Extreme Weather Events and PDO wine exports

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Abstract

More competition in the input market contributes to improved access to lower-priced, higher-quality/technology embodied inputs, as well as a broader range of inputs. This increases the likelihood of firms manufacturing and selling more diverse final products. In this paper, we examine the impact an increase in imports of intermediate inputs has on the quality of exported products and the diversification of exported final goods, utilizing detailed trade and firm-level data from Italy in the period 2012 to 2020. We find a strong positive relationship between the variety of imported intermediate inputs and the quality of exported products. Furthermore, our analysis indicates that imported intermediate inputs positively affect the scope of exported end products. The results suggest that by acquiring a greater choice of intermediate inputs, local firms innovate and create new types of goods. The findings show that product upgrading supported by quality inherent in imported intermediate inputs improves the overall export performance of Italian enterprises.

*Keywords:*Intermediate input imports, export quality, extensive margin.

1 Introduction

In recent years, food-quality characteristics demanded by consumers have expanded to include not only taste, appearance, and convenience, but also dimensions such as the food production process and its impact on the environment and food safety. At the international level, the demand for higher food quality has translated into a setting of food-quality standards, both public and private, with the potential to affect trade flows (see Li and Beghin 2012). Consequently, firms in the food industry have adopted vertical product differentiation strategies as consumers have become less sensitive to price. The demand for food quality has also meant that firms producing quality-differentiated food products have increased their demand for intermediate agricultural inputs with the characteristics required to meet relevant product-quality specifications. The relevant characteristics required to meet consumer expectations and food quality standards are often embodied in the inputs used in the production processes. Firms may benefit, for instance, from importing new higher-grade varieties of intermediate goods in order to improve the quality of an existing product, thereby increasing the competitiveness of the firm to access new export markets or to increase exports to existing markets. Also, firms may choose from a larger range of inputs to reach a better combination of inputs at a lower cost to increase firms' competitiveness. This gain in efficiency allows more firms to absorb part of the cost of exporting, thereby inducing higher export participation by exporting more varieties or accessing new export markets. The gains of accessing foreign intermediate inputs to the local economy by spurring efficiency/productivity growth have also been the focus of some theoretical studies (Ethier, 1982; Rivera-Batiz and Romer, 1991; Backus et al., 1992). Empirical studies at the microeconomic level strongly confirm a positive relationship between foreign inputs and firm productivity, in quality-upgrading, in the number of new products, and in the probability of firms' entry in the export market (Amiti and Konings, 2007; Goldberg et al., 2010; Feng et al., 2016; Xu and Mao, 2018; Colantone and Crinò, 2014; Castellani and Fassio, 2019). Despite the increasing availability of inputs made possible by the growing trade integration of the global food value chains and the evident importance of trade in intermediate inputs on the performance of firms, to the best of our knowledge, there are still very few papers in the literature analyzing the effect of increasing availability of intermediate inputs on the export performance of food firms (Chevassus-Lozza et al., 2013; Olper et al., 2017; Curzi et al., 2021). Against this background, this paper aims to shed more light on the impact of input import penetration on various firm-level outcomes, such as the quality

of exported products, probability of entering new markets, and the diversification of exported final goods. To the best of our knowledge, no empirical study has investigated these relationships. The food industry exhibits unique characteristics, including stringent quality standards, complex value chains, and specific consumer preferences. Examining how imported intermediate inputs shape export performance within this sector would provide industry-specific insights and practical implications for food firms aiming to optimize their export strategies.

To this end, we use extensive data from the universe of Italian food firms operating over the 2012–2020 period. We test this relationship using information on the intermediate input consumption structures at the firm and sectoral levels. For the former, we use balance sheet information deflated by producer price indices to arrive at a panel dataset of about 7,000 Italian food firms. For the latter, we exploit transaction-level data of export flows at a disaggregated product level (8-digit classification) for each firm to identify products that were added to a firm's import and export portfolio in each year, i.e., products that were imported and exported for the first time by a firm. We also matched these data with balance sheet data collected by the Bureau-Van Dijk (BVD), which allows us to study the relationship between import competition in final and intermediary products and firm-level markups while accounting for additional firm-level factors and industry characteristics that might influence their overall ability to export new products.

Our results confirm a positive and significant role of newly imported inputs as an important factor in improving the quality of export products and fostering the introduction of new exported products. We confirm that through higher importing activities, firms can achieve a better combination of foreign and domestic inputs, leading to the absorption of part of the cost of exporting and, therefore, greater export participation. We also find some support, that new technologies embodied in the foreign-produced input led to innovations since import of intermediate goods is positively associated with the export of new products and product upgrading.

The following section provides some background by reviewing the literature on imported intermediate goods in conjunction with international trade. We then outline the method by which we capture intermediate goods from the data. We then apply our preferred measure to test the implications for the exporting behavior of firms, followed by some concluding remarks.

2 Background and Literature Review

International trade plays a pivotal role, not only in influencing the export performance of companies but also in creating motivations and opportunities for innovation. The existing body of literature that delves into the intersection of trade and endogenous innovation suggests the potential for dynamic welfare improvements through trade. However, there is no widespread consensus on how much innovation can accelerate. In a recent review article by Melitz and Redding (2023), the primary mechanisms by which trade impacts the growth and innovation originating within an economy are elucidated. From a Schumpeterian perspective, these authors delineate four key channels that influence the innovative capacity of firms: (i) Expansion of market size, which leads to a reduction in the fixed costs associated with innovation due to the ability to distribute these costs across a larger number of products; (ii) Heightened market competition, which, in alignment with the Schumpeterian theory, results in a non-linear relationship between competition and innovation; (iii) Specialization driven by the definition of trade flows according to comparative advantage; (iv) International knowledge spillovers, which facilitate the pace at which firms engage in innovation.

