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FOOD EXPORTERS IN GLOBAL VALUE CHAINS: FOOD FOR THOUGHT

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Abstract

This paper offers a firm level perspective of global value chain participation in the food industry. Exploiting a very rich and original dataset, based on a 2011 survey of 25,090 Italian firms operating in manufacturing and related services, we characterize the food industry, describing its main strengths and weaknesses, and analyze the links between the probability to export and the value chain participation. Stylized facts on food global value chains and the Italian food industry are singled out. Italian food processing firms offer an ideal setting to study whether entering a value chain helps the internationalization of small, often high quality, firms. Italy is well known for gourmet food, but is despecialized, since it has a substantial trade deficit in the sector. Food processing firms are very small, on average with less than seven workers, and when in value chain, their distribution is skewed towards downstream activities, with a much lower share of subcontractors than of own-branded and final firms. After having described and characterized the sector, we estimate the probability to export of food processing firms and the role of value chains. Our results show that participating in a value chain significantly increases the probability to export. This is particularly true for small firms in the industrial food value chain and for firms positioned downstream. Participating in distribution chains, for instance being able to sell products through large supermarkets, also significantly contributes to internationalization. Our results have important implications in terms of trade policy: tariffs and other protection measures are cumulative when intermediate inputs are traded across borders multiple times. Hence, protection can end up in a significantly higher cost of the finished good. This shows the importance to "think value chain" when discussing trade policy.

Keywords: Global Value Chain, Heterogeneous firms, Export, Internationalization, Food

JEL Classification: F12, F14, F21

1. Introduction*

Global value chains (GVC) are increasingly emerging as a key to understand the most recent transformations in the global economy and in the patterns of trade. In the last two decades, technology advancements and reductions in transportation and communication costs have changed the way goods and services are produced, by triggering a higher division of labor both within and between firms and countries.

This phenomenon is not entirely new, being closely related to concepts such as production networks, *filière* (Raikes et al., 2000) or Marshallian districts, as well as to outsourcing, offshoring, foreign direct investments and more in general with multinationals (de Backer and Miroudot, 2014).

To account for GVC, two main strand have been developed. One is the so-called "Global Value Chain (GVC) Approach", an analytical framework able to shift the focus from a merely technical perspective, i.e. production only activities, to a broader governance perspective, including a wide range of market and non-market activities related to the provision of the final good (Gereffi, 1994; Gereffi *et al.*, 2001). This approach has triggered interesting intuitions on how several organizational forms have different implications for the gains from trade, creating winners and losers from globalization. Nonetheless, the studies employing this approach usually rely on specific case studies, which can give hints, but whose findings are rather qualitative and difficult to encompass into a more general theory.

A second strand of the literature takes a different, more quantitative and theoretical perspective and tries to identify the main economic mechanisms at work. In particular, recent advancements in trade theory highlight imperfect competition and firms heterogeneity (Melitz, 2003; Bernard *et al.*, 2007; Bernard *et al.*, 2011; Melitz and Redding, 2013), fragmentation of production, the role of trade in intermediate goods and even "trade in tasks" (Grossman and Rossi-Hansberg, 2008). However, these models keep representing trade flows in terms of final goods and modeling global production sharing as an increase in the tradability of homogeneous inputs across countries. The disintegration of the production process, on the other hand, should be associated with the growth of trade in differentiated intermediate inputs.

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This means that the existing models tend to overlook some characteristics of intermediate input trade, which are often customized to the needs of their buyers (as highlighted by the GVC Approach and the related case studies).

The effort is therefore to bridge the gap between the new characteristics of international trade which show in the data and the existing trade theories, also accounting for the existence of incomplete contracts, which are likely to affect the decision of the firm on whether and how to outsource or vertically integrate, and, one could say, enter the GVC (Grossman and Helpman, 2002; Grossman and Hart, 1986; Antràs, 2003). Under different contracts and conditions, firms are likely to choose different internationalization strategies and play different roles within the GVC (Castellani *et al.*, 2010; Baldwin and Lopez-Gonzales, 2013; Giovannetti *et al*., 2015). In particular, unreliability of suppliers or courts in a country may change the comparative advantage of a country along the value chain.

The lack of a unified framework of analysis can be partially traced back to data unavailability. Global value chains challenge the way statistics on trade and output are collected as well as the models. As pointed out by de Backer and Miroudot (2014) "there is a growing awareness that current statistics can give the wrong picture… Trade statistics… record several times the value of intermediate inputs traded along the value chain. As a consequence, the country of the final producer appears as capturing most of the value of goods and services traded, while the role of countries providing inputs upstream is overlooked. Bilateral trade statistics and output measures at the national level make it difficult to visualise the "chain" or the production network" (p. 8). A first attempt at filling this gap comes from the OECD and the WTO, which have built a new database of trade flows in value-added terms based on a global model of international production and trade networks. A second attempt to bring more disaggregate analysis to the table comes from studies employing firm level data to understand the role of GVC. In this line, in previous work (Giovannetti *et al.*, 2015), we link the different perspectives and assess the relation between internationalization of firms and their participation in value chains. Our findings suggest that participating to a value chain significantly helps small Italian manufacturing firms to export and to increase their export intensity, especially when they operate in downstream activities.

To our knowledge, Giovannetti *et al.* (2015) is one of the first studies to explicitly include a direct measure of value chain participation into a firm level analysis. The

advantage of this kind of analysis is that, starting with disaggregated data, it makes it possible to provide a broad picture at the country level. The evidence that emerges is generally consistent with theoretical expectations.

A number of studies from the above mentioned "GVC Approach" highlights that GVC may take several configurations and have different governance structures in different industries (for instance, Gereffi, 1994; Gereffi *et al.*, 2005). Even the very concept of sector may become problematic in a context where value chains are pervasive and often involve firms from different sectors. Firms operating in different sectors of the economy, as well as in different positions along the value chain, are likely to entertain very diverse types of relations with other firms and to hold varied degrees of decisional power (Gereffi *et al.*, 2005). This observation suggests that more detailed information can be extracted by investigating the structural relation between value chain participation and internationalization focusing on a specific sector.[1]

We decided to analyse an interesting typology: food processing firms. Our aim is twofold: on the one hand, we want to investigate whether and how food processing firms differ from firms in other sectors; on the other hand, we want to assess the specific relation between value chain participation and internationalization of food processing firms, a sector which is highly international along all the phases of the global value chain (see de Backer and Miroudot, 2014).

The empirical analysis exploits an original dataset based on a firm-level survey on over twenty-five thousands Italian firms, mostly small and medium-sized firms. The survey provides data on many activities pursued by firms, including their internationalization strategy, networks and, notably for our research question, a direct information about participation of firms in value chains.[2]

The food processing sector and Italy represents an interesting case for a number of reasons.

[1] In our previous work, we account for this possible source of heterogeneity by introducing sector level fixed effects and several other controls. Our results are robust, but we recognize that, when our research interest is on a specific sector, then a greater level of detail may be appropriate. In particular, to better analyze the peculiarities of a given sector, it may be useful to focus on the sector specific relation between value chain participation and internationalization.

[2] In particular, we exploit the answers to an explicit question in the survey about participation of firms in value chains. The same answer is exploited in Giovannetti *et al.* (2015). Related works had to rely on an indirect measure, such as the status of subcontractor or supplier of intermediate goods as a proxy for participation in value chains (see for instance Accetturo *et al.*, 2011, Agostino *et al.*, 2011; Wynarczy and Watson, 2005).

First, a number of studies shows that the food value chain is rather peculiar as it tends to be "buyer-driven", relatively long in production and with long retailing chains (Lee *et al.*, 2012; Fally, 2012; de Backer and Miroudot, 2014). Moreover, the value chain for food products involves a high number of countries, both developed and developing, and the stage of development does not seem to imply any specific role along the chain (de Backer and Miroudot, 2014).[3] The current structure of the food GVC is mainly the result of an important restructuring process of the food industry that has taken place in the last decade and has led to an increased level of market concentration (Lee *et al.*, 2012; Humphrey and Memedovic, 2006; Burch and Lawrence, 2005). Analysing the specific value chain of food products leads to a more consistent evaluation of the relation between value chain and internationalization, especially since the configurations of the value chain may be very different in other sectors.

Second, food is not a specialization sector for Italy. Italian food is universally appreciated and many Italian food products are renown and exported worldwide. But Italy also imports many food products. Imports are greater than exports, leading to a trade deficit. Studying the relation between value chains and internationalization in this sector for Italy can help verifying whether there are differences with other specialization sectors. In particular, Italian food-processing firms, especially the smaller ones, operating into a despecialization sector where many products display a high level of global integration, may be particularly exposed to foreign competition. Studying the strategies of successful firms in such a sector may yield important policy implications.

Third, in the food market, as in other sectors, competition is to a certain extent based on quality rather than prices. In the case of food products quality has a rather clear meaning. A recent study identified high-quality food products by referring to those typically "made in Italy", with "Protected Designation of Origin" or the "ISO 9000" certification. The evidence shows that Italian food firms producing high-quality products are more likely to export more and to more distant and richer destinations (Curzi and Olper, 2012). Importantly, quality competition has important consequences on how the entire value chain is organized. In the last decade, the reorganization of production in the food sector has led to the emergence of private quality and safety

[3] A notable example that is both very representative of a food GVC and related to this paper is that of the Italian brand Nutella (de Backer and Miroudot, 2014).

standards within the value chain. Quality competition and consumers' concerns about food safety have even led private standards to be applied from product to process as well. This phenomenon, in turn, has increased the importance of branding and has required a narrower level of vertical coordination within the value chain, often led by large retailers (Humphrey and Memedovic, 2006; Lee *et al.*, 2012).

