dynamics by about 0.2 percentage points; for Germany the drag was nearly 0.5 points. This factor hence cannot explain the large export growth differential between the two countries.

⁵ Historically, Italy’s energy exports are dominated by refined oil products (Giordano and Tosti, 2022), but their contribution is generally contained.

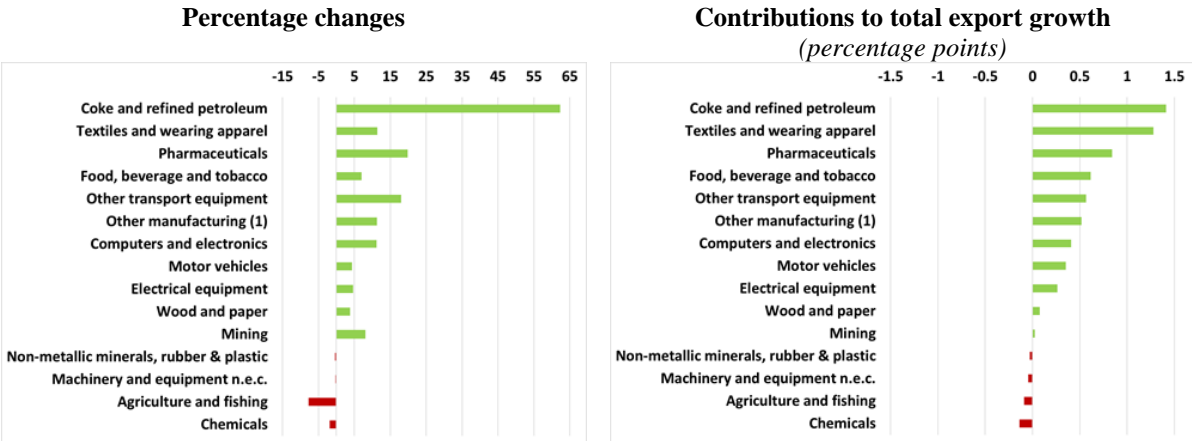
and the subsequent sanctions introduced by the international community.⁶ Strong contributions also originated from the fashion, pharmaceutical and food industries. By using more detailed IMTS, in Section 4 we will dig deeper into sectoral developments within manufacturing and into their link to energy intensity.

Figure 3. Italy’s goods exports by main destination country in 2022



Source: Authors’ estimates based on Istat national accounts and IMTS; volumes.
 Notes: Countries are ordered according to their contribution to overall export growth. (1) Dynamic Asian Countries (DAC) include South Korea, Hong Kong, Malaysia, Singapore, Taiwan and Thailand. OPEC includes Algeria, Angola, Saudi Arabia, United Arab Emirates, Gabon, Equatorial Guinea, Iran, Iraq, Kuwait, Libya, Nigeria, the Congo Republic and Venezuela.

Figure 4. Italy’s goods exports by sector in 2022



Source: Bank of Italy calculations based on Istat national accounts; volumes.
 Notes: Sectors are ordered according to their contribution to overall export growth; service sectors are excluded from these charts given their small contributions. (1) Other manufacturing includes furniture and jewellery.

⁶ It is not possible to compute Russia’s total exports of petroleum products, due to the suspension of the publication of customs data by this country since February 2022. According to Italy’s IMTS, Italy exported petroleum products mainly to the following markets in 2022: Croatia, United States, France, Slovenia and the Netherlands, all sanctioning countries; the sales to these destinations accounted for nearly half of overall exports of this sector.

3. Price-competitiveness developments

In 2022 Italy's price competitiveness improved by over 2.5 percentage points relative to the average of the previous year⁷ (based on the Bank of Italy's real effective exchange rates, which are deflated by the producer price index (PPI) and weighted with manufacturing trade flows; Fig. 5). The gain was similar in Germany, yet significantly smaller in France; Spain recorded a 2.0 percentage point loss.⁸ Italy's improvement did not materialize only on account of the weakening of the euro, which anyhow came to a halt and inverted at the end of 2022. Half of the gain was indeed due to relative producer price dynamics, confirming an ongoing trend since 2010: over the past 12 years Italy's relative producer prices have dampened by more than 9 percentage points, leading to an overall price-competitiveness gain of nearly 5 points (Table A2 in the Annex).

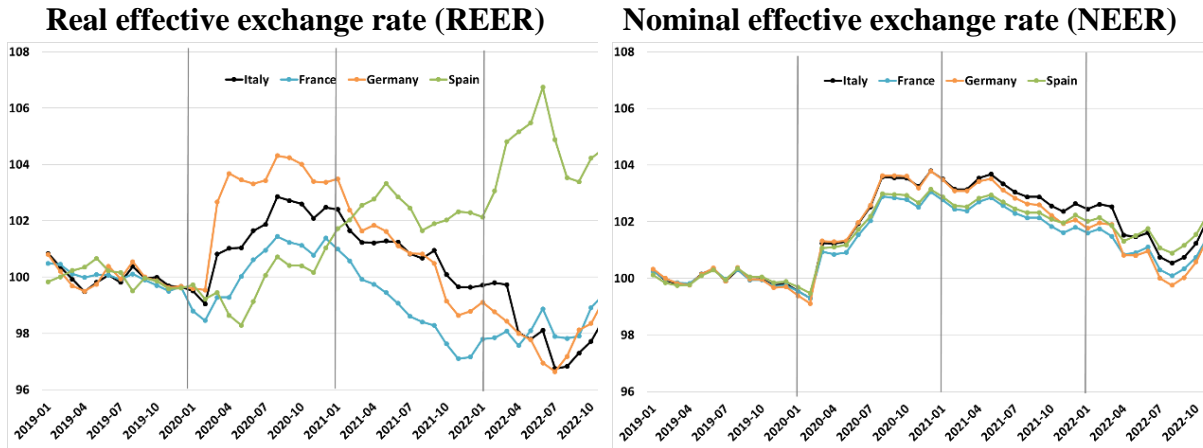
A REER can be broken down into an import-weighted REER, which captures import competition in the reporting country's economy, and an export-weighted REER, which measures the competition faced by the reporting country in foreign markets, in turn exerted both by domestic producers and by other exporters. Both import- and export-weighted components contributed to Italy's price-competitiveness gain in 2022 (Table 2; Fig. A1 in the Annex). Moreover, export-weighted competitiveness improved both in euro-area and non euro-area markets,⁹ suggesting that the recent energy shock did not even deteriorate Italy's price competitiveness with respect to non-euro area partners, which were less affected by the energy – in particular natural gas – price hikes.

⁷ The ECB's consumer price index and unit labour cost of the total economy-deflated indicators (which are also weighted with service flows) also point to a substantial gain for Italy (nearly 2 and over 3 per cent, respectively).

⁸ The loss in Spain is due to stronger manufacturing producer prices growth than in its main trading partners in 2021-22. According to national experts, this was in turn a result of the swift pass-through of wholesale gas prices to electricity prices, due to the pricing mechanism in the Spanish electricity market. In particular, producer prices surged in the oil refining industry; moreover, the sharp increase in electricity prices was especially reflected in prices of energy-intensive sectors. Given the recent moderation of gas prices, this loss is expected to be limited to the energy shock period.