Exporting a broader range of products or enhancing the quality of existing varieties sometimes necessitates integrating inputs and technologies that go beyond the scope of a single firm and are thus sourced from other firms. This can be achieved by acquiring relevant technology through purchased inputs, which significantly impacts production efficiency and enables firms to compete internationally.

Generally, access to foreign intermediate inputs can impact exported variety in two ways. Firstly, having access to foreign intermediate inputs broadens the scope of inputs a firm may utilize to make end goods. Given the imperfect substitution between foreign and domestic inputs, a firm's access to both would allow it to achieve a more optimal combination of inputs, resulting in productivity increases that may materialize in the form of a broader scope of final export products (Halpern et al., 2015; Xu and Mao, 2018; Castellani and Fassio, 2019). Similarly, producers may obtain cheaper inputs, resulting in a decrease in the firm's cost of production (Damijan et al., 2014). This may encourage firms to absorb the cost associated with exporting and/or introducing new kinds of existing goods to their export scope (Bas and Strauss-Kahn, 2014) or the entry of new firms with new products. This refers to the so-called "variety effect."

Secondly, imported intermediate inputs can also impact the exported variety through the "innovation effect". According to this view, firms may benefit from the absorption

of a more advanced technology embodied in the imported intermediate input. This suggests that domestic firms can widen the scope of products and upgrade the quality of the existing product scope by accessing a larger set of vertically differentiated intermediate inputs.

The benefits of exporting a wider variety of products have spurred a body of literature examining its drivers. Following the seminal work of Goldberg et al. (2010), there has been a rise in empirical studies examining the impact of imported intermediate inputs on the variety of products sold either locally or globally. Pioneering this literature, Goldberg et al. (2010) discovered that freshly imported inputs helped Indian firms increase the number of products sold domestically during India's 1991 trade liberalization. These authors argue that a larger number of products produced within a firm derives from greater availability of imported inputs rather than cheaper ones. Similarly, Colantone and Crinò (2014) use product-level data across EU countries and find a positive relationship between imported inputs and the scope of products in the EU, stemming from both an increase in the availability of high-quality and cheaper foreign inputs. Feng et al. (2016) use data on Chinese manufacturing firms and find that an increase in the imports of intermediate inputs increased the scope of exported products. Xu and Mao (2018) test whether the increase in Chinese firms' access to a greater variety of imported intermediate inputs can explain the product quality upgrading of these firms by deriving export quality at the firm-product-year level. The authors find a positive effect of intermediate input imports on the export quality of Chinese manufacturing firms. However, these effects significantly differ among firms with different characteristics, including different productivity levels. Moreover, the magnitude of these effects differs with the import source and the quality of the intermediate input. Castellani and Fassio (2019) showed for Swedish manufacturing firms that new intermediate inputs promote the emergence of new exported goods, and that small and medium-sized enterprises (SMEs) gain the greatest advantage from having access to imported resources, suggesting that larger firms may have alternative means of acquiring better technologies and intermediate inputs compared to SMEs.

3 Data and research methodology

3.1 Measuring intermediate inputs

Our analysis is based on a unique database obtained from matching balance-sheet data from the Bureau Van-Dijk ORBIS database and export and import firm-level data from ISTAT (Italian National Institute of Statistics). The former database provides balance-sheet data on a rotating sample of around 7,000 Italian food and drink firms from 2012-2020. These data have been used to build variables proxying to relevant firms' characteristics (e.g. TFP). Data from ISTAT allow knowing for each firm in ORBIS the annual value and volume of exports and imports at the maximum level of product disaggregation (i.e. 8-digit) and providing also information on the destination (or origin) countries.

Depending on the stage of the production process (final vs intermediate), the level of import competition to which firms or industries are exposed can be disentangled in *Output Import Penetration (OIP)*, when it refers to final products, *Input Import Penetration (IIP)* if it considers imported intermediate inputs. In the former case, OIP refers to competition from final goods and foreign competitors within the same industry. In contrast, IIP does not directly impact sector competition, but rather it captures the input composition of each sector. In our empirical analysis, we measure OIP and IIP at the industry level (i.e., NACE 4-digit) for all the Italian food and drink sectors over the 2012-2020 period, following, among others, Acemoglu et al. (2016) and Altomonte et al. (2014). The OIP index is estimated as follows:

$$\Delta OIP_{ht} = \frac{\Delta import_{ht}}{production_{h,2012} + import_{h,2012} - export_{h,2012}} \tag{1}$$