Fourth, Italy is characterized by a large number of relatively small firms that represent the bulk of the productive structure and largely contribute to employment and export (Barba Navaretti et al., 2011). This is true for specialization sectors and even more so for food-processing firms. Investigating the specific relations between value chains and internationalization for a despecialization sector largely characterized by small firms may have important policy implications. In particular, the high level of concentration in the food sector and the fact that food value chains tend to be buyer-driven has led to an increasing risk of marginalization for small firms (Lee *et al.*, 2012). In contrast, the GVC may also represent for small firms an opportunity to upgrade. Small firms may overcome some of their structural constraints by integrating into value chains so to better exploit their specific comparative advantage or focusing on niche high-quality segments (Dentoni and Reardon, 2010; Humphrey, 2005).

Results from an econometric analysis of the probability to export, indicate that value chain participation is likely to be particularly beneficial for small food processing firms. This applies especially to downstream firms, such as own-branded or final good producers, operating in the industrial food value chain, where economies of scale are likely to arise, but also smaller producers gourmet preparations seem to benefit from the value chain.

The remainder of the paper is organized as follows. Section 2 presents five stylized facts characterizing the Italian food sector. Section 3 describes the data and the descriptive statistics, while econometric results are in Section 4. Section 5 concludes, drawing some policy implications.

2. Stylized facts

The agri-food industry is increasingly global and organized in international production networks. This makes it an interesting case to study. Let us single out the main stylized factors of the sector.

> *STYLIZED FACT 1*: The food value chain tends to be buyer-driven, with large retailers as lead firms. It has relatively long production and retail chains. At the international level, the food value chain has a global reach.

Evidence from recent studies using a GVC approach highlighted a number of specific features that characterize the agri-food value chain. Even though our explicit focus is on food manufacturers, that is on a subset of all the parties that participate to the broader agri-food value chain, findings from the above mentioned studies provide a few important stylized facts.

In general, participants to a value chain may have different interests and different incentives. Hence understanding the governance structure is fundamental. There are many factors that can affect it, such as technical reasons related to the specific production process and other market characteristics.

The international reach, the number of parties involved, the type of lead firms, the role of small players and the degree of market concentration all represent important factors to consider in order to characterize the structure of a value chain.

The agri-food value chain has been characterized by an intense restructuring process that has reshaped its structure over the last decades. Recent evidence suggests that, over time, power has shifted towards downstream firms in the production process, and even more strongly towards downstream firms in the distribution process, such as large-scale retail (LSR) distributors, e.g. supermarkets (Lee *et al.*, 2012).

The resulting governance structure is the consequence of a continuous process of market concentration. It started from retailers, who progressively increased their sourcing needs. This in turn required an increased level of coordination, which was more effectively pursued by coordinating a relatively small number of large suppliers better fit to exploit economies of scale, developing private standards and own-brand products. The current food value chain tends to be characterized by a relatively concentrated market and even monopsony in distribution (Burch and Lawrence, 2005; Humphrey and Memedovic, 2006).

In terms of governance, the agri-food value chain tends to be buyer-driven; however, a large fraction of the value continues to be added at the food processing stage, especially for own-branded downstream firms. For instance, margins (EBIT) are

found to be about 10-20% for food companies, while they tend to be much lower for pure retailers (KPMG, 2013).

Based on the recent literature, the agri-food value chain can be schematically represented as in FIGURE 1. The main features of the broader agri-food global value chain sketched above include a wide variety of activities from inputs suppliers, such as seeds, machinery and chemicals, to farming, processing, distribution and other food-related services (also financial inputs, not included in the diagram for simplicity, play an important role). Analyzing the specific governance structure of the entire value chain of a given product is thus a very complicated task and it is likely to be more accurately pursued with specific case studies, as is in fact the case of many of the above mentioned and related studies.

In what follows, we confine the analysis to manufacturers of food products, that is on firms labeled as upstream and downstream food processors in FIGURE 1. This choice is consistent with our research question and with our firm-level dataset.

Confining the analysis to food products, a characterizing feature of the food value chain is that it tends to involve a large number of firms and countries. Data from cross-countries input-output tables show that food products are characterized by relatively long production and retailing chains. This general feature is confirmed, for instance, for meat processors (Fally, 2012). Interestingly, while the patterns of specialization are different across countries in terms of distance from final demand, the stage of development does not seem to imply a particular role in the value chain: large food exporters are found in both developed and developing countries as well as in upstream and downstream activities. The above evidence is supported by recent findings, de Backer and Miroudot (2014) among others.

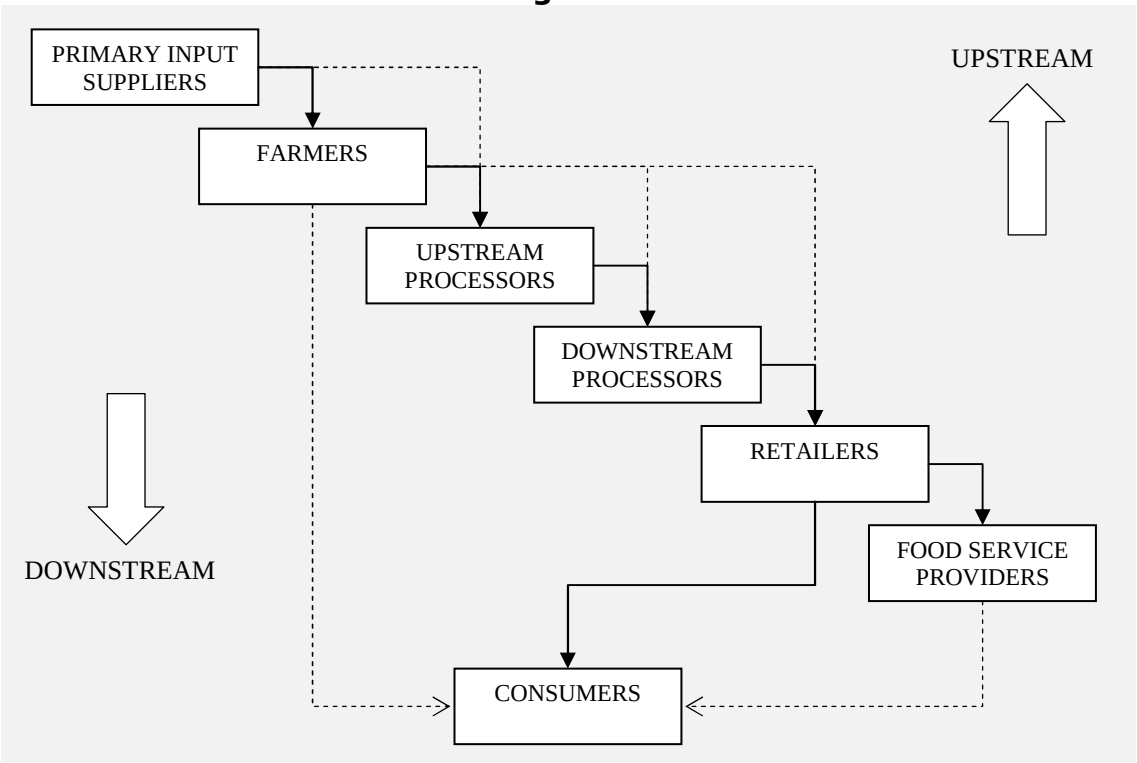
> *STYLIZED FACT 2*: Italy is one of the world largest exporters of food products. However, it has a trade deficit in food, it is not specialized in this sector where exporting firms are few and small . At the product level there is a relatively high degree of heterogeneity, with some high specialization products.

This suggests that Italy represents an interesting case.

The number of firms in the food products manufacturing sector is calculated to be about 55 thousands, employing some 395 thousands workers. The average margins (EBITDA) are about 33% of the value added, about 6 points higher than in all

manufacturing. The share of firms involved in export is around 12%, about half than in all manufacturing (ISTAT, 2015).

FIGURE 1: The agri-food value chain.



In particular, Italy is the 8th food (and beverages) exporter at the world level and the 5th at the European level. The other largest exporters being Germany, the Netherlands, France and Belgium.[4] However, while many Italian food products are renown and exported worldwide, trade data show that Italy is not specialized in food, and actually has historically had a trade deficit in the sector. Hence, Italy is a large food exporter, but also a large importer, with a trade deficit of about 570 euro millions in 2013 (ICE, 2014).

The normalized trade balance for food products is negative and significantly lower than France (deficit), Germany (surplus) or the EU 27 (slight surplus). However, , over time it shows an improvement from less than -0.2 in 2001 to over -0.1 in 2013 (authors' elaborations on EUROSTAT data).[5]

[4] Note that the Netherlands and Belgium are rather peculiar, being relatively small countries characterized by the presence of some important multnationals. France and Germany provide more appropriate references for Italy.

[5] The normalized trade balance is defined as (X-M)/(X+M), where X and M are exports and imports respectively. Food products are identified as those included in the number 10 of the 2-digit NACE classification. More detailed results available upon request.

A more accurate figure of the specialization level can be obtained by means of the Lafay index (Lafay, 1992), which takes into account the contribute to the overall trade balance, identifying as specialization sectors those with a relatively high normalized trade balance.[6] Positive values indicate specialization, while negative values despecialization; by construction the index sums up to zero.