⁹ Since the analysis herein ends in 2022, this note considers the euro area as made up of 19 member countries, excluding Croatia, which joined on 1st January 2023. For this reason the figures reported may differ from the official Bank of Italy figures, which use a fixed composition definition of the euro area based on 20 countries including Croatia.

Figure 5. Real and nominal price-competitiveness developments
(monthly data; index 2019=100)



Source: Bank of Italy.

Notes: An increase in the REER (NEER) signals a loss in real (nominal) competitiveness.

Table 2. A decomposition of price-competitiveness dynamics by market
(percentage changes)

	Italy					France				
	REER	Import-weighted REER	Export-weighted REER	Euro area	Non-euro area	REER	Import-weighted REER	Export-weighted REER	Euro area	Non-euro area
	<i>(annual changes)</i>									
2019	-1.5	-1.2	-1.6	-0.9	-2.2	-1.5	-1.3	-1.8	-1.2	-2.4
2020	1.5	1.0	1.9	1.0	2.5	0.3	-0.2	0.8	0.0	1.5
2021	-0.6	-0.5	-0.6	-0.9	-0.4	-1.4	-1.7	-1.0	-1.4	-0.7
2022	-2.6	-2.3	-2.8	-2.6	-3.1	-0.6	-0.6	-0.6	-0.5	-0.6
	<i>(cumulative changes)</i>									
2010-2022	-4.7	-4.7	-4.6	-4.3	-4.9	-6.7	-7.2	-6.2	-6.4	-6.1
2019-2022	-1.7	-1.8	-1.6	-2.4	-1.0	-1.7	-2.4	-0.8	-1.9	0.2
	Germany					Spain				
	REER	Import-weighted REER	Export-weighted REER	Euro area	Non-euro area	REER	Import-weighted REER	Export-weighted REER	Euro area	Non-euro area
	<i>(annual changes)</i>									
2019	-0.9	-0.7	-1.0	-0.3	-1.5	-1.6	-1.4	-1.7	-1.2	-2.5
2020	2.9	2.5	3.2	2.4	3.7	-0.2	-0.6	0.2	-0.6	1.2
2021	-2.0	-2.2	-1.8	-2.0	-1.6	2.6	2.6	2.5	2.4	2.5
2022	-2.6	-2.7	-2.6	-2.3	-2.8	2.0	2.3	1.6	1.9	1.1
	<i>(cumulative changes)</i>									
2010-2022	-3.8	-4.2	-3.5	-3.0	-3.9	4.4	4.4	4.4	4.8	3.9
2019-2022	-1.7	-2.5	-1.2	-2.0	-0.7	4.3	4.4	4.3	3.8	5.0

Source: Bank of Italy.

Notes: An increase in the REER (NEER) signals a loss in real (nominal) competitiveness.

4. Exports by energy intensity

In this section we assess the energy intensity of exports and the impact of the energy shock on foreign sales of sectors differing along this dimension.

As in Alpino, Citino and Roma (2022), we define the energy intensity of a given 2-digit manufacturing sector¹⁰ as the ratio of net domestic energy use (taken from PEFA) to value added at factor cost in 2019.¹¹ We then group sectors into energy-intensive (EI), non-energy-intensive (NEI) and energy producers, similarly to Corsello, Flaccadoro and Villa (2023) and compute export volumes of these three groups by deflating official sectoral export values with producer price indices of exported goods.

The EI sectors include chemicals, basic metals, other non-metallic metals and paper (Table A3 in the Annex). Coke and refined petroleum products is the only energy-producing sector in manufacturing and kept apart from the EI industries as its exports' relationship to energy prices is not necessarily negative, as seen in Figure 4, suggesting a possible flip side to the energy shock.

A first caveat to bear in mind is that manifold government measures to counter the impact of the energy shock on firms' balance sheets were introduced in the four countries under study; these measures differ in number, timing and intensity and could have affected the export behaviour of firms in a heterogeneous fashion across countries.

A second caveat refers to our volume estimates for Spain. The producer price index of exported goods for Spain has risen significantly less than the national accounts goods export deflator (in particular, in 2022 by 13 against 19 per cent, respectively). This entails that our producer price-based estimates overestimate export dynamics for this country relative to national accounts, in part explaining the vast difference between official total goods real export growth (Table 1) and our estimated real manufacturing growth (Table 3). Another source of bias stems from the strong contribution of pharmaceuticals to Spain's export growth. This sector is known to be heavily involved in processing practices, leading to significant discrepancies between national accounts and IMTS.¹²

According to our estimates, when the energy shock began in 2021 the weight of EI sectors in manufacturing export volumes was lower in Italy and in Germany (18 and 17 per cent

¹⁰ We only consider manufacturing since the producer price indices of exported goods, necessary to deflate sectoral export values, are only available for these sectors.

¹¹ Sector rankings are the same even if the most updated PEFA data, referred to 2020, are employed.

¹² For Italy, for which both sectoral national accounts and IMTS-based estimates are available, the positive contribution of pharmaceuticals to overall good exports growth was about three times larger according to the latter data (Fig. A2 in the Annex) than the former (Table 1). Assuming that a similar ratio applies also to Spain and correcting for this single statistical discrepancy, our estimates of manufacturing export growth for this country would drop below 7 per cent. Agricultural products – which are included in goods but not in manufacturing and could therefore also explain the difference between the two growth rates – did not instead play a significant role since their contribution (in value terms) was positive but not particularly important.

respectively, against 21 in France and 23 in Spain; Table A4 in the Annex);¹³ the share came down in 2022 across the board. The industry composition within the EI group also differed substantially across the four countries, in particular with the weight of the chemical industry in 2021 being significantly lower in Italy relative to its three peers. The share of coke and petroleum products went up in Italy and Spain between 2021 and 2022, owing to the expansion in production and sales in this branch, against little change in the other two economies.

As of 2021 EI exports underperformed relative to NEI exports in all four countries, with a clear widening of the gap between the two groups in the last months of 2022 (Fig. 6), suggesting a negative impact of rising energy costs.¹⁴ In particular, according to our estimates, in Italy in 2022 NEI foreign sales grew by nearly 8 per cent, against a decline of 2.5 in EI exports (Table 3).¹⁵ Italy's growth differential between the two groups was broadly comparable to that observed in France and Spain, while in Germany it was around 14 per cent. In the latter country EI foreign sales indeed contracted by an exceptional 11 per cent and NEI exports only expanded by around 3 per cent. Italy's robust manufacturing export growth with respect to Germany was thus due both to a more limited negative contribution of EI sectors and to a stronger stimulus stemming from NEI industries (Fig. 7).

Digging deeper into sectoral heterogeneity (Fig. A3 in the Annex), the decline in the exports of Italy's EI sectors was due to chemicals and basic metals. The negative contribution of chemicals was, however, much larger in Germany,¹⁶ where overall export growth was also dragged down by the NEI sectors machinery and equipment and computer and electrical equipment, for which a large exposure to global supply bottlenecks kicked in, as will be discussed in Section 5. By contrast, the automotive sector did not play a role in explaining Germany's negative NEI differential relative to Italy, since its contribution was positive and important.