Where ΔOIP_{ht} is the change in output import penetration in a NACE 4-digit sector h, computed as the difference between the time t and t-1. The numerator, $\Delta import_{ht}$ is the difference in the total value of imports of sector h between time t and t-1. The denominator allows for measuring the so-called initial absorption, which is given by the sum of the total value of imports and production of sector h at the time t_0 (i.e., the year 2012), minus the total value of exports in the same sector h at the time t_0.
The IIP captures the contribution of a given imported input k to an industry j. The IIP index is thus calculated as the weighted average change in the output import penetration of all sectors k purchasing from a sector h as follows:

$$\Delta IIP_{ht} = \sum_{k \epsilon j} \alpha_{kh} \Delta OIP^{*}_{kt} \tag{2}$$

where $a_k h$ is a weight that captures the share of the value of the inputs coming from sector k used in sector h over the total value of inputs used in sector h. ΔOIP^{*}_{kt} represents the change in the import penetration, hence calculated as in eq. (1), in sector k between time t and $t-1$. Following Altomonte et al. (2014), when computing ΔOIP^{*}_{kt} we consider only import, export and production data concerning intermediate inputs, which we indicated with * in eq.(2). We select these products relying on the Broad Economic Category – SNA Categories (BEC) classification, which allows distinguishing between final and intermediate goods categories at the HS 6-digit product level.
We calculate the weight a_{kh} relying on data from the 2007 US I–O tables of the Bureau of Economic Analysis, and more specifically from the "Use table" which provides data at the BEA level NAICS level on the contribution of each input k in the production of a given sector h. We rely on the US I-O table as these data allow us to work at a level of disaggregation that guarantees the possibility of building the Input import penetration index at the sectoral level (i.e. NACE 4-digit), which would not be possible with data on Italian or EU I-O Tables that instead provide data at a more aggregated level. As the US I-O Tables provide data at the BEA level, a classification linked to the NAICS classification, we have been able to adapt the data at the NACE 4-digit level through appropriate correspondence tables. As previous work in the literature, we assume that the US I-O is a reliable proxy for the features of another country's main characteristics based on the presumption suggested by Nunn and Trefler (2014: 274) that "no matter where goods are produced, they still require the same inputs and in the same proportions". Data on the value of imports and exports are taken from the BACI (Base pour l'Analyse du Commerce International) database of CEPII (Centre d'Etudes Prospectives et d'Informations Internationales).

Data on production value are taken from the PRODCOM (Eurostat) database and the FAO when considering agricultural products.

3.2 Quality estimation

We assess export quality at the level of individual firms, products, and destinations by employing the methodology developed by Khandelwal et al. (2013). This method relies on a fundamental assumption that, after controlling for price, products exported in larger quantities are generally associated with higher quality. This approach is widely

utilized in existing literature. In order to estimate the quality of exported products, we consider the following demand function, employing Ordinary Least Squares (OLS) regression analysis

$$\log q_{fjzt} + \sigma_{jz} \log p_{fjzt} = \alpha_z + \alpha_{jt} + \epsilon_{fjzt} \tag{3}$$

In this context, $\log qfjzt$ and $\log pfjzt$ represent the logarithm of the quantity and unit value of exports of firm f to country i for product z at time t. The primary control variables include αz and αjt, which respectively capture product-specific effects and importer-time fixed effects. σ_{jz} represents the elasticity of substitution specific to the country and product, with the data sourced from the study by Broda and Weinstein (2006). [1] Finally, the error term is $\epsilon fjzt$. The estimation of product quality is thus derived as the residual component from the demand function in the following manner:

$$Qual_{fjzt} = \frac{\hat{\epsilon}_{fjzt}}{(\sigma_{jz} - 1)} \tag{4}$$

3.3 Identification strategy

3.3.1 Imported intermediate inputs and export quality

To explore the relationships between imported intermediate inputs and export performance indicators, we run the following regression specification using OLS:

$$\begin{aligned} Y_{fjzt} = \beta_0 + \beta_1 IntInputs_{ft} + \beta_2 \Delta IIP_{ht} + \beta_3 \Delta OIP_{ht} + \beta_4 (log) TFP_{ft} + \\ + \beta_5 (log) Tariff_{jzt} + a_t + \gamma_{fjz} + \epsilon_{fjzt}, \end{aligned} \tag{5}$$

where Y_{fjzt} is, alternatively, firm-level export quality growth [2], extensive trade margin, and exit probability of firm *f*, exporting to a destination market j an 8-digit product z (belonging to a NACE 4-digit sector h) at time t. Our extensive margin variable captures the probability of a firm exporting a product in a new destination market, and it is measured as a dummy variable, that takes the value of one for positive product-destination trade flows for firms and zero for years when no trade took place

[1] Note that the elasticity of subtitution taken from Broda and Weinstein (2006) are at HS 3-digit level

[2] Fitm level export quality growth is computed as the yearly growth in the (log of) quality for firm f, exporting to a country j a product z at time t, Specifically $\Delta Quality_{fjzt} = (log) Quality_{fjzt} - (log) Quality_{fjzt-1}$

before. Conversely, we gauge the likelihood of firms exiting a specific product market when they cease exporting there, provided they had exported in the preceding year. $IntInputs_{ft}$ accounts for the firm-level number of imported intermediate inputs, the value, and the quality of imported inputs. ΔIIP_{ht} is 100 times the annual change in input import penetration. It is worth noting that our choice of including an additional control for a sector-level variable concerning imports of intermediate inputs, despite having data on imports at the firm level, is because we also want to control for the overall availability of imported inputs in an industry. Firms may decide not to import intermediate goods directly, but to purchase them in the domestic market. Moreover, as shown among the others by De Loecker and Goldberg (2014), greater domestic exposure to intermediate inputs may lead firms to have access to less costly inputs, which in turn may have a positive effect on their performance in terms of productivity, markup, and, ultimately, quality upgrading.