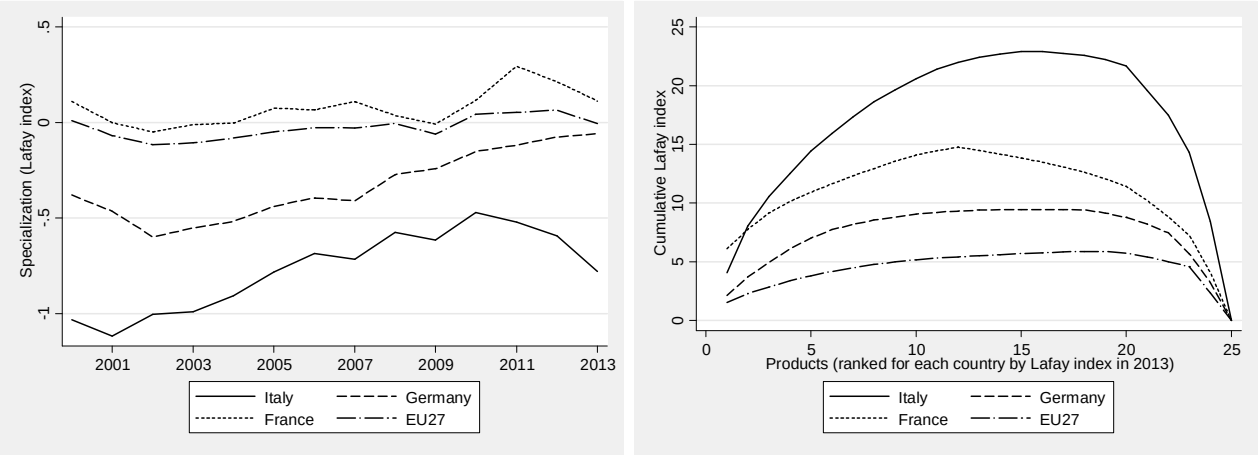
The Lafay index for the food sector is shown in FIGURE 2.a. Consistently with the normalized trade balance, Italy is found not to be specialized and its index is lower than that of France or Germany; moreover Italy seems to have increased its despecialization in the last years. It is worth noting that Germany, notwithstanding the trade surplus, is also despecialized, while the opposite is true for France.

The previous figures refer to food products as an aggregate. However, food products are rather differentiated and a finer level of detail might be more appropriate. In FIGURE 2.b we report the cumulative 2013 Lafay index computed at the product level for each of the 25 products included in the sector (at the 4-digit level). As noted above, by construction the Lafay index sums up to zero, thus if we order the products by level of specialization the result is an inverted-U curve. The increasing part of the curve corresponds to specialization products, while the decreasing part indicates despecialization products. Italy has the most pronounced inverted-U curve by far. This suggests that the Italian specialization is polarized at the product level within the sector: in some food products Italy is very specialized, while the opposite is true elsewhere.

[6] The Lafay index for a given sector is defined as L = [(x-m)/(x+m) - (X-M)/(X+M)] (x+m)/(X+M), where small case letters indicate exports and imports of the sector and upper case letters indicate overall exports and imports. In our case, the use of the Lafay index is preferable with respect to alternatives, such as the Balassa index, because it allows to take into account both import and export, a feature that is particularly relevant in a GVC context and for the caracteristics of the Italian food sector.

FIGURE 2: Italy's specialization in food products.

(a) Food sector Specialization (b) Food products specialization



Source: authors' elaborations on EUROSTAT data.

STYLIZED FACT 3: Italian imports and exports of food products have a relatively low degree of overlap at the sector level, and even lower at the product level. Italian exports of food products have a high domestic content and a low import content.

The findings about specialization suggest that Italy both imports and exports large amounts of food products within the sector, but also has a relatively high heterogeneity between products. To get a more precise idea of the extent to which import and export overlap, we can consider intra-industry trade (IIT).[7]

Evidence about IIT is informative. On the one hand, it provides hints about the level of world trade integration. On the other hand, a high IIT may indicate a relatively high level of import competition. Note also that if a country is strongly integrated into GVC, then it is likely to trade inputs and outputs also within the same sector and thus show high levels of IIT. Although this is not necessarily the case (for instance IIT may be simply due to love for variety), it may still represent a first approximation of GVC participation, especially considering that we already know from other studies that the food GVC is rather relevant.

In FIGURE 3.a, we show the IIT for the aggregate food sector. IIT is generally very high, ranging between from 80 to almost 100%. The time trend is interesting. In 2001 Italy had an IIT of less than 80%, substantially lower than that of France and Germany, which were above 98%. Italy has then significantly increased its IIT, while

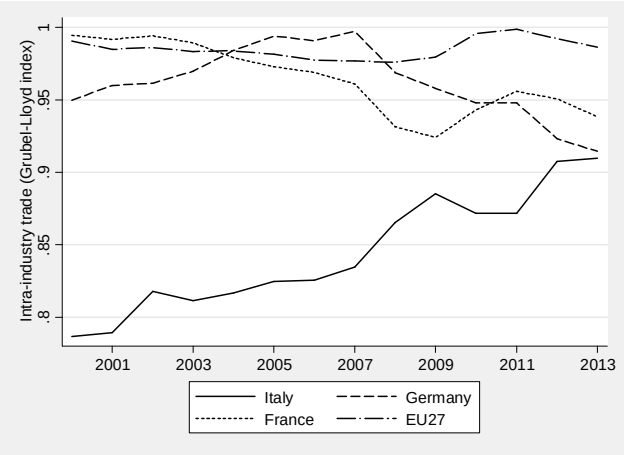
[7] IIT is measured by the Grubel-Lloyd (1971) index, which calculated as GL = 2 min(X, M)/(X+M). The index is 0 if there is no overlap between import and export and 1 if the overlap is perfect.

France and Germany have decreased it. In 2013 Italy, France and Germany converged to about 92-94%, but Italy still remains the country with the lowest level of IIT. For Italy, the increase in IIT is due to a stronger increase in export than in import, which is clearly consistent with the observed reduction in despecialization.

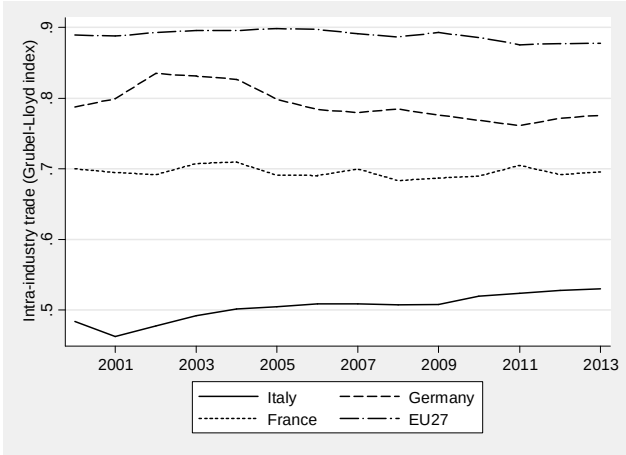
Considering IIT at the product level, we see even clearer differences between countries.[8] Italy now shows a level of IIT (about 50%) much lower than France and Germany, and there is no evidence of convergence. Product-level IIT is very stable over time. France stays at about 70% and Germany just below 80% (FIGURE 3.b). The low level of IIT for Italy is compatible with a relatively low import content of export, possibly due to a low level of GVC participation or with a focus on high value added activities.[9]

FIGURE 3: Italy's intra-industry trade in food products.

(a) Food sector intra-industry trade



(b) Food products intra-product trade



Source: authors' elaborations on EUROSTAT data.

To have a more direct evidence of GVC participation at the country level, detailed cross-country input-output data would be necessary. This kind of data would make it possible to build sector or even product-level measures of the domestic and foreign content of exports. Some data is available, but, unfortunately, the level of detail currently available includes food product, beverages and tobacco altogether. In FIGURE 4 we report domestic and foreign content of exports, measured in value added as a share of exports, for the five largest European food exporters. Results are consistent, the low level of IIT is matched with a high domestic content of export,

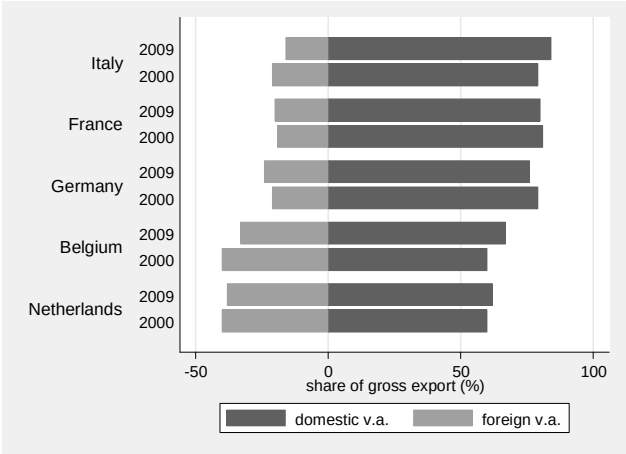
[8] The product-level IIT is calculated as a weighted average of the individual product-level IIT indexes.

[9] Italian food exports go for about one third towards non-EU27 destinations, while only about one fourth of food imports comes from outside EU27 (EUROSTAT data). The fact that imports are less geographically disperse than exports, and both are quite concentrated within Europe, is also consitent with a relatively low or not globally integrated GVC participation.

higher than 80%, and a low foreign content; moreover, the domestic content has increase over time.

Considering the described evidence, we can say that: either Italy has a relatively low degree of GVC participation or it integrates into GVC by focusing on relatively high value added activities or a combination of the two.

FIGURE 4: Domestic content of export in food products, beverages and tobacco.



Source: authors' elaborations on OECD data.