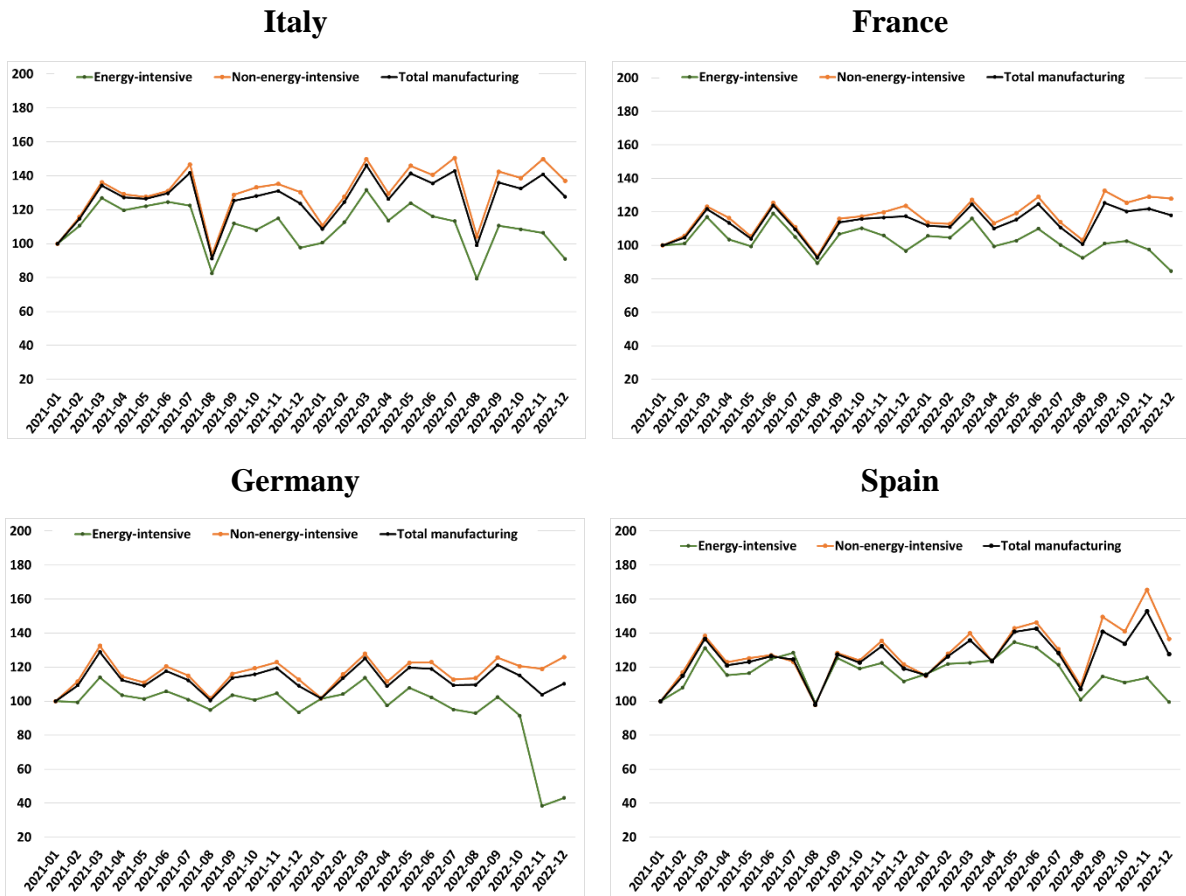
¹³ In Table A5 in the Annex we report the export weights in value terms of EI and NEI sectors in total goods exports.

¹⁴ The gap between the two series is likely to be affected also by the different timing of government support measures across the four countries.

¹⁵ Sectoral export national account data in volume terms, available only at an annual frequency and only for Italy and employed in Figure 4, point to a similar outcome to our estimates with NEI foreign sales rising against a drop in EI sales (Figure A2 in the Annex). Similarly, over the period April-December 2022 Corsello, Flaccadoro and Villa (2023) find that industrial production in Italy declined by 11 per cent for EI sectors, against a fall of only 1 per cent for NEI sectors; Destatis (2023) too points to significantly more unfavourable dynamics of industrial production in Germany's EI industries. According to 2019 Asian Development Bank input-output tables, several important sectors for Italy's overall goods exports, although not EI themselves, use significant shares of value added produced by EI sectors in their foreign sales, such as transport equipment, machinery and equipment, rubber and plastic (Giglioli, 2022). Indeed, Figure 4 had already reported that the latter two industries had contributed nil to Italy's export growth in 2022. When adding the three branches to our EI definition, the growth differential between the NEI and EI groupings remains of about 10 percentage points for Italy, although EI sectors now record a small increase in exports (largely due to the rise in transport equipment sales).

¹⁶ Despite the energy intensity of German and Italian chemical industries being broadly similar (Table A2 in Annex A).

Figure 6. Manufacturing exports by energy intensity
(seasonally unadjusted monthly data; index January 2021=100; volumes)



Source: Authors' calculations based on Eurostat Physical energy flow accounts, Istat and Eurostat national accounts, Istat and Eurostat IMTS, Istat and Eurostat producer price indices.

Notes: Total manufacturing is net of coke and refined petroleum and of printing and reproduction. Energy and non-energy-intensive sectors are defined as in Table A3 in the Annex.

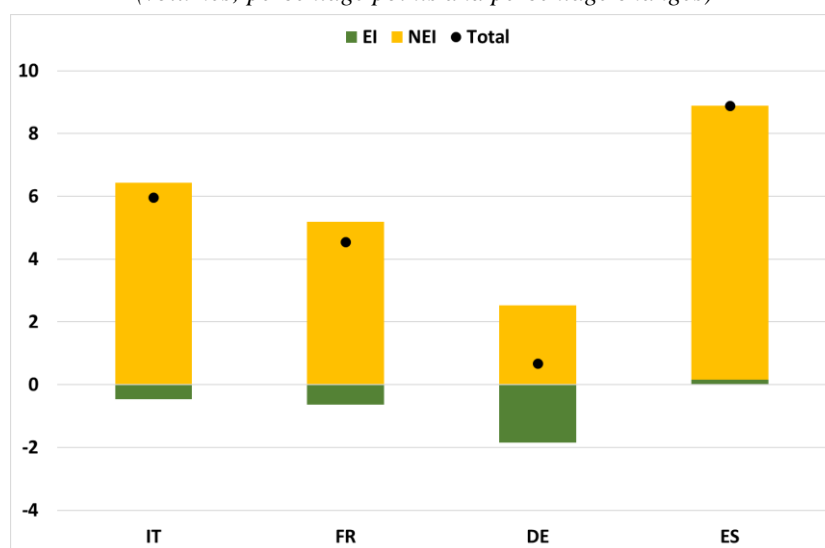
Table 3. Manufacturing exports by energy intensity: growth rates in 2022
(percentage changes and percentage points for differences and shares; volumes)

	ITALY	FRANCE	GERMANY	SPAIN
Non-energy-intensive	7.9	6.6	3.1	11.4
Energy-intensive	-2.5	-2.9	-10.8	0.7
Total manufacturing (1)	6.0	4.6	0.7	8.9
Difference NEI-EI	10.4	9.5	13.8	10.7
<i>Memo: weight EI in 2021</i>	18.1	21.3	17.0	22.6

Source: Authors' calculations based on Eurostat Physical energy flow accounts, Istat and Eurostat national accounts, Istat and Eurostat IMTS, Istat and Eurostat producer price indices.