Our main control variables are: ΔOIP_{ht}, which represents 100 times the annual change in output import penetration; $(log)TFP_{ft}$ that is firm level Total Factor Productivity estimated with the Levinsohn and Petrin (2003) approach; $(log)Tariff_{jzt}$, which controls for the ad valore tariffs, imposed by country j on HS 6-digit product z, at time t. Finally, a_t and γ_{fjz} are year and firm-product-destination fixed effect, respectively.

Using the three-way fixed effects γ_{fjz} allows us to explore the within-firm variation in the outcome variable while also controlling for product-destination-specific idiosyncratic factors, such as demand and supply shocks. Using such a strict set of fixed effects alleviates concerns for potential endogeneity bias due to selection or omitted variable bias. In particular, exporting firms do not necessarily base their quality decision on domestic preferences, but on the export destination's preference for quality. Therefore, the inclusion of the firm-product-destination fixed effects controls for the quality of new products catered to any given destination.

3.3.2 New imported inputs, new exported products

To analyze the relationship between new imported inputs and new exported products, we follow Castellani and Fassio (2019), who carried out this analysis for a sample of Swedish manufacturing firms. We run the following specification using OLS:

$$\begin{aligned} NewExp_{ft} = \beta_0 + \beta_1 logNewImp_{ft-1} + \beta_3 \Delta IIP_{ht-1} + \beta_4 \Delta OIP_{ht-1} + \\ + \beta_5 (log)TFP_{ft-1} + a_t + \gamma_f + \epsilon_{ft} \end{aligned} \tag{6}$$

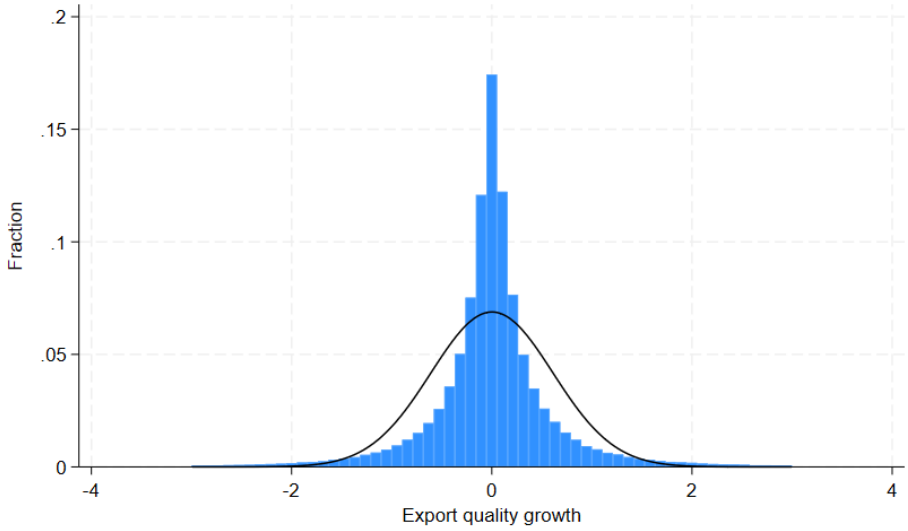
Where $NewExp_{ft}$ represents the logarithm of the number of new products exported by firm f at time t, and $logNewImp_{ft-1}$ denotes the logarithm of the count of new intermediate inputs imported by firm f at time *t-1*. The variable $NewExp_{ft}$ is constructed by summing all the distinct products z exported by firm f at time t, which had never been exported before. Similarly, the variable $NewImp_{ft-1}$ accounts for the total number of intermediate inputs imported by firm f at time t. It specifically represents the combination of products z imported for the first time from a specific country j, which had never been imported before. We also control for both input and output import penetration and firm-level TFP. Finally, a_t and γ_f are time and firm-level fixed effects. As outlined by Castellani and Fassio (2019), using a year lag in the independent variables can attenuate potential reverse causality problems that may arise in case firms aimed at exporting new products decide to import new intermediate inputs.

4 Results

In this section, we present the main results of our empirical analysis. Before going to the main findings, it is worth describing some of the main variables of interest used in our analysis. Figure 1 depicts the distribution of the average firm-level export quality growth. Being expressed as a yearly difference in the logarithm of quality, our dependent variable thus represents the annual percentage growth in export quality. Figure 1 suggests that, on average, firms present a slightly positive quality growth, although the graph shows that the variable follows a normal distribution. When considering our main independent variables, Figure 2 shows the yearly distribution of the average Input Import Penetration growth. While initially, in 2013, the index showed positive growth, in the following years, from 2013 to 2016, the line became flatter, showing modest average growth, and it even turned negative in 2017. Finally, from 2018 to 2020, it resumes growth again. Finally, when considering the firm-level yearly average total value of imports and the average total number of imported varieties, Figure 3 shows that the distribution of the two variables in both cases is considerably skewed, and thus suggesting that the only a small share of firms have a considerable import activity, both in terms of value of imports and number of imported products, while most of the firms have a much less intense import activity.