> *STYLIZED FACT 4*: In the food value chain, quality based competition is important. Italian high quality firms are more likely to export. Italy has higher export prices than import prices and the differential has increased over time. Italian food products prices show a high degree of heterogeneity.

As for the food sector, the rise of GVC has triggered an increased attention to food standards, safety and quality. In particular, in response to an increased level of quality competition, also due to more informed consumers, retailers requirements have become more stringent and the need for vertical coordination has increased (Lee *et al.*, 2012). This has led to the proliferation of own-branded products, certifications and food standards.[10] There is even evidence of a switch from product standards to process standards, requiring even narrower controls of all the phases of the vale chain. This means that not only the final outcome is subject to controls, but even the

[10] Note that some public food-safety standards are sometimes regarded as non-tariff barriers to trade. Thus, this issue is related to both the GVC governance, international trade and policy. For a discussion see Beghin *et al.* (2015).

very production process in its various stages. A typical example is the mandatory HACCP for dairy products (Humphrey and Memedovic, 2006).

High quality goods are usually highly priced, especially if the quality of inputs is high and there are many controls to pass. Unfortunately, product prices are not usually available to researchers, especially at the firm level. Also for this reason, the use of certifications represents a valid alternative proxy for quality in empirical works. Recent studies on the Italian food industry have, for instance, employed certifications to identify high-quality food products. Examples are products such as those typically referred as "made in Italy", having the "Protected Designation of Origin" or the "ISO 9000" certification. Recent findings employing firm-level data show that Italian food firms producing "certified" high-quality products are more likely to export, they export more and reach more distant and richer destinations (Curzi and Olper, 2012).

To contrast the lack of price data, we can use unit values (UV), a proxy of the average price on the international market. The trade literature usually uses UV to gauge product quality. Though imprecise, UV can provide preliminary evidence of the existence of price/quality differentiation within the sector.

Data from EUROSTAT show that, when compared with other countries, Italian food products have very high UV: in 2013, Italy exported at more than 160 Euros per 100 kg, while exports from France, Germany and the EU27 were paid around 20 Euros less. On the import side, Italian UV are in line with Germany (less than 140 Euros per 100 kg) and about 10 Euros below France. Over time Italy has increased its gap in export UV and it is the country with the largest export-import UV differential among those analyzed.

The figures above refer to the aggregate sector, but also product-level heterogeneity must be considered. In FIGURE 5, we report price indexes based on the individual UV computed for each of the 25 products included in the food sector at the 4-digit level. Even at the product level Italian export UV of food products have increased significantly more than import UV (+60% vs. +25% using 2000 as the base year). Note that this change is likely to be underestimated, if highly priced goods tend to increase their weight in the export bundle and/or decrease it in the import bundle.

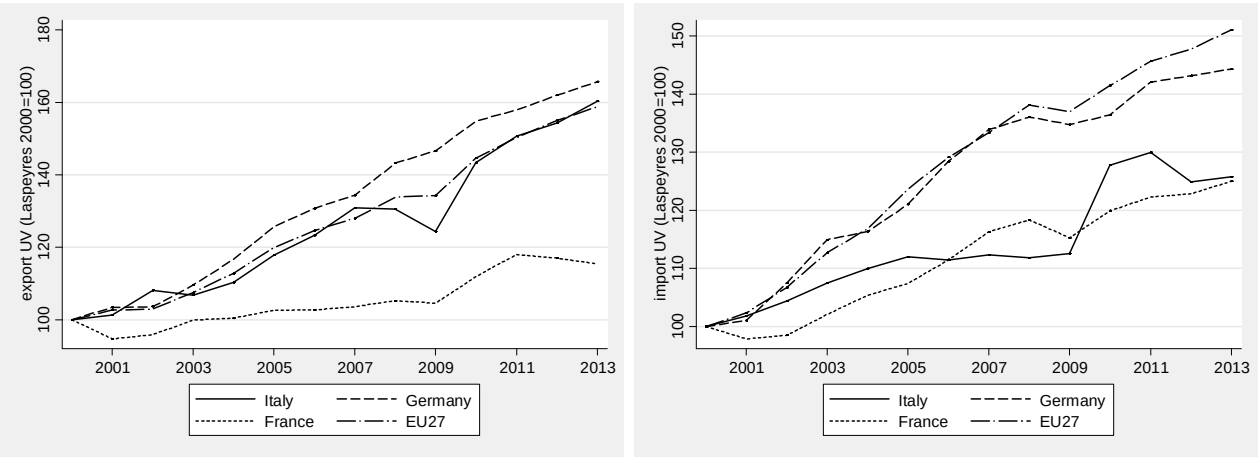
FIGURE 6 provides evidence of the higher level of heterogeneity between products for Italy with respect to France and Germany. This heterogeneity is clearly reflected in product UV relative to EU27. A relative UV greater than one indicates that the product is traded by the country at an average price higher than for the EU27, and vice versa.

Italian food products have two characteristics: first, the median product UV is greater than one and slightly greater than for France and Germany; second, the distribution has a much wider range, particularly for export.

Our findings show that Italy has gradually reduced its despecialization and simultaneously increased its already high export UV, remaining one of the largest food exporters. In line with Curzi and Olper (2012), which maintain that product quality plays an important role in the export performance of Italian food exporters, this might be consistent with a quality upgrading or with an increased importance of some successful highly priced goods, rather than with higher production costs or reduced levels of efficiency.

FIGURE 5: Export and import product-level UV indexes.

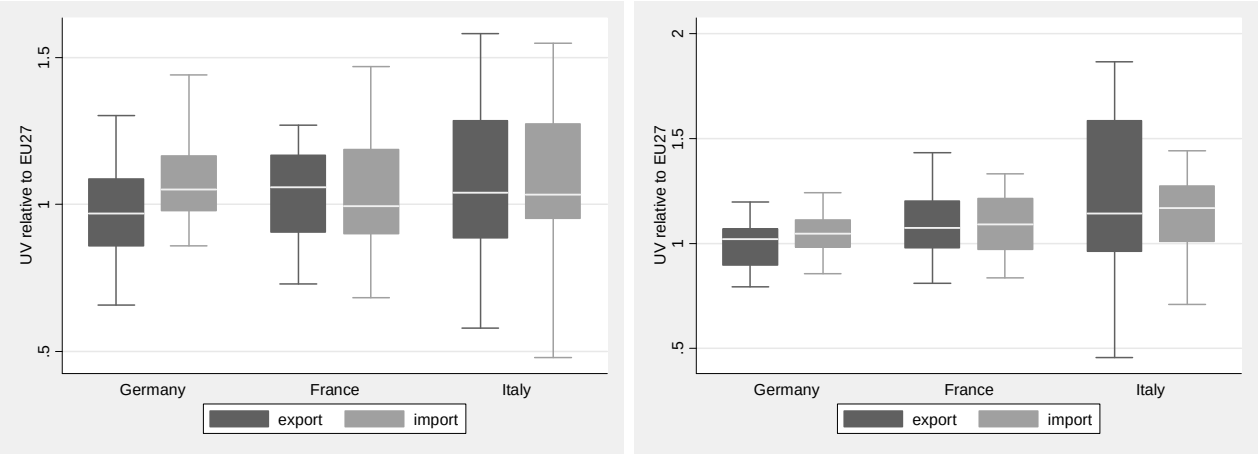
(a) Export UV (b) Import UV



Source: authors' elaborations on EUROSTAT data.

FIGURE 6: Distributions of product-level UV relative to EU27 (2013).

(a) 2000 (b) 2013



Source: authors' elaborations on EUROSTAT data.

STYLIZED FACT 5: In a GVC, small firms risk to be marginalized if they are not able to upgrade. Italian food processors are very small, even smaller than in the rest of manufacturing: almost 88% of firms have less than 10 employees and the average number of persons employed is 7. Small and medium firms account for more than 60% of exports.

The last piece of evidence regards firms size. In a food GVC that tends to be buyer-driven and concentrated, small firms face an increasing risk of marginalization (Lee *et al.*, 2012). bBut small firms may find in the value chain the right place to upgrade, further develop their specific comparative advantage and/or the opportunity to focus on niche high-quality segments (Dentoni and Reardon, 2010; Humphrey, 2005).

This is particularly relevant for Italy, characterized by a firms distribution typically skewed towards small firms. Italian small and medium firms largely contribute to the overall productive structure, employment and export (Barba Navaretti et al., 2011). They contribute to more than 60% of exports of food products, while for aggregate manufacturing they account for less than 50% (ISTAT, 2015). In TABLE # we add some more detail to the numbers provided above about the number of firms and their employment. Italy and France have a distribution of firms that is strongly skewed towards small and micro firms. Italy has the lowest number of persons employed per firm, on average 7, lower than the number for aggregate manufacturing (on average 9).

This specific feature of the Italian productive structure poses a challenge for the entire food processing industry. Small firms, especially in a despecialization sector open to international competition, may risk to remain confined to marginal roles or even to be left out of GVC. Understanding the specific needs of small firms is a necessary step in order to devise specific policies that are likely to have a strong impact on the entire food industry. Evidence specifically focusing on small firms is scant, mainly due to lack of data. For Italy, for instance, the above mentioned study by Curzi and Olper (2012) only considers firms above 10 employees (recall that the average firm has 7 persons employed). One contribution of this paper is to provide a focus also on small and micro firms.

TABLE 1: Number of food processing firms and employment (2012).