Notes: Energy and non-energy-intensive sectors are defined as in Table A3 in the Annex. (1) Net of coke and refined petroleum and of printing and reproduction.

Figure 7. Contributions of EI and NEI sectors to manufacturing export growth in 2022
(volumes; percentage points and percentage changes)



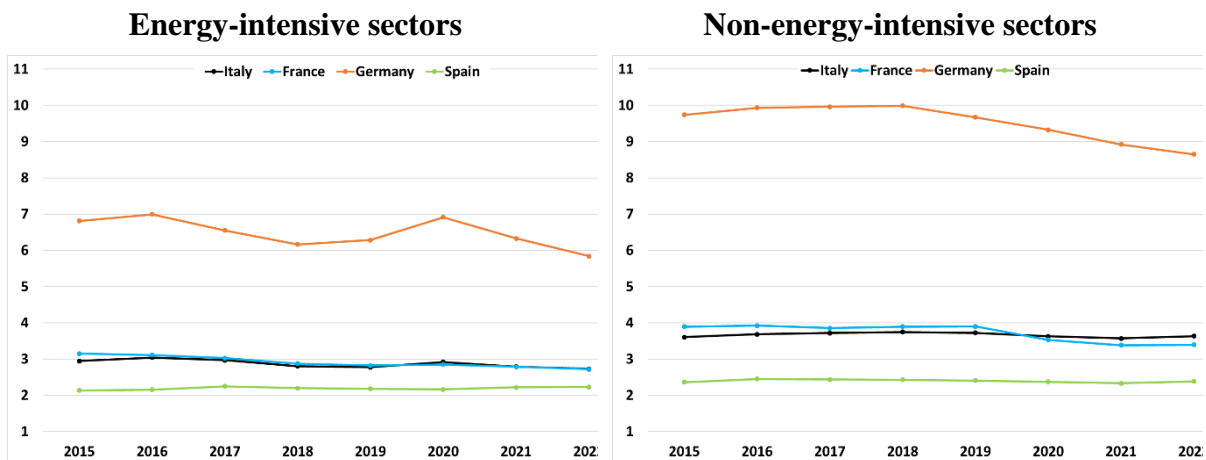
Source: Authors' calculations based on Eurostat Physical energy flow accounts, Istat and Eurostat national accounts, Istat and Eurostat IMTS, Istat and Eurostat producer price indices.

Notes: Energy-intensive (EI) and non-energy-intensive (NEI) sectors are defined as in Table A3 in the Annex. Total manufacturing is net of coke and refined petroleum and of printing and reproduction.

Based on Trade Monitor Data at current prices (which therefore are not strictly comparable to the national account data employed for total export markets shares in Figure 2), in 2022 Italy's NEI exports grew at the same rate as NEI world imports, implying a stable export market share in value terms; the country's EI market share declined by only 0.1 percentage points. Germany instead recorded a significant fall in both its market shares, especially for EI sectors (Fig. 8).¹⁷

¹⁷ Developments are similar when employing CEPII-BACI data, which offer a fuller country coverage, but are only available until 2021 (Figure A4 in the Annex).

Figure 8. Sectoral market shares at current prices by energy intensity
(annual estimates; percentage shares)



Source: Trade Monitor Data.

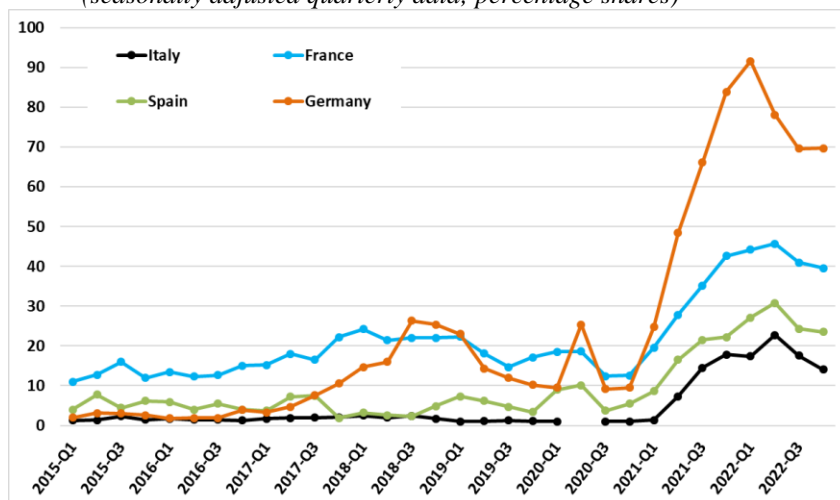
Notes: The EI and NEI categories are built by aggregating the following HS 2-digit sectors. For EI: 27 - mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes; 28 - inorganic chemicals; organic and inorganic compounds of precious metals; of rare earth metals, of radio-active elements and of isotopes; 29 - organic chemicals; 38 - chemical products n.e.c.; 48 - paper and paperboard; articles of paper pulp, of paper or paperboard; 72 - iron and steel; 73 - iron or steel articles; 74 - copper and articles thereof; 75 - nickel and articles thereof; 76 - aluminium and articles thereof; 78 - lead and articles thereof; 79 - zinc and articles thereof; 80 - tin; articles thereof; 81 - metals; n.e.c., cements and articles thereof. NEI is computed as the residual with respect to total manufacturing exports.

5. Global supply bottlenecks

Another factor potentially hindering exports is the sourcing difficulties firms faced in 2021-22 owing to pandemic containment measures in key world regions and to logistical issues. According to the European Commission Business Survey, the share of Italian firms indicating that the shortage of material and equipment was a key factor limiting production increased on average to 18 per cent in 2022 (from 10 the previous year); yet it still remained significantly below the shares reported for the other euro-area economies (Fig. 9). The most affected sectors in Italy, with over 30 per cent of firms signalling supply shortages, were machinery, computer and electrical equipment (Table A6 in the Annex); shortages in the motor vehicles sectors were reported by around one fourth of firms. These shares were much higher in the other countries, and in particular in Germany, where they were around and over 90 per cent.

Figure 9. Share of manufacturing firms indicating that shortage of material and/or equipment was a key factor limiting production

(seasonally adjusted quarterly data; percentage shares)



Source: European Commission Business Survey, January 2023.

Notes: Survey responses are provided at the beginning of each quarter. Data for France have been revised in September 2021 and January 2022 with respect to previous releases. Missing data for Italy for 2020-Q2 are due to a suspension of the survey for the Covid-19 pandemic.

6. Regression analysis

We complete the analysis by assessing whether the three factors considered in this note are statistically significant for countries' export performance in a regression framework. To achieve this aim, we augment a standard goods export dynamics equation à la Goldstein-Khan (1985), which relates changes in exports to those in foreign demand and price competitiveness, with an energy intensity sectoral dummy and a global supply bottlenecks indicator, as in equation (1).

$$(1) \Delta x_{(is,t/t-4)} = \alpha_{ist} \Delta for_dem_{(is,t/t-4)} + \beta_{ist} \Delta REER_{(is,t/t-4)} + \delta_s EI_dum_{(s)} + \theta_{ist} bottlenecks_{(is,t-4)} + FE_i + FE_t + \varepsilon_{ist}$$

Our dependent variable is the log-change of the volume of manufacturing exports relative to the corresponding quarter of the previous year (to account for seasonality), of each of the four countries (France, Germany, Italy and Spain, indexed by i), broken down by 15 manufacturing branches (indexed by s)¹⁸ in a given quarter over the 2010Q1-2022Q4 period. Real manufacturing exports are estimated as in Section 3. Price competitiveness is measured by sectoral REERs produced by Sato et al. (2015).¹⁹ Sectoral foreign demand and global supply bottlenecks are proxied, respectively, by firms' expectations on export orders and by the share of firms declaring shortages of inputs and materials, both from the European Commission

¹⁸ The sectors considered in the regression analysis are more aggregated relative to those discussed in Sections 4 and 5 due to sectoral REER availability.