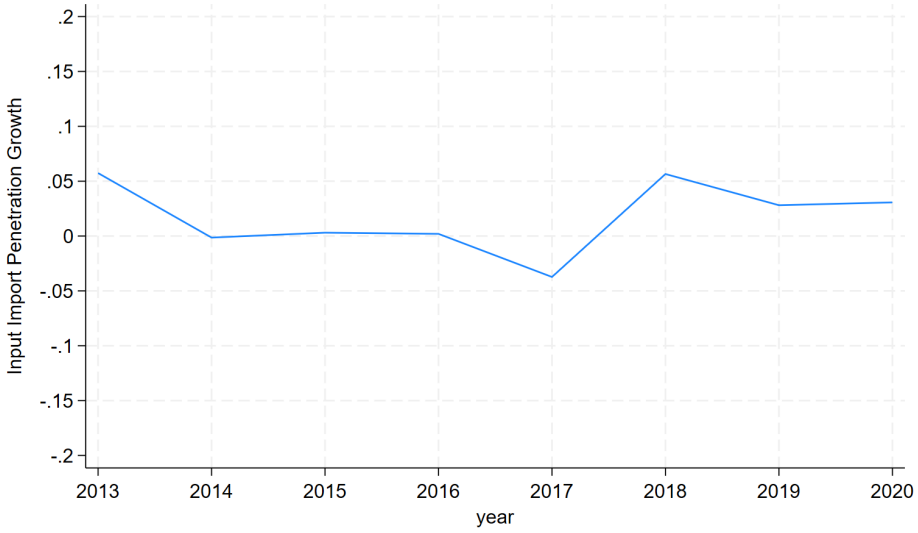
In Table I we present the results of analyzing the relationship between firms' exposure to imported intermediate inputs and export quality upgrading. The results in column 1 show that increased sectoral (NACE 4-digit) availability of imported inter-

Figure 1: Distribution of the average firms' export quality growth



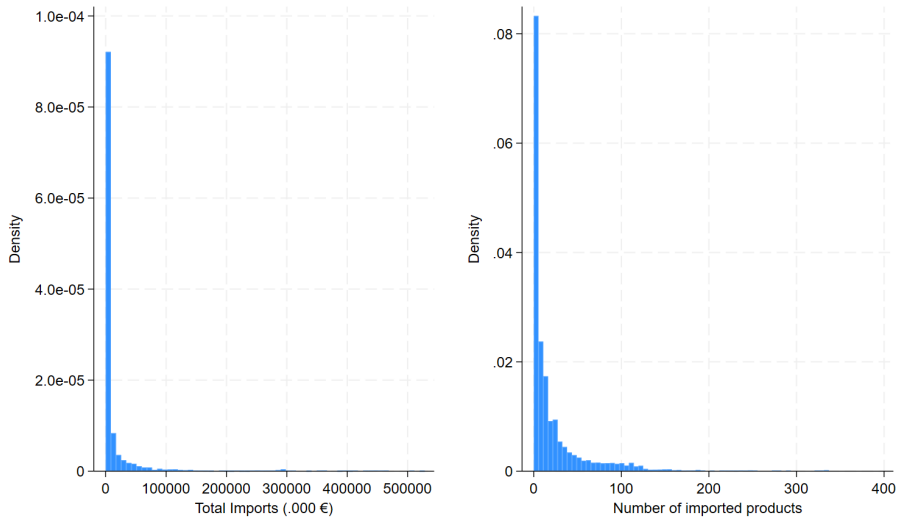
Note: Product quality is estimated at the firm-product-destination level using the Khandelwal et al. (2013) approach. See section 3.2 for further details

Figure 2: Yearly evolution of the average Input Import Penetration growth



Sources: Authors' analysis based on data described in the text.

Figure 3: Distribution of the average value of and number of firms' imported products



Sources: Authors' analysis based on data described in the text.

mediate inputs promotes firm-level export quality upgrading. Quantitatively, a 10% increase in Input Import Penetration increases export quality growth by 1.9%. should we use standard deviation? Concerning the other control variables, the effect of output import penetration on export quality growth is positive, but not statistically significant at a conventional level (i.e., 10% or lower). Bilateral tariffs are negatively and statistically significantly associated with quality growth. Finally, the positive and significant coefficient of the TFP variable suggests that more productive firms are more likely to increase export quality. In column 2, we present the results obtained by adding to the specification the (log of) quality of imported Inputs. [we should standardize this as well]As expected, the higher quality of imported inputs promotes the quality of exported products. The estimated effect is statistically significant at the 1% level and suggests that a 10% increase in the quality of intermediate inputs increases export quality growth by about 0.07%. We then include in our specification the value of imported intermediate inputs. The results in column 3 show again a positive and statistically significant effect (10% level). We obtain a similar result when we control for the number of imported inputs, as shown in column 4. Note that, as a robustness check, we run the same estimations shown in columns from 2 to 4, excluding the input and output import penetration index, while adding sector (NACE 4-digit)-time fixed effects to control for other potential idiosyncratic shocks. The results are quantitatively

similar to those presented in Table 1 but are not shown to save space.