	Italy	France	Germany
NUMBER OF FIRMS BY CLASS OF EMPLOYMENT			
1-9	87.5	89.1	52.5
10-19	7.8	6	31.3
20-49	3.3	2.9	7.1
50-249	1.2	1.6	7.3
≥250	0.2	0.4	1.8
Total	100	100	100
Total Number	55,100	57,475	29,106
Share of manufacturing	13.2	26.4	14.3
NUMBER OF PERSONS EMPLOYED			
Total Number	394,042	561,001	814,811
Share of manufacturing	10.2	18.5	11.4

Source: authors' elaborations on EUROSTAT data.

3. Data and descriptive statistics

Our firm level dataset is based on a 2011 survey of 25,090 Italian firms operating in manufacturing and related services. The survey, conducted by MET s.r.l., provides information on various characteristics of firms over the period 2009-2011. For an accurate description of the dataset we refer to the Appendix and Giovannetti *et al.* (2015). Here we discuss our variable of interest: how the survey captures participation to a value chain. We also present the main descriptive statistics.

The existing literature does not provide a standard definition of value chain. In general, a value chain is defined having in mind an input-output structure including a range of value-added activities that take into account all the phases that are required to bring a product to the final market (WTO, 2013; Baldwin and Lopez-Gonzales, 2013; Gereffi et al., 2001).

Note that this is a very general definition, and it is difficult to imagine a firm not participating to some degree in a value chain. This broad definition is therefore useful if we want to characterize a specific production process or industry, understand the governance structure, or if we want to determine the "upstreamness" of a firm or a country. Under such a broad definition, it is even difficult to discriminate whether a given firm belongs to a local or a global value chain, since participating in GVC does not necessarily imply being an importer or an exporter, or more generally internationalized: it depends on the particular configuration of the chain and on the specific role of the firm. Hence, some further specifications are required if we are

interested in firms' specialization on particular tasks within the chain, also considering the specific relations that can arise between firms and internationalization.

The definition used in this paper is based on a direct measure of value chain participation. In the survey, firms are first asked whether they belong to a specific value chain and then they are required to specify the type of value chain productions in which they are involved. To answer positively to the first question, a firm must satisfy three requirements: it has to be specialized in specific productions within a value chain, its involvement must be continuative and the majority of the turnover must come from value chain productions. It is then clear that the definition at hand is rather restrictive and excludes all firms that are either not focused on specific productions within a value chain or that entertain non-continuative relations with other actors, or whose main activity does not regard a value chain.

Note that nothing is said about internationalization or the type of relations with other firms. In fact, our definition of a value chain is focused on the production process alone, while information about internationalization and relations with other firms comes from other questions.

According to the above definition, firms belonging to a value chain are over 11% of our total sample, a majority of which (71.2%) are manufacturers. The share of exporters (firms involved in either direct or indirect export, that is through intermediaries, in the last three years) is 25.4% and it rises to 45.5% for firms in a value chain.

Food processing firms are 1,599, about 6.4% of the sample.[11] As regarding to value chains, food processors are twice as likely to be in a value chain (more than 21%) with respect to the rest of firms (about 10%). More detailed inspection reveals that the food sector is actually one of the sectors with the highest number of firms participating in a value chain, the others being textile and apparel (21.8%) and mechanics (15.3%). The share of exporting food firms is 17%, which raises to 29.7% for firms in the food value chain. Note, however, that this shares are well below the averages for the whole sample.

In TABLE 2 we report the distribution of firms by employment class for the for food processing firms and the rest, and the share of exporters by value chain participation. Our sample is in line with the official statistics: food firms tend to be particularly

[11] Note that while the vast majority of firms in the food value chain are food processing firms, this is not necessarily the case, as a non-food firm can supply non-food products for the food value chain.

small, almost 78% of them have less than 10 employees. The comparison of the two export columns suggests that belonging to a value chain increases the share of exporters, particularly for smaller firms. This seems to apply more strongly to micro-firms in the food sector. Moreover, while in the food sector the share of exporters is generally smaller than for the whole sample, it is actually higher for larger food firms.

TABLE 2: Share of exporters by class of employment

Class of employment	Number of firms	Number of exporters		
		Value chain	No value chain	Odds
FOOD PROCESSING FIRMS				
1-9	77.67	14.4	5.0	2.9
10-49	16.2	47.5	46.4	1.0
50-249	4.94	71.9	61.7	1.2
≥250	1.19	88.9	90.0	1.0
Total	100	29.7	13.6	2.2
Total Number	1,599	100	172	
OTHER FIRMS				
0-9	60.38	23.4	11.7	2.0
10-49	25.27	54.0	37.4	1.4
50-249	10.93	73.9	52.8	1.4
≥250	3.41	75.7	61.9	1.2
Total	100	48.1	23.5	2.0
Total Number	23,491	1117	4977	

The survey also allows us to distinguish between the food industrial value chain and the high quality/gourmet value chain.[12] This information is relevant in order to better control for positioning of firms. More than half of processors in the food value chain operate into the gourmet segment (about 57%), while some 45% operate in the industrial food value chain. The two types of food value chain show a different distribution by firm size: within the gourmet value chain small processors are common (78% of firms have less than 10 employees, in line with the overall distribution), while within the industrial value chain larger firms are more represented (46% of firms have less than 10 employees). This feature seems to suggest that the gourmet value chain is likely to be focused on niche artisanal productions.

An important information, complementary to that about production chain participation, comes from the consideration of the retailing chain. For food processors especially, participation in LSR distribution chains (e.g. supermarkets) seems of

[12] Firms in the food value chain are directly asked to select the kind of value chain in which they operate. Note, however, that the survey does not convey any specific definition of industrial and high-quality/gourmet food value chains.

particular importance, also as a possible mean for reaching the international market. About 9.5% food processors sell their products prevalently through LSR distribution chains. Not surprisingly, participation in LSR distribution chains is more common when firms are in a value chain, as the share increases to more than 16%. In terms of export, participation in LSR distribution chains has a very strong effect as it is found to increase the share of food exporters to more than 50% from less than 14% for food firms not in LSR distribution chains.

As regarding to positioning of firms, from our data we know for each respondent the share of total sales by type of product (final vs. intermediate) and to which extent each firm produces for other firms or on its own. We therefore distinguish three different types of firms: 1) a *final-good producer*, a firm whose sales are entirely constituted by final consumption and final industrial goods; 2) a *subcontractor*, a firm which works only on a contractual basis for other firms; and 3) a *"own-branded" firm*, a firms that sells own-designed proprietary products (i.e. a firm that designs its own products, final or not, and retains the industrial property, either with or without patents).[13]

The distribution of food processing firms is skewed towards downstream activities with respect to non-food firms, showing a much lower share of subcontractors (9% versus 34%) and a much higher share of own-branded and final firms (72% and 75% versus 52% and 38%, respectively). Firms in the food value chain show a higher share of subcontractors (12%) with respect to firms outside the value chain (8%). On the contrary, for non-food firms there seems not to be significant difference. The descriptive analysis suggests that Italian food processing firms tend to occupy upstream positions, but also to increase their role as subcontractors when participating in the food value chain. Descriptive statistics by type of food value chain and firm positioning are reported in the first part of TABLE 2.

The share of exporters is generally much higher for firms in a value chain both for food and non-food firms. Moreover, it tends to be higher among firms occupying upstream positions . For food processing firms, the industrial and the gourmet food value chains look very different: firms in the industrial value chain show a very large premium in terms of share of exporters with respect to gourmet value chain firms. The latter even seem to be penalized if they are subcontractors, which is possibly due

[13] The same definition is used in Giovannetti *et al.* (2015).

to the high concentration of gourmet value chain firms towards the small size, which even more pronounced for subcontractors (83% of firms have less than 10 employees).[14] The shares of exporters along the value chain are reported in the second part of TABLE 3.

Overall descriptive statistics on our firm level data confirm that food processors tend to be smaller and export less than firms on other sectors. The share of food exporters increases substantially with firms participation in value chains and with participation in LSR distribution. The gourmet value chain is characterized by an even smaller size of firms, suggesting a niche with artisanal connotation, but also possibly implying a higher risk of marginalization. Finally, Italian food processing firms tend to occupy downstream positions.

TABLE 3: Firms positioning along the value chain

	Share of firms			Share of exporters		
	Subcon.	Own-brand	Final prod.	Subcon.	Own-brand	Final prod.
FOOD PROCESSING FIRMS						
Value chain	12.2	65.3	76.3	22.0	32.7	28.4
food industrial	15.7	65.4	73.9	29.2	46.0	45.1
food gourmet	9.4	64.4	78.5	11.1	22.7	16.7
No value chain	8.1	74.3	74.6	15.7	13.6	14.6
OTHER FIRMS						
Value chain	34.2	45.7	38.3	34.8	55.8	55.4
No value chain	34.0	52.4	38.3	18.6	24.7	31.0

4. Empirical analysis

In this section we directly tackle our research question through econometric analysis. We are interested in assessing the what extent, if any, participating in a value chain is associated with a higher probability to export. The focus is food processing firms.

Our baseline model to explore the relation between exporting and value chain participation is a standard probit model where the dependent variable is the exporter status dummy and the main controls are firm level characteristics regarded by the literature as the most likely to affect the export probability of firms. We augment this model with some value chain specific indicators, which are our variables of interest. Our primary indicator is the food value chain participation dummy. We also introduce

[14] In our data there are actually no subcontractors in the gourmet value chain with more than 50 employees.

proxies for firms' positioning within the value chain (i.e. upstream or downstream). These proxies correspond to the three dummies reported in the descriptive statistics, e.g. subcontractor, own-branded firm and final good producer. Finally, we also consider participation to LSR distribution chains (e.g. supermarkets).