¹⁹ Data are available at: <http://www.rieti.go.jp/users/eeri/en/>. These REERs are also deflated by the producer price index, similarly to the official Banca d'Italia indicators discussed in Section 3.

manufacturing business survey.²⁰ The EI dummy is defined as 1 for those sectors defined as EI in Section 3, zero otherwise. All regressions also include country and year fixed effects.²¹ Regressions are estimated using standard OLS and robust standard errors.

As to be expected, goods exports dynamics are positively related (with a coefficient close to unity) to changes in foreign demand and negatively related to REER developments (Table 4). Interestingly, only Italy and France's foreign sales respond significantly across all specifications to changes in price competitiveness; a similar result for Italy is found in Fabiani et al. (2019), focusing solely on intra-euro area goods trade. Since 2010 EI sectors have dampened export developments, yet specifically in 2021-22 their negative contribution was even larger than average. Moreover, whereas shortages in materials and equipment generally do not matter, in 2021-22 they were significantly and negatively correlated to foreign sales. The improvement in the goodness of fit between columns 1 (standard regression) and 4 (full augmented regression), as measured by the adjusted R-squared, suggests an (albeit contained) increase in the variance of export developments explained by the additional two determinants.

Table 4. Manufacturing export dynamics: a regression analysis
(dependent variable: log-changes on corresponding quarter of previous year)

	(1)	(2)	(3)	(4)
$\Delta \log_{(t,t-4)}$ external demand	0.096*** (0.011)	0.096*** (0.011)	0.096*** (0.011)	0.095*** (0.011)
$\Delta \log_{(t,t-4)}$ REER	-0.138** (0.069)			
$\Delta \log_{(t,t-4)}$ REER*IT		-0.488** (0.196)	-0.473** (0.193)	-0.451** (0.189)
$\Delta \log(t/t-4)$ REER*DE		0.031 (0.082)	0.043 (0.087)	0.027 (0.085)
$\Delta \log(t/t-4)$ REER*FR		-0.256*** (0.093)	-0.270*** (0.095)	-0.286*** (0.095)
$\Delta \log(t/t-4)$ REER*ES		0.322 (0.200)	0.343* (0.197)	0.316* (0.188)
EI sectors			-0.012*** (0.003)	-0.012*** (0.003)
EI sectors*2021-22 dummy			-0.024** (0.011)	-0.026** (0.011)
L4. bottlenecks				0.016 (0.032)
L4. bottlenecks*2021-22 dummy				-0.084** (0.040)
2021-22 dummy			0.122*** (0.012)	0.020 (0.013)
Country and year FE	YES	YES	YES	YES
Number of observations	2,850	2,850	2,850	2,837
Adjusted R ²	0.232	0.240	0.247	0.256

Notes: Fixed-effects regressions on 2010q1-2022q4 data for 15 manufacturing sectors in the four countries.

²⁰ In the regressions including the global supply bottlenecks indicator the number of observations drops by 13 units because data for 2020q2 for Italy are not available due to the suspension of the survey for the Covid-19 pandemic and those for coke and petroleum products for Spain are missing from 2010q1 to 2013q1.

²¹ When specifications in columns 1 and 2 of Table 4 also include sectoral fixed effects, results are confirmed. These fixed effects are not however included in the baseline set-up in order to report comparable specifications and goodness-of-fit statistics across all four columns of the table, given the collinearity between the EI dummy introduced in columns 3 and 4 and sector fixed effects.

7. Concluding remarks

At least three factors concur in explaining the recent resilience in Italy's export performance with respect to its main euro-area competitors: a) a pronounced improvement in price competitiveness, which significantly enhanced foreign sales in Italy; b) a more contained negative contribution of EI sectors to overall exports with respect to Germany; c) relatively lower shortages in materials and intermediate inputs in 2021-22, which notably dampened export dynamics in all four economies.

Annex – Additional information

Table A1. China's share in total goods exports

(percentage shares)

	2019	2020	2021	2022
Germany	7.2	8.0	7.6	6.8
Spain	2.3	3.0	2.7	2.0
France	4.1	4.1	4.9	4.0
Italy	2.7	2.9	3.0	2.6

Source: Eurostat IMTS.

Table A2. A decomposition of price-competitiveness dynamics

(percentage changes)

	Italy			France		
	REER	NEER	Relative prices	REER	NEER	Relative prices
	<i>(annual changes)</i>					
2019	-1.5	-0.5	-0.9	-1.5	-0.6	-0.9
2020	1.5	2.1	-0.6	0.3	1.6	-1.3
2021	-0.6	1.0	-1.5	-1.4	0.7	-2.1
2022	-2.6	-1.3	-1.3	-0.6	-1.2	0.6
	<i>(cumulative changes)</i>					
2010-2022	-4.7	4.7	-9.4	-6.7	2.6	-9.4
2019-2022	-1.7	1.7	-3.4	-1.7	1.1	-2.7
	Germany			Spain		
	REER	NEER	Relative prices	REER	NEER	Relative prices
	<i>(annual changes)</i>					
2019	-0.9	-0.7	-0.2	-1.6	-0.3	-1.3
2020	2.9	2.1	0.8	-0.2	1.8	-2.0
2021	-2.0	0.7	-2.7	2.6	0.7	1.8
2022	-2.6	-1.8	-0.9	2.0	-0.8	2.7
	<i>(cumulative changes)</i>					
2010-2022	-3.8	3.0	-6.8	4.4	5.4	-1.0
2019-2022	-1.7	1.0	-2.8	4.3	1.7	2.6

Source: Bank of Italy.

Notes: An increase in the REER (NEER) signals a loss in real (nominal) competitiveness.

Table A3. Energy intensity of manufacturing sectors in 2019
(annual data; terajoules per EUR millions)

Sector	ITALY	FRANCE	GERMANY	SPAIN
Coke and refined petroleum	175.5	56.6	108.4	-
Basic metals	30.5	60.4	32.3	41.6
Chemicals	26.5	26.6	27.8	31.1
Other non-metallic minerals	22.7	18.1	15.0	25.7
Paper	18.7	18.6	16.6	19.4
Wood	7.0	8.3	10.6	13.0
Food, beverage and tobacco	5.6	5.3	4.2	4.8
Rubber and plastic	4.1	3.9	2.9	4.0
Basic pharmaceuticals	3.6	2.0	2.2	2.9
Electrical equipment	3.1	1.4	0.7	1.7
Metal products	2.9	2.3	1.6	2.3
Textiles	2.5	1.9	2.9	4.1
Computers and electronics	1.8	0.9	0.8	0.8
Motor vehicles	1.6	1.7	1.1	2.0
Furniture	1.4	1.2	1.2	0.9
Machinery and equipment n.e.c.	1.2	1.2	0.7	1.0
Other transport equipment	0.6	0.5	0.8	1.3

Source: Authors' calculations based on Eurostat Physical energy flow accounts, Istat and Eurostat national accounts.