Table I: Effect of imported intermediate inputs on firm-level export quality growth

	(1)	**(2)**	**(3)**	**(4)**
	Quality growth	Quality growth	Quality growth	Quality growth
Δ Input Import Penetration	0.192*	0.191*	0.195*	0.195*
	(0.105)	(0.105)	(0.105)	(0.105)
(log) Quality Imported Inputs		0.069***		
		(0.027)		
(log) Inputs (€)			0.002*	
			(0.001)	
(log) Imp. Input Varities				0.006**
				(0.003)
Δ Output Import Penetration	0.066	0.058	0.067	0.069
	(0.116)	(0.116)	(0.116)	(0.116)
log (1+Tariif)	-0.037**	-0.037**	-0.037**	-0.037**
	(0.015)	(0.015)	(0.015)	(0.015)
(log) TFP	0.124***	0.125***	0.125***	0.125***
	(0.042)	(0.042)	(0.042)	(0.042)
Fixed Effects	Yes	Yes	Yes	Yes
N	450435	450435	450435	450435

Notes: All regression included firm-destination-product FE and time FE. Robust Standard are shown in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In Table II, we present the results considering as outcome variables firms' extensive margins and exit probability. The results indicate the existence of a positive and significant (1% level) relationship between input import penetration and firms' export extensive margins (columns from 1 to 3). Quantitatively, a 10% increase in input import penetration raises firms' extensive margins by 0.2%. Similarly, when introducing our firm-level independent variables, the results show that the quality of imported inputs and the value of imported inputs are associated to an increase in firms' extensive mar-

gin (columns 2 and 3). Notably, all the estimated coefficients are strongly statistically significant (1% level). Conversely, the results in column 4 show that increasing availability of intermediate inputs, both considering sector-specific and firm-level variables, are negatively and significantly (at 1% level) associated with firms' exit probability from the destination markets.

Table II: Effect of imported intermediate inputs on firm-level extensive margin and exit probability

	(1)	(2)	(3)	(4)
	Extensive Margin	Extensive Margin	Extensive Margin	Exit Probability
Δ Input Import Penetration	0.021***	0.019***	0.023***	-0.027***
	(0.006)	(0.006)	(0.006)	(0.006)
(log) Quality Imported Inputs		0.069***	0.025***	-0.144***
		(0.005)	(0.005)	(0.005)
(log) Imported Input Varities			0.006***	-0.001***
			(0.000)	(0.000)
Δ Output Import Penetration	0.253***	0.253***	0.255***	-0.016*
	(0.009)	(0.009)	(0.009)	(0.009)
log (1+Tariif)	-0.002	-0.002	-0.002	0.007***
	(0.001)	(0.001)	(0.001)	(0.001)
(log) TFP	-0.050***	-0.050***	-0.046***	-0.016***
	(0.002)	(0.002)	(0.002)	(0.002)
Fixed Effects	Yes	Yes	Yes	Yes
N	1871258	1871258	1871258	1871258

Notes: All regression included firm-destination-product FE and time FE. Robust Standard are shown in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.1 Testing the heterogeneity of the results according to the level of sectorial competition

In this section, we test whether our results are heterogeneous across sectors with different levels of competition. We first compute the concentration level of the 42 NACE 4-digit food and drink sectors characterizing our sample by estimating their Pareto

distribution. The Pareto distribution represents a continuous probabilistic distribution function that usually describes those situations where a small number of individuals, firms, or events have a disproportionately large impact or occurrence compared to the majority, and it is often used in fields like economics, finance, and engineering. [3] From the Pareto distribution, we calculate for each NACE 4-digit sector in our sample the so-called *shape parameter*, which represents an indicator that determines the distribution's shape, usually denoted as α. The shape parameter is usually larger than 1, and values of α close to 1 define distributions with a very heavy tail. In contrast, larger values of α suggest that a relatively light tail characterizes the distribution. We estimate the Pareto distribution of all the NACE 4-digit sectors in our sample by considering the firm-level TFP estimated with the Levinsohn and Petrin (2003) approach. [4] We then split the sample according to the estimated shape parameters in lower-concentrated sectors, which are defined by an above-the-median value of the shape parameter, and higher-concentrated sectors, whose Pareto distribution is defined by an above-the-median value of the shape parameter.

In Figure 4 we plot the cumulative TFP distributions of NACE 4-digit sectors according to the value of the estimated shape parameter (i.e., below or above the median shape parameter). [5] The graph shows, as expected that sectors with lower shape parameters have a heavier tail distribution, where fewer firms have larger productivity. In contrast, sectors with higher shape parameters have a more homogeneous TFP distribution.

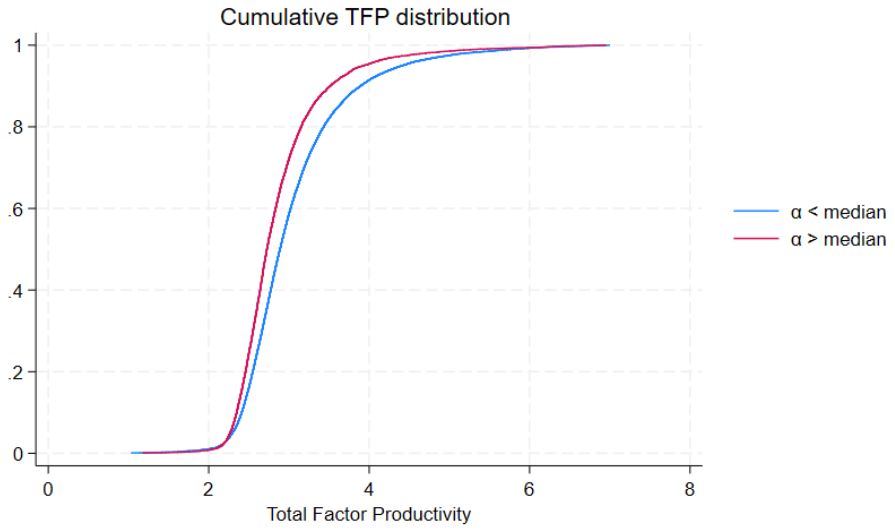
In Table III we show the results we obtain when estimating equation 3 with separate coefficients for each of the imported intermediate input variables for sectors with lower and higher shape parameters. Specifically, we generate one dummy variable, "Low Shape Parameter", which takes the value of 1 for those NACE 4-digit sectors with a below-the-median shape parameter, and zero otherwise. Conversely, we generate a dummy variable, "High Shape Parameter", which takes the value of 1 for those NACE 4-digit sectors with an above-the-median shape parameter, and zero otherwise. We then interacted with these two dummy variables, with each independent variable capturing