We proceed by steps. First, we provide a broad evidence about export and value chain participation comparing the food and non-food value chains. This is done by means of a pooled regression on the whole survey sample in which we assume that the same model holds for all types of firms, except than for sectoral fixed effects. Second, in line with expectations from the literature showing that different value chains may have different configurations, we focus on food processing firms only, thus performing a food sector specific model. Third, building on the main findings from heterogeneous trade literature, we estimate and introduce total factor productivity into the analysis as a possible determinant of export.

TABLE 3 shows the descriptive statistics for the variables used on the econometric analysis. Correlations matrices reported in the appendix show that there are no apparent collinearity concerns.

TABLE 4: Descriptive statistics on variables used in the econometric analysis

	Whole survey		Food processors		TFP sample	
Export	0.254	(0.435)	0.170	(0.376)	0.403	(0.490)
Food VC	0.018	(0.133)	0.211	(0.408)	0.023	(0.151)
Food VC industrial	0.009	(0.093)	0.096	(0.294)	0.015	(0.122)
Food VC gourmet	0.010	(0.098)	0.119	(0.324)	0.009	(0.094)
Other VC	0.093	(0.291)	-	-	0.134	(0.341)
LSR (supermarkets)	-	-	0.095	(0.293)	-	-
Subcontractor	0.324	(0.468)	0.089	(0.285)	0.291	(0.454)
Own-branded firm	0.531	(0.499)	0.724	(0.447)	0.548	(0.498)
Final good producer	0.406	(0.491)	0.750	(0.433)	0.436	(0.496)
N. employees (ln)	2.005	(1.592)	1.660	(1.179)	2.919	(1.474)
Domestic network	0.229	(0.420)	0.183	(0.387)	0.269	(0.443)
International network	0.038	(0.191)	0.024	(0.152)	0.057	(0.233)
Product innovation	0.079	(0.270)	0.051	(0.219)	0.115	(0.319)
Process innovation	0.064	(0.246)	0.033	(0.177)	0.090	(0.286)
Group	0.113	(0.317)	2.778	(1.055)	0.174	(0.379)
Age (ln)*	2.801	(0.852)	0.051	(0.221)	3.073	(0.589)
TFP (ln)	-	-	-	-	4.061	(0.942)
Number of sectors	80		1		63	
Number of regions	20		20		20	
Number of firms	25090		1599		7590	

Standard deviation in parenthesis.
* Age (ln) is available for 23796 firms in whole survey.

4.1 Food and non-food value chains

We first assess the relation between export and the value chain considering the whole survey sample. Analyzing together both food processing firms and firms from other sectors of the economy, and applying the same model to all firms, has two advantages[15]: first, we can compare the value chains in the food and non food industry and single out possible differences; second, a pooled model provides a general picture of the relations between our control variables and export, thus constituting a benchmark against which we can then evaluate food processing firms.

Let us estimate:

$$(1) \quad Pr(Y_i = 1) = \Phi(a + \beta_1 FVC_i + \beta_2 OVC_i + \beta_3 POS_i + \beta_4 X_i + \gamma_i + \delta_i)$$

where $Y_i=\{0,1\}$ is the export dummy for firm i,[16] $\Phi(\bullet)$ is the c.d.f. of the standard normal distribution, a is the constant term and γ_i and δ_i are region and sector effects.[17] Participation to the food and other value chains is captured by the FVC_i and OVC_i respectively, while POS_i is a vector of the three dummies capturing the upstream or downstream position of the firm, i.e. subcontractor, own-branded firms and final good producer. Other controls (X_i) include main variables that are standard in the literature such as size of the firm, age, group, innovation and network participation (see for instance Barba Navaretti et al., 2011; Giovannetti et al., 2013; Bartoli et al., 2014). Note that in our case network participation also has the important role to discriminate the specific production relations arising within the value chain from other types of intra-firms activities not directly related to the production process (e.g. collaborations with universities and other institutions, shared R&D etc.).[18]

We start by providing evidence on the conditional means by running a set of basic regressions including only value chain dummies, a dummy for the food sector, a dummy for small firms (less than 50 employees) and region fixed effects. Since there are no other firm level controls, the aim of this regression is simply descriptive. Results from this descriptive regression are useful in order to judge the effect of the inclusion of our firm level controls.

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[15] Of course, another advantage is that we also have a higher number of observations.

[16] Recall that direct and indirect exports are considered. This enhances consistency with firm's positioning within the the value chain, given that upstream or downstream actors are likely to have different degrees of proximity to the market.

[17] The number of Italian regions is 20 and the number of sectors at the 2-digit level is 80.

[18] The network variables that we employ are built so to be mutually exclusive: firms are classified by the broader type of network in which they operate.

TABLE 5 reports results from the basic regressions. In line with Giovannetti *et al.* (2015), firms participating in any type of value chain are more likely to be exporters. Conditional on size and value chain participation, food processing firms are found to have a lower share of exporters with respect to firms in other sectors. This is consistent with the official statistics reported above showing that Italy is not specialized and there are a large number of small firms in the sector. The negative sign of the small firm dummy (less than 50 employees) is fully expected and in line with the literature on heterogeneous firms (Bernard *et al.*, 2007; Bernard *et al.*, 2011). In columns (2) and (3) we split our sample based on this dummy. Results are rather robust for the two subgroups. Notable difference regard the VC coefficients, which seems to be larger for small firms; the food sector dummy, which does not show any significant difference between food processing firms and the rest for medium-large enterprises; and, as expected, the constant term, which signals that medium-large firms are on average more likely to export than small firms.

In colums (4)-(6) of TABLE 5 we repeat the analysis replacing the food VC dummy with the two types of food VC available in our data, industrial and gourmet. All previous results are confirmed. The higher level of disaggregation, however, allows us to see that firms participating in an industrial food VC are the most likely to export, while gourmet VC firms seem less likely to export and not significant difference is found with respect to medium-large firms outside the value chain (recall from the descriptive analysis that the gourmet VC is characterized by a higher number of small firms).

TABLE 5: Basic regressions on the whole sample

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Export	All	Small	Med-large	All	Small	Med-large
Food VC	0.511***	0.509***	0.444**			
	(7.18)	(6.58)	(2.21)			
Food VC industrial				0.693***	0.710***	0.484**
				(7.46)	(6.79)	(2.19)
Food VC gourmet				0.318***	0.326***	0.340
				(3.30)	(3.23)	(0.92)
Other VC	0.518***	0.525***	0.503***	0.519***	0.526***	0.504***
	(17.84)	(15.81)	(8.32)	(17.86)	(15.82)	(8.32)
Food Sector	-0.278***	-0.322***	0.221	-0.277***	-0.321***	0.216
	(-6.24)	(-6.80)	(1.40)	(-6.25)	(-6.81)	(1.37)
Small firm	-0.964***			-0.962***		
	(-39.70)			(-39.60)		
Constant	0.253***	-0.744***	0.411***	0.251***	-0.745***	0.410***
	(6.45)	(-20.06)	(4.97)	(6.38)	(-20.07)	(4.96)
Observations	25090	21622	3468	25090	21622	3468
Pseudo R-squared	0.113	0.044	0.056	0.113	0.044	0.056

t statistics in parentheses
All models have region f.e.
* p<0.1, ** p<0.05, *** p<0.01

Now that we gathered basic evidence about export, food processing firms and value chain participation, we add other firm level controls. In particular, in TABLE 6, we add the three positioning dummies, namely, subcontractor, own-branded firm and final good producer. We replace the small firm dummy with the actual number of employees (in log). Moreover, we introduce controls for network participation, innovation, group and age. All this controls are in line with the most recent evidence from the heterogeneous firm literature (Wagner, 2012; Antràs and Yeaple, 2014).

We find a negative coefficient for subcontractors and for own-branded firms, with the latter being quite small in absolute value. On the contrary, final good producers seem more likely to export, other thing equal. This is not surprising and in line with recent evidence showing the existence of a subcontracting discount, at least for Italian firms (Razzolini and Vannoni, 2011).

As expected, firm's size is found to be positively correlated with the likelihood of being an exporter. Similarly, firms in international networks are also more likely to export. Interestingly, firms participating only in domestic networks are found to be less likely to export. While this is not our main focus here, we stress that, while this may be due in part to a lower level of competitiveness, it is not necessarily so for all firms in domestic networks, since it may simply signal a strategic choice of some

firms, that is to focus on the domestic market (Di Giacinto *et al.*, 2014; Chiarvesio *et al.*, 2010; Duranton and Overman, 2008).

Innovation, not surprisingly, has a positive correlation with the probability to export, especially product innovation; process innovation instead to a lesser extent. Finally, group and age are positively correlated with export.

In columns (2)-(5) of TABLE 6, we add the food industrial and gourmet VC dummies; additionally, as we did above, we split the sample by size of the firm, now also adding a separate regression for micro firms (below 10 employees).

Results are robust across models. Few comments arise from the comparison between firms of different sizes. First, the value chain coefficients tend to be larger for smaller firms, especially for food processing firms and even more so for the gourmet value chain, whose coefficient are positive but not significant for med large firms. Second, the negative sign for subcontractors seems to be mainly due to smaller firms, while the negative sign for domestic networks seems due to larger firms.

All in all, firm size seem to be one of the most important variables affecting the probability to export both alone and in conjunction with other characteristics of the firms.