Notes: Energy intensity is measured as terajoules of use of resources and energy products per million euro of value added. We do not consider the sector printing and reproduction on recorded media, whose energy intensity and exports are negligible.

Table A4. Weight of different sectors in manufacturing export volumes
(annual averages on monthly data; percentage shares)

Sector	ITALY				FRANCE				GERMANY				SPAIN			
	2019	2020	2021	2022	2019	2020	2021	2022	2019	2020	2021	2022	2019	2020	2021	2022
Energy-intensive																
Chemicals	6.8	7.3	7.4	6.7	11.8	13.2	14.0	13.0	9.0	9.5	9.7	8.1	10.3	10.4	11.0	10.4
Basic metals	6.8	7.8	6.8	6.0	4.3	4.2	4.5	4.1	4.6	4.8	4.3	3.7	6.2	5.8	6.3	5.5
Other non-metallic minerals	2.3	2.4	2.4	2.3	1.2	1.2	1.2	1.1	1.3	1.3	1.3	1.6	2.9	3.1	3.3	3.2
Paper	1.5	1.5	1.5	1.5	1.4	1.6	1.6	1.5	1.7	1.7	1.6	1.6	1.8	2.0	1.9	1.7
Total energy-intensive	17.4	18.9	18.1	16.5	18.7	20.2	21.3	19.8	16.5	17.3	17.0	15.0	21.3	21.3	22.6	20.8
Non-energy-intensive																
Food, beverage and tobacco	8.3	9.3	9.2	9.0	10.6	11.9	12.2	11.7	5.3	5.6	5.4	5.5	13.1	14.7	14.5	14.4
Wood	0.5	0.4	0.5	0.4	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.6	0.7	0.7	0.8	0.7
Rubber and plastic	3.7	3.8	3.8	3.4	3.0	3.3	3.4	3.3	3.7	3.9	3.9	4.5	3.3	3.5	3.6	3.3
Basic pharmaceuticals	7.1	8.1	7.0	9.0	7.3	9.1	8.0	7.8	6.7	7.7	8.1	9.2	4.6	5.3	6.7	8.9
Electrical equipment	5.2	5.3	5.5	5.4	4.5	4.8	4.9	5.0	7.2	7.6	7.8	8.0	4.6	4.7	4.7	4.5
Metal products	4.5	4.4	4.5	4.3	2.3	2.4	2.5	2.5	3.6	3.6	3.6	3.7	3.6	3.6	3.7	3.6
Textiles	12.4	11.0	11.3	11.6	6.3	6.5	7.0	7.7	3.6	3.6	3.6	3.7	8.4	7.6	8.0	8.3
Motor vehicles	7.8	7.3	7.4	7.2	10.8	10.1	9.7	9.4	18.1	16.4	16.7	17.2	19.5	18.5	16.4	15.9
Computers and electronics	3.4	3.6	3.5	3.6	6.9	7.0	7.0	7.5	9.7	9.9	10.0	9.0	2.7	2.9	2.9	2.7
Furniture	6.0	5.4	6.0	6.1	4.3	4.1	4.1	4.1	3.4	3.5	3.6	3.4	2.3	2.6	2.5	2.5
Machinery and equipment n.e.c.	18.0	17.2	17.3	16.2	8.5	8.8	8.8	8.7	15.7	15.3	15.3	13.6	6.5	6.5	6.4	6.1
Other transport equipment	3.1	3.1	3.4	3.8	14.7	9.5	9.1	10.6	5.0	3.9	3.3	5.5	4.1	3.3	3.4	3.8
Total not energy-intensive	79.9	78.9	79.4	80.2	79.7	78.1	77.3	78.9	82.5	81.6	82.0	84.0	73.6	74.0	73.5	74.8
Energy producers																
Coke and refined petroleum	2.7	2.1	2.5	3.3	1.6	1.7	1.4	1.3	1.0	1.1	1.1	0.9	5.2	4.8	3.9	4.4
Total manufacturing	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Authors' calculations based on Eurostat Physical energy flow accounts, Istat and Eurostat national accounts, Istat and Eurostat IMTS, Istat and Eurostat producer price indices.

Notes: We have excluded the printing and reproduction sector, given its negligible size.

Table A5. Weight of different sectors in goods export values*(annual averages on monthly data; percentage shares)*

Sector	ITALY				FRANCE				GERMANY				SPAIN			
	2019	2020	2021	2022	2019	2020	2021	2022	2019	2020	2021	2022	2019	2020	2021	2022
Energy-intensive																
Chemicals	6.4	6.8	6.9	7.0	11.1	12.0	13.7	13.8	8.8	9.1	9.8	10.2	9.4	9.2	10.3	10.3
Basic metals	6.4	7.0	7.7	7.8	4.0	3.8	4.7	5.0	4.5	4.6	4.9	5.2	5.6	5.2	6.8	6.5
Other non-metallic minerals	2.2	2.3	2.2	2.2	1.1	1.1	1.1	1.1	1.3	1.3	1.3	1.3	2.7	2.8	2.9	2.8
Paper	1.4	1.4	1.4	1.6	1.3	1.4	1.4	1.5	1.6	1.6	1.6	1.8	1.6	1.7	1.7	1.7
Total energy-intensive	16.5	17.5	18.2	18.5	17.5	18.3	20.9	21.4	16.1	16.6	17.5	18.4	19.3	18.9	21.6	21.4
Non-energy-intensive																
Food, beverage and tobacco	8.0	9.1	8.6	8.4	10.0	11.4	11.2	10.8	5.3	5.6	5.2	5.3	12.0	13.6	12.8	12.2
Wood	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.7	0.8	0.7	0.6	0.6	0.7	0.7
Rubber and plastic	3.5	3.6	3.6	3.4	2.9	3.1	3.1	3.0	3.7	3.8	3.9	3.7	3.0	3.2	3.1	3.0
Basic pharmaceuticals	6.8	7.8	6.4	7.6	6.8	8.5	7.4	6.7	6.5	7.6	7.7	8.0	4.3	5.0	6.0	7.3
Electrical equipment	5.0	5.0	5.2	5.0	4.2	4.6	4.5	4.3	7.1	7.5	7.5	7.2	4.2	4.4	4.2	3.9
Metal products	4.3	4.3	4.3	4.2	2.2	2.3	2.3	2.2	3.5	3.5	3.6	3.4	3.3	3.3	3.2	3.2
Textiles	11.9	10.7	10.7	10.4	5.9	6.2	6.3	6.4	3.5	3.6	3.4	3.3	7.7	6.9	6.9	6.7
Motor vehicles	7.5	7.2	7.0	6.3	10.3	9.9	9.3	8.4	17.8	16.3	16.2	16.2	17.8	17.4	14.8	13.4
Computers and electronics	3.3	3.6	3.4	3.4	6.6	6.6	6.2	6.0	9.4	9.4	9.1	8.8	2.5	2.7	2.5	2.2
Furniture	5.8	5.3	5.8	5.6	4.0	3.9	3.8	3.6	3.3	3.4	3.5	3.3	2.1	2.4	2.2	2.1
Machinery and equipment n.e.c.	17.2	16.7	16.2	14.6	8.0	8.3	8.1	7.5	15.4	15.2	14.8	13.8	5.9	6.0	5.7	5.2
Other transport equipment	3.0	3.0	3.2	3.3	14.2	9.5	8.5	8.8	4.9	3.9	3.2	3.1	3.8	3.1	2.9	3.0
Total not energy-intensive	76.7	76.7	74.8	72.6	75.6	74.9	71.0	68.2	81.0	80.5	78.8	76.8	67.2	68.6	65.0	62.8
Energy producers																
Mining industry	0.2	0.2	0.3	0.5	0.6	0.5	0.6	1.7	0.1	0.1	0.2	0.2	1.2	0.9	1.2	1.3
Coke and refined petroleum	2.8	1.9	2.6	4.0	1.7	1.1	1.4	2.0	1.0	0.8	1.1	1.7	5.3	3.6	4.2	6.6
Supply of electricity and gas	0.1	0.1	0.1	0.3	0.6	0.5	1.3	1.5	0.3	0.3	0.5	1.2	0.2	0.2	0.8	1.7
Total manufacturing	3.1	2.2	3.1	4.8	2.9	2.1	3.3	5.2	1.4	1.2	1.8	3.1	6.8	4.7	6.3	9.6
Agriculture	1.4	1.6	1.6	1.3	3.2	3.8	3.5	3.9	0.7	0.9	0.8	0.8	6.1	7.1	6.4	5.4
Other products (1)	2.3	2.0	2.3	2.8	0.9	0.9	1.4	1.3	0.7	0.8	1.0	0.9	0.6	0.6	0.8	0.7
Total goods	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Authors' calculations based on Eurostat Physical energy flow accounts, Istat and Eurostat national accounts, Istat and Eurostat IMTS.