[3] The Pareto distribution is frequently associated with the 80/20 principle, which refers to those phenomena where roughly 80% of the outcomes result from just 20% of the underlying factors. A typical example is wealth inequalities, which suggest that the most significant percent of wealth is in the hands of very few people.

[4] We estimate the shape parameter using the *paretofit* command in STATA 17.

[5] The Pareto distribution has the following cumulative distribution function $F(x) = 1 - (x/x_0)^{(-a)}$, where a¿0 is the shaper parameter, x_0 is a scale parameter, x $\geq$ x$_0\geq$ 0 is a randome variable.

Figure 4: Cumulative TFP distributions in higher vs. lower concentrated NACE 4-digit sectors



Sources: Authors' analysis based on data described in the text.

intermediate inputs. The results in column 1 of Table III suggest that the positive effect of Input Import Penetrations holds in both cases. However, despite the magnitude of the coefficient being higher for those sectors with a higher shape parameter, the effect is statistically significant at a conventional level (10%) only for sectors characterized by a lower shape parameter. Following the same strategy as for the results presented in Table I, we add the other imported intermediate input variables measured at the firm level individually. Interestingly, the positive and significant effect of imported intermediate inputs on the quality of the exported products holds only for sectors characterized by a lower shape parameter. The same coefficients for the sectors with a higher shape parameter display a negative coefficient, which is never statistically significant at a conventional level. Therefore, our results suggest that imported intermediate input positively affects export quality upgrading only for more concentrated sectors, thus characterized by lower competition.

Table III: Effect of imported intermediate inputs on firm-level export quality growth controlling for sectoral concentration

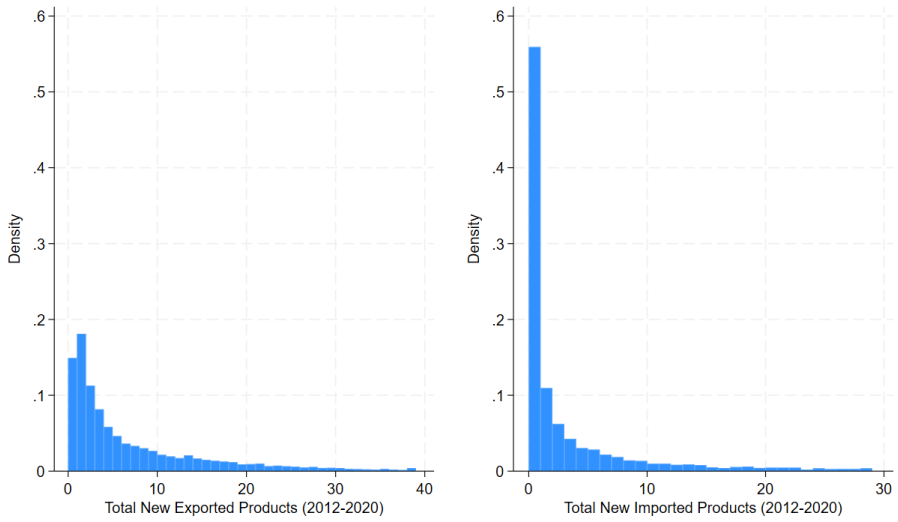
Dep. Variable: Quality Growth	(1)	(2)	(3)	(4)
Δ Input Import Penetration - Low Shape Parameter	0.184*	0.183*	0.188*	0.188*
	(0.105)	(0.105)	(0.105)	(0.105)
Δ Input Import Penetration - High Shape Parameter	0.834	0.811	0.778	0.746
	(0.603)	(0.604)	(0.608)	(0.608)
(log) Quality Imported Inputs - Low Shape Parameter		0.083***		
		(0.029)		
(log) Quality Imported Inputs - High Shape Parameter		-0.025		
		(0.074)		
(log) Imported Inputs (€) - Low Shape Parameter			0.003**	
			(0.001)	
(log) Imported Inputs (€) - High Shape Parameter			-0.000	
			(0.003)	
(log) Imported Input Varieties - Low Shape Parameter				0.007**
				(0.003)
(log) Imported Input Varieties - High Shape Parameter				-0.004
				(0.008)
Control Variables	Yes	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes	Yes
N	450435	450435	450435	450435

Notes: All regression included firm-destination-product FE and time FE. Robust Standard are shown in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.2 Do new imported inputs promote the export of new products?