TABLE 6: Baseline model for the whole sample

	(1)	(2)	(3)	(4)	(5)
Dep. Export	All	All	Micro	Small	Med-large
Food VC	0.324***				
	(4.08)				
Food VC industrial		0.428***	0.582***	0.401***	0.519**
		(4.22)	(3.59)	(3.53)	(2.10)
Food VC gourmet		0.216**	0.305**	0.185*	0.106
		(2.01)	(2.16)	(1.67)	(0.25)
Other VC	0.257***	0.258***	0.337***	0.301***	0.195***
	(7.51)	(7.53)	(5.79)	(7.75)	(2.65)
Subcontractor	-0.224***	-0.225***	-0.305***	-0.271***	-0.064
	(-6.83)	(-6.85)	(-6.25)	(-7.56)	(-0.78)
Own-branded fimr	-0.079***	-0.080***	-0.207***	-0.133***	0.122*
	(-2.64)	(-2.64)	(-4.64)	(-4.04)	(1.68)
Final-good producer	0.229***	0.229***	0.217***	0.236***	0.260***
	(10.17)	(10.17)	(6.47)	(9.64)	(4.67)
N. employees (ln)	0.251***	0.251***			
	(31.02)	(30.96)			
Domestic network	-0.102***	-0.103***	0.046	-0.069**	-0.158***
	(-4.10)	(-4.13)	(1.23)	(-2.51)	(-2.71)
Foreign network	1.279***	1.278***	1.388***	1.350***	1.056***
	(22.08)	(22.05)	(16.01)	(21.48)	(7.57)
Product innovation	0.622***	0.622***	0.629***	0.651***	0.649***
	(15.48)	(15.48)	(9.34)	(14.09)	(7.97)
Process innovation	0.184***	0.184***	0.143*	0.186***	0.395***
	(4.13)	(4.13)	(1.77)	(3.49)	(4.77)
Group	0.228***	0.227***	0.397***	0.378***	0.333***
	(6.94)	(6.91)	(5.65)	(8.93)	(6.14)
Age (ln)	0.082***	0.081***	0.076***	0.167***	0.031
	(5.30)	(5.25)	(3.78)	(10.52)	(0.71)
Constant	2.765	2.770	3.097	2.634	-0.790
	(0.02)	(0.02)	(0.02)	(0.03)	(-1.48)
Observations	20726	20726	11621	17485	3201
Pseudo R-squared	0.254	0.255	0.126	0.170	0.276

t statistics in parentheses
All models have region and 2-digit sector f.e.
* p<0.1, ** p<0.05, *** p<0.01

4.2 Food processing firms

The results for the whole survey allow us to set a benchmark for the expected conditional correlations and to compare, to some extent, food processing firms with the rest. In this section we concentrate on food processing firms only. This has pros and cons: if on the one hand, it allows for a food sector specific model, and this seems appropriate, given the evidence from studies about the food value chain pointing out

that there may be some important specificities;[19] on the other hand, the economic analysis must deal with a reduced number of observations, which is likely to affect the significance of coefficients.

Our specification is in line with the previous one, the main difference is that, focusing on food processing firms only, we do not control for participation in chains different from food; however, we add an additional regressor that we expect to be particularly relevant in this sector, that is participation in LSR distribution chains (e.g. supermarkets):

$$(2) \quad Pr(Y_i = 1) = \Phi(\alpha + \beta_1 FVC_i + \beta_2 LSR_i + \beta_3 POS_i + \beta_4 X_i + \gamma_i)$$

where all variables are defined as in the previous section and LSR_i is a dummy indicating participation in large scale retail distribution chains (and, of course, there are no sector f.e.).

Results from regressions on food processing firms only are showed in TABLE 7.

Our previous findings are confirmed. In particular, the food VC is generally positively associated with export, especially for firms along the industrial VC. For the gourmet VC we find a positive non-significant, coefficient. It is worth noting that both VC coefficients are negative and non-significant for larger firms, and this is, at least in part, consistent with our evidence that the VC tends to benefit smaller enterprises. Interestingly, LSR emerges as the only significant variable for larger firms; however, food processing firms with more than 50 employees included in the regression are only 63, thus we do not speculate any further on this subsample.

Our "positioning" dummies do not seem to capture any particular relation with export. The same applies to domestic networks. The negative association found for the whole sample does not seem to hold for food processing firms.

[19] See the references from the stylized facts, in particular Lee *et al.* (2012), Burch and Lawrence (2005), Humphrey and Memedovic (2006) and de Backer and Miroudot (2014).

TABLE 7: Baseline model for food processing firms

	(1)	(2)	(3)	(4)	(5)
Dep. Export	All	All	Micro	Small	Med-large
Food VC	0.253**				
	(2.32)				
Food VC industrial		0.312**	0.739***	0.421***	-0.163
		(2.22)	(3.54)	(2.93)	(-0.31)
Food VC gourmet		0.185	0.204	0.136	-0.818
		(1.29)	(1.11)	(0.99)	(-1.19)
LSR (supermarkets)	0.465***	0.467***	0.609***	0.783***	0.975*
	(3.41)	(3.42)	(2.67)	(5.65)	(1.68)
Subcontractor	-0.167	-0.171	-0.423	-0.122	0.956
	(-0.84)	(-0.85)	(-1.45)	(-0.65)	(1.06)
Own-branded fimr	0.071	0.073	-0.138	0.011	1.139
	(0.56)	(0.58)	(-0.82)	(0.09)	(1.64)
Final-good producer	0.135	0.133	-0.015	0.084	0.473
	(1.18)	(1.17)	(-0.10)	(0.76)	(1.15)
N. employees (ln)	0.618***	0.615***			
	(13.29)	(13.15)			
Domestic network	0.003	-0.002	0.047	-0.024	0.474
	(0.02)	(-0.02)	(0.28)	(-0.21)	(0.94)
Foreign network	2.087***	2.080***	2.442***	2.151***	n.a.
	(5.80)	(5.78)	(4.98)	(6.26)	
Product innovation	0.477**	0.476**	0.829***	0.729***	1.100
	(2.31)	(2.30)	(2.72)	(3.41)	(1.29)
Process innovation	0.539**	0.547**	0.558	0.384	n.a.
	(2.12)	(2.15)	(1.56)	(1.46)	
Group	-0.092	-0.108	-0.598	0.189	0.243
	(-0.47)	(-0.55)	(-1.36)	(0.85)	(0.48)
Age (ln)	0.117**	0.116**	0.200***	0.287***	0.135
	(2.00)	(1.96)	(2.82)	(5.29)	(0.36)
Constant	-2.856***	-2.851***	-2.194***	-2.163***	-1.783
	(-9.38)	(-9.34)	(-5.63)	(-7.70)	(-1.01)
Observations	1478	1478	1061	1380	63
Pseudo R-squared	0.385	0.386	0.221	0.194	0.240

t statistics in parentheses
All models have region f.e.
* p<0.1, ** p<0.05, *** p<0.01

4.3 Total factor productivity

The above findings all point towards a positive correlation between export and supply chain participation for food processing firms, especially in the industrial food VC. One of the main variables associated with export is size of the firm. Firms of different sizes have different degrees of market power and different scope for economies of scale.

The literature on heterogeneous firms suggests that productivity is one of the main determinants of export. More productive firms are more likely to successfully afford the entry costs in the international market. The consequence of this mechanism is that exporters and firms pursuing other internationalization strategies are expected

theoretically to have on average higher levels of productivity. This result is indeed empirically verified. The main channels identified by the literature are due to selection effects, which seem the main, and to the fact that internationalized firms may further upgrade through positive spillovers and learning effects (for a review, see Wagner, 2012 and 2007, and Greenaway and Kneller, 2007).

Hence, we decided to check our model also controlling for firm level productivity. We claim that productivity is likely to be particularly important in our case, given our measure of value chain participation. In fact, as discussed previously in the paper, our value chain participation variables are quite restrictive and capture a continuative and rather specialized involvement of the firm the production process within the value chain. For this reason, we expect productivity and efficiency in production to be a major determinant of the possible gains of the firm from value chain participation.

In line with the literature on heterogeneous firms, we use total factor productivity (TFP) as a control variable. Measuring TFP requires estimation of the Solow residuals from a production function at the firm level (usually a Cobb-Douglas; see Van Beveren, 2012, for a review). The specific information we need, includes output, usually value added or sales, and production factors such as labor, capital and intermediate inputs. These variables are typically obtained from the balance sheets of the firms.

Unfortunately, our data do not contain a direct measure of productivity . In order to account for productivity therefore, we need to merge our survey data with some information, namely with balance sheet information from AIDA (Bureau Van Dijk).

After the merging procedure, we are left with 7,590 firms from all sectors, for which we can successfully estimate TFP. The loss in the number of observations is relevant, due to the fact that our original survey, being representative of the Italian production structure, includes a majority of micro and small firms for which balance sheet data are not currently available. After the merge, the share of small firms (below 50 employees) is reduced to 75.3% from 86.2%.