(1) "Other products" includes the following sectors: printing and reproduction on recorded media; supply of water, sewage systems, waste treatment; other products.

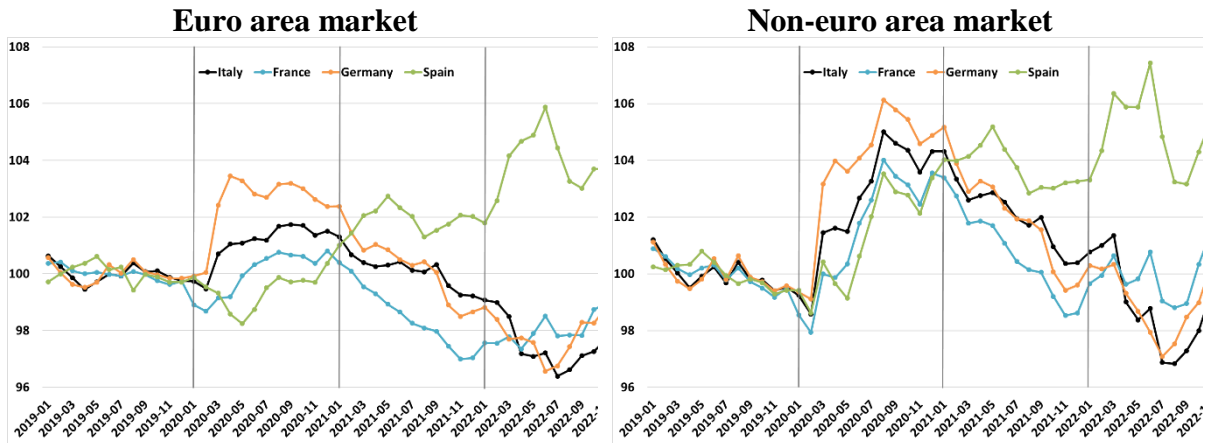
Table A6. The share of firms by sector indicating that shortage of material and/or equipment was a key factor limiting production by sector
(annual averages of quarterly data; percentage shares)

	ITALY				FRANCE				GERMANY				SPAIN			
	2019	2020	2021	2022	2019	2020	2021	2022	2019	2020	2021	2022	2019	2020	2021	2022
Machinery and equipment n.e.c.	1.0	1.0	15.9	32.4	17.7	22.2	44.1	65.1	21.8	16.2	56.0	93.9	1.9	3.0	8.8	19.3
Computers and electronics	1.2	3.1	15.8	30.9	10.0	24.3	36.8	60.2	19.6	20.0	73.7	99.0	11.7	4.0	27.3	40.4
Electrical equipment	0.5	1.2	19.9	30.6	23.4	25.0	52.3	77.0	22.3	17.9	71.9	98.2	2.8	10.5	37.5	39.3
Motor vehicles	0.3	1.3	14.0	23.5	26.1	8.6	79.7	82.4	11.6	16.9	71.6	87.2	17.6	6.1	44.4	76.1
Chemicals	2.0	2.3	14.7	21.8	17.0	8.3	34.7	33.1	16.0	13.2	56.5	59.5	5.4	12.7	12.2	15.8
Furniture	1.7	1.6	12.4	21.0	19.3	38.4	68.1	41.1	6.5	14.9	64.4	59.9	1.1	17.4	10.3	4.5
Paper	1.7	0.9	8.7	18.3	15.9	12.1	28.0	34.8	5.4	4.1	57.1	50.0	3.6	2.0	20.2	43.1
Wood	0.9	1.3	16.6	17.4	19.1	13.9	39.9	45.8	12.9	16.1	50.2	45.5	20.2	1.1	18.6	23.4
Printing	1.1	0.6	3.6	16.9	11.7	11.7	19.8	51.9	4.8	6.0	40.0	70.8	1.7	2.5	6.2	25.1
Beverages	0.8	1.3	6.2	16.8	30.7	19.5	25.7	48.6	7.8	5.2	20.9	46.3	1.4	3.0	11.1	26.6
Rubber and plastic	1.0	0.5	16.9	16.1	14.2	11.6	42.0	43.2	7.6	10.4	74.9	70.4	1.3	1.7	38.0	18.2
Metal products	1.2	0.9	11.5	14.2	13.3	18.1	40.3	45.8	8.9	9.6	59.8	65.3	6.4	13.3	28.2	36.7
Other transport equipment	0.4	0.6	10.7	13.9	44.9	26.1	17.3	30.0	19.5	59.8	76.2	98.3	0.1	0.1	15.0	33.2
Basic pharmaceuticals	1.7	0.8	3.0	11.8	11.2	6.3	8.0	11.2	26.4	5.7	22.9	62.4	12.4	7.8	4.5	10.6
Other non-metallic minerals	1.0	0.4	5.7	11.0	19.1	10.9	26.3	28.2	15.5	9.1	35.6	52.1	2.6	8.1	12.7	17.6
Textiles	0.4	0.1	4.2	10.7	14.4	10.8	49.1	37.4	11.0	10.1	48.3	58.5	4.3	8.2	17.2	8.6
Food	2.0	0.9	2.4	8.8	18.6	16.8	27.5	39.1	14.1	11.9	31.2	66.3	2.4	7.8	4.5	11.9
Other manufacturing	0.9	1.8	5.3	8.3	20.4	16.0	27.1	18.6	13.5	11.8	25.4	91.2	5.9	3.4	2.7	15.1
Basic metals	1.4	0.5	6.8	7.8	8.7	9.3	14.6	36.9	7.3	6.8	33.4	45.8	5.8	6.0	6.7	12.0
Clothing	0.0	0.9	2.6	7.3	6.3	4.2	11.4	19.9	1.8	13.9	30.0	62.7	0.0	0.0	0.1	32.3
Coke and refined petroleum	0.0	0.0	3.6	5.4	3.4	2.5	8.0	8.8	7.8	11.5	82.4	88.7	0.0	0.0	0.0	0.0
Leather	0.9	0.9	1.2	4.9	3.4	9.8	1.6	2.5	0.5	5.8	42.8	74.7	4.4	10.3	5.2	9.3
Total manufacturing	1.1	1.0	10.3	18.0	18.1	15.5	31.3	42.6	14.9	13.4	55.8	77.3	5.4	7.1	17.2	26.4

Source: European Commission Business Survey, January 2023.