In this section, we present the results obtained from our analysis of the impact of importing new intermediate inputs on the export of new products. To further comprehend the data used in the analysis, in Figure 5 we plot the frequency distribution of our main variables of interest. For this purpose, we calculate the total number of new exported products and new intermediate inputs each firm collected over the period. As expected, the two distributions appear highly skewed. As shown in the left panel of the figure, about 15% of firms have never exported new products, while around 18% have exported one new product over the period. The graph on the right panel suggests that more than half of the firms in the sample have never imported new products, about 10% of them imported only one product, while about 30% imported two or more products over time. In Figure 6, we further distinguished the origin of the intermediate products. The larger share of intermediate products comes from EU 15 countries, while New EU Member States, OECD, and Developing countries show a similar distribution.

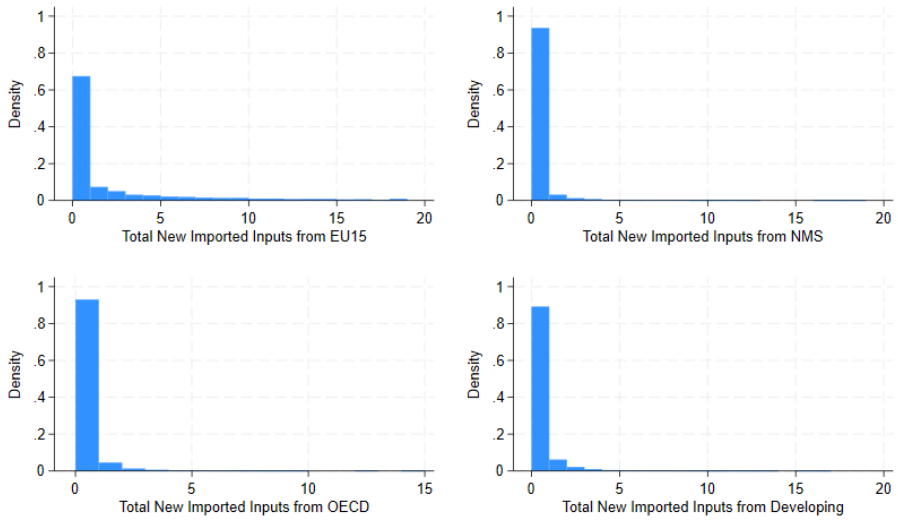
Figure 5: Frequency distribution of new exported products and new imported inputs



Sources: Authors' analysis based on data described in the text.

Coming to the main results, the findings in column 1 of Table IV suggest a significant positive effect of newly imported intermediate inputs on new product exports. We then analyze whether the firm dimension plays any role in affecting our main re-

Figure 6: Frequency distribution of imported inputs disentangling by their origin



Sources: Authors' analysis based on data described in the text.

sults. For this purpose, we interacted the new imported input variable with firm-level TFP. The results of this test are presented in column 2, and they show negative and significant coefficient for the interaction term. This result suggests that new imported inputs are more likely to promote new exported products in the case of smaller firms. This finding is in line with Castellani and Fassio (2019), who found a similar result in the case of Swedish manufacturing firms. We then further test the heterogeneity of the results by disentangling the effect of new imports coming from different origins. The results in column 3 suggest that all groups (i.e., EU 15, NMS, OECD, and Developing countries) show a positive effect, which is not significant only in the case of EU 15 countries. The magnitude of the estimated coefficients is higher for Developing countries and EU NMS.

Table IV: Effect of new imported inputs on the export of new products

Dep. Variable: New Exported products	(1)	(2)	(3)
(log) New Imported Inputs (t-1)	0.086**	0.449***	
	(0.037)	(0.169)	
(log) New Imported Inputs (t-1) * (log) TFP (t-1)		-0.341**	
		(0.155)	
(log) New Imported Inputs (t-1) - EU15			0.054
			(0.037)
(log) New Imported Inputs (t-1) - NMS			0.428***
			(0.127)
(log) New Imported Inputs (t-1) - OECD			0.289**
			(0.143)
(log) New Imported Inputs (t-1) - Developing Countries			0.374***
			(0.105)
(log) TFP (t-1)	-0.027	0.210	-0.036
	(0.205)	(0.232)	(0.205)
Δ Input Import Penetration (t-1)	-0.216	-0.232	-0.230
	(0.312)	(0.312)	(0.311)
Δ Output Import Penetration (t-1)	0.314	0.310	0.380
	(0.402)	(0.402)	(0.402)
Fixed Effects	Yes	Yes	Yes
N	15255	15255	15255

Notes: All regression included firm-destination-product FE and time FE. Robust Standard are shown in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5 Conclusion

In this paper, we empirically analyze to what extent imported intermediate inputs affect firms' export performance, particularly quality upgrading and the exports of new products. We provide compelling evidence that a higher firm's exposure to intermediate inputs promotes export quality growth, especially if imported inputs are high quality. We also find that importing new inputs increases the probability of firms exporting new products, especially when inputs come from developing countries. The results of this paper may have relevant policy implications. We shed new light on the importance that exposure to imported inputs has in promoting the competitiveness of the Italian food and drink sector. From this perspective, our findings may encourage EU policies to promote imports of intermediate inputs. However, the recent EU Farm to Fork strategy goes in the opposite direction, as its implementation may reduce the array of intermediate inputs available in the agri-food sector.

It is also worth mentioning that policies promoting imports of intermediate inputs should also take into consideration the recent findings by Shapiro (2021), who provided evidence that the global structure of trade policies, which is on average less restrictive for intermediate inputs, has accidentally promoted an increase in the emission of CO2, as inputs are generally more polluting than outputs. A recent article by Raimondi et al. (2022) confirms these findings in the agri-food sector.

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