Notes: Seasonally adjusted data. Total manufacturing also includes the residual sector “Repair of machinery and equipment”.

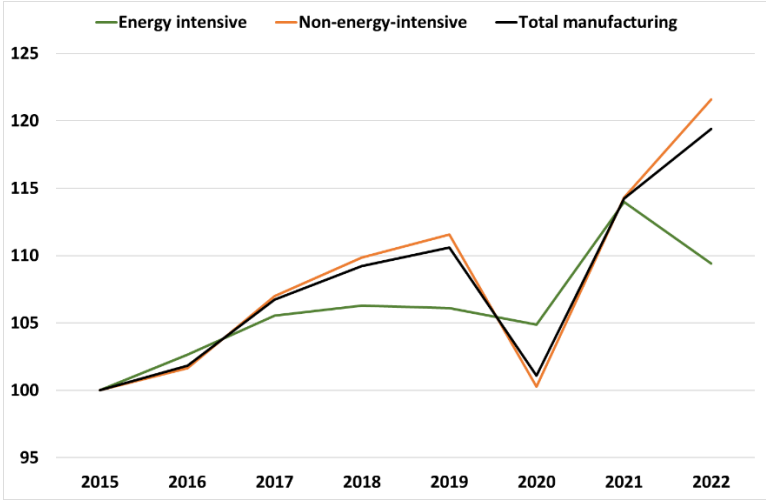
Figure A1. Export-weighted price-competitiveness developments by market
(monthly data; index 2010=100)



Source: Bank of Italy.

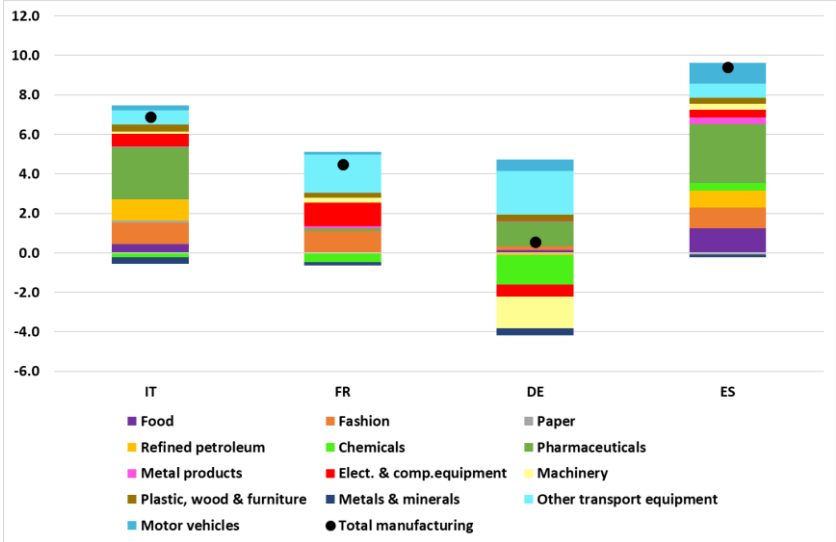
Notes: An increase in the REER signals a loss in price competitiveness.

Fig. A2. Italy's goods export volumes by energy intensity according to national accounts
(annual data; index 2015=100)



Source: Authors' calculations based on Eurostat Physical energy flow accounts and Istat national accounts.
 Notes: Total manufacturing is net of coke and refined petroleum and of printing and reproduction. Energy and non-energy-intensive sectors are defined as in Table A3.

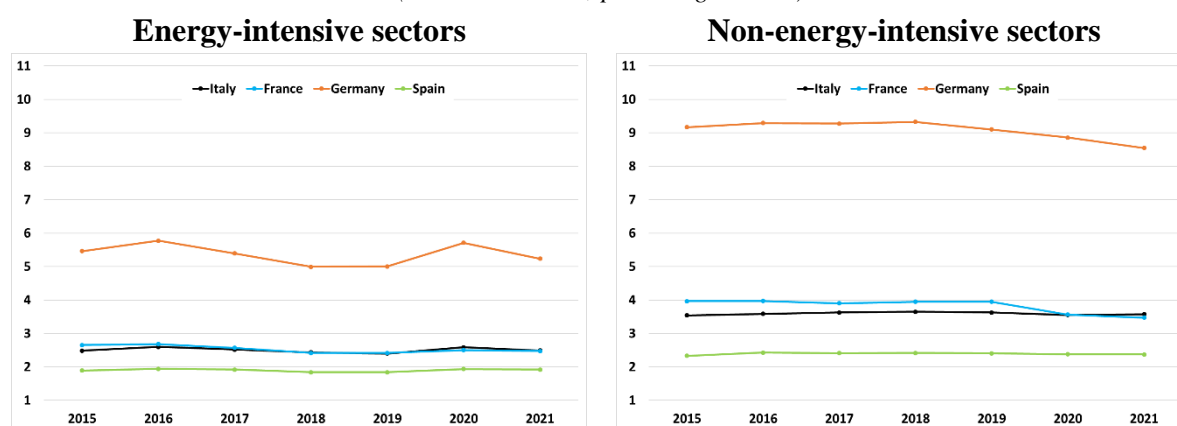
Figure A3. Sectoral contributions to manufacturing export dynamics in 2022
(volumes; percentage points)



Source: Authors' calculations based on Istat and Eurostat IMTS, Istat and Eurostat producer price indices.
 Notes: Total manufacturing is net of coke and refined petroleum and of printing and reproduction on recorded media.

Figure A4. Sectoral market shares at current prices by energy intensity according to an alternative dataset

(annual estimates; percentage shares)



Source: CEPII-BACI data.

Notes: The EI and NEI categories are here built by aggregating the following HS 2-digit sectors. For EI: 27 - mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes; 28 - inorganic chemicals; organic and inorganic compounds of precious metals; of rare earth metals, of radio-active elements and of isotopes; 29 - organic chemicals; 38 - chemical products n.e.c.; 48 - paper and paperboard; articles of paper pulp, of paper or paperboard; 72 - iron and steel; 73 - iron or steel articles; 74 - copper and articles thereof; 75 - nickel and articles thereof; 76 - aluminium and articles thereof; 78 - lead and articles thereof; 79 - zinc and articles thereof; 80 - tin; articles thereof; 81 - metals; n.e.c., cements and articles thereof. NEI is computed as the residual with respect to total manufacturing exports.

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