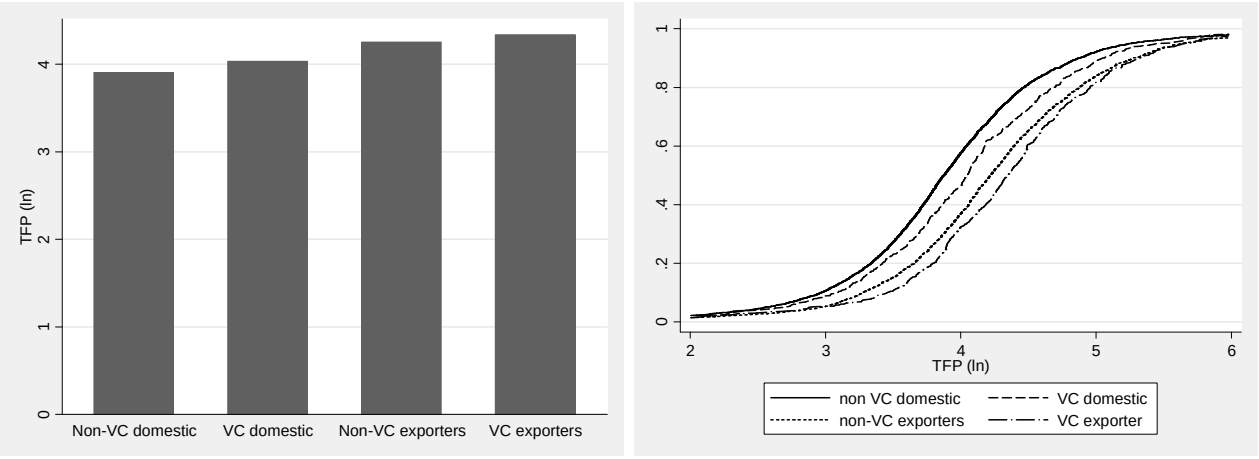
Introducing TFP into the analysis allows us to provide more robust evidence of the link between export and value chain participation. However, we lose important information on small firms, which our previous findings seem to indicate as the group that is more likely to gain from value chain participation. Hence, the following analysis must be considered as complementary to the one included in the previous sections.

The TFP is estimated following the estimation procedure proposed by Levinsohn and Petrin (2003), using intermediate inputs to proxy for unobservable productivity shocks.[20] This methodology seems particularly suited for our context, accounting for intermediate inputs. The same applies to our output variable: a value added based TFP measure is more likely to capture aspects of productivity that are the most relevant for value chain participation. We estimate TFP separately for each sector (and thus separately for food processing firms), so to take into account that different sectors are likely to have different production functions.

Our TFP estimates are in line with literature showing that there exists a hierarchy in terms of productivity by mode of internationalization (see, for instance, Wagner, 2012; Antràs and Yeaple, 2014). Our results show that exporters a clearly more productive than domestic firms. We add the value chain dimension to this stylized fact: for either domestic firms and exporters, firms participating in a value chain have a *premium* in terms of productivity. This is shown in FIGURE 7, where we display both the average levels of productivity (a) and its distribution (b).

FIGURE 7: Total factor productivity by export and value chain participation

(a) Average TFP by export and VC. (b) TFP distribution by export and VC.



Before actually augmenting our baseline model with the TFP estimates, we are interested in assessing the correlation between export and TFP. We expect this correlation to be positive.

In FIGURE 8.a, we show the estimated export probability from a basic pooled probit model with just TFP and dummies as regressors, that is:

[20] Other estimates, such as FE and GMM, produce similar results. For details we refer to Giovannetti *et al.* (2015).

$$(3) \quad Pr(Y_i = 1) = \Phi(\alpha + \beta_1 TFP_i + \beta_2 FVC_i + \beta_3 FS_i + \beta_4 OVC_i + \beta_5 OS_i)$$

where TFP_i is total factor productivity (in log), FS_i is a food sector dummy including all food processing firms not in a value chain, OS_i is a dummy for non-value chain firms from all the other sectors, and FVC_i and OVC_i have been already defined previously.

FIGURE 8.a shows that the relation between export and TFP is in fact positive. As expected, different types of firms have different estimated export probabilities. With respect to the rest of the firms not participating in a value chain, food processing firms tend to have a lower probability to export. Participating in a value chain increases the likelihood to export for both food processing firms and the others. Nonetheless, firms in the food value chain seem to maintain a lower export probability with respect to firms in other value chains.

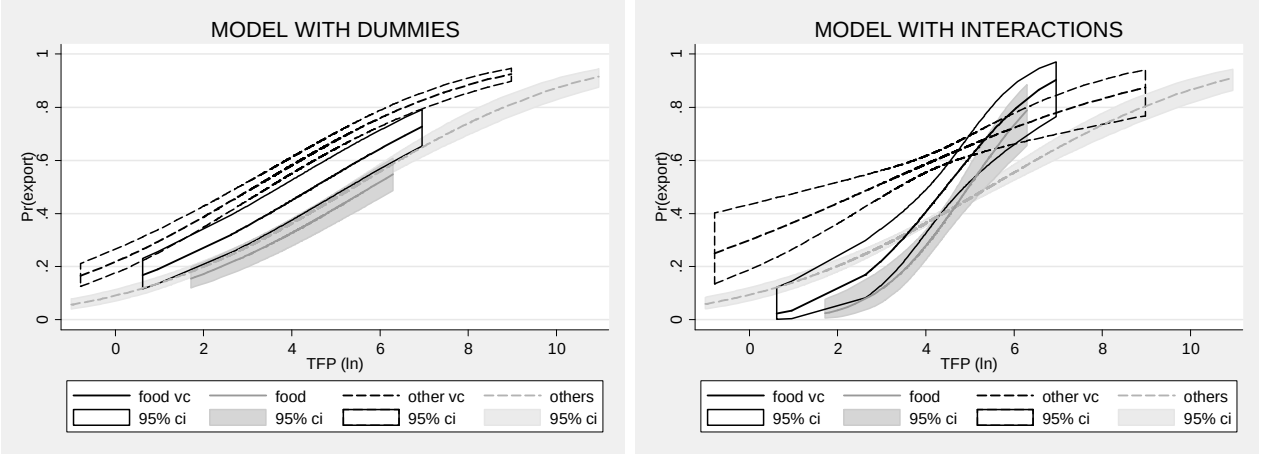
The above findings are in line with expectations from the descriptive statistics and from our previous results. However, given that productivity is likely to affect sectors differently depending on the specific production processes, it now becomes apparent that a pooled model with simple dummies might not capture sector specific characteristics. To test for this possibility and allow for a greater degree of freedom, we also run the above basic model augmented with a full set of interactions, that is:

$$(4) \quad Pr(Y_i = 1) = \Phi(\alpha + \beta_1 TFP_i + \beta_2 FVC_i + \beta_3 FS_i + \beta_4 OVC_i + \beta_5 OS_i + \beta_6 TFP \times VC_i + \beta_7 TFP \times FS_i + \beta_8 TFP \times OVC_i + \beta_9 TFP \times OS_i)$$

Results from the basic model with interactions are showed in FIGURE 8.b. The average estimated export probabilities are clearly ranked as in the previous model, however we now see that food processing firms tend to behave differently from other firms: they seem to benefit more in terms of export probability from increases in TFP. Note that this is probably a sector specific characteristic as suggested by the fact that the export-TFP relation is more similar within sectors than between sectors. This results corroborates the idea that it may be appropriate to allow for food sector specificities, as also suggested by the food value chain literature mentioned above.

FIGURE 8: Estimated export probability and total factor productivity.

(a) Model with dummies. (b) Model with interactions.



Having assessed the relation between export and TFP, we can introduce productivity into our baseline model.

The analysis in this section introduces TFP into the model on the whole sample, and then we focus exclusively on food processing firms. In both cases, we also introduce TFP interactions with sector and value chain. We introduce productivity as a regressor by taking a three-year lagged value of TFP: since our information comes from the balance sheet data, for which previous years are available, we can also avoid possible endogeneity issues, at least for this variable.

Results from the TFP augmented model for all firms are reported in TABLE 8. Aggregate results are in line with our previous findings for all the regressors, and in particular value chain participation is still found to be positively correlated with export. As expected, TFP positively affects the probability to export also once we add all our other controls.

In columns (2) and (3) of TABLE 8, we split the sample into small and medium-large firms. Results are generally confirmed for the two subgroups, with two important differences. First, the food value chain dummy is significant for larger firms only, while on the contrary the other VC dummy is significant only for small firms. Second, TFP seems to actually affect small firms only.

In columns (4)-(6) of TABLE 8, we introduce the interactions. Main results are robust. In line with our basic TFP regressions, we find that food sector-TFP interaction is positive and significant, indicating that food processing firms tend to gain more in terms of export probability from increases in productivity. On the contrary, when food processors operate in the food value chain productivity seems to become a less

stringent requirement for exporting. This applies to small firms, while the evidence for medium-large firms does not allow to make a precise statement.

We then confine the analysis on food processing firms only. As already mentioned, it is interesting to introduce LSR distribution chains into the analysis. Note that we do not also introduce a TFP-LSR interaction. There are two reasons for this: first, as explained above, we claim that TFP is likely to directly interact with participation in production value chains, while the link between productivity and retailing seems blurred or less direct; second, parsimony, given that the TFP augmented model for food processing firms has already many variables and, unfortunately, few observations.

We report results for food processing firms in TABLE 9. In columns (1) and (2) we employ the lagged levels of TFP and region fixed effects. Since we have a reduced number observations, in order to allow for a greater variability in the data and to test the robustness of those estimates, we first replace the number of employees with a small firm dummy in all the regressions. Then, in columns (3) and (4), we replace the 20 regions fixed effects, with 3 areas fixed effects (north, south and center of Italy respectively). Finally, in columns (5) and (6), we reintroduce region fixed effects, but replace lagged TFP with contemporaneous TFP, for which we have more observations.

Results are again generally consistent, indicating a positive correlation between export and productivity, LSR distribution, foreign networks and product innovation. As expected, small firms are less likely to export, other things equal. The value chain coefficients are significant only for the industrial value chain and only when the interactions are included, suggesting that food processing firms participating to the industrial value chain tend to increase their export probability and to decrease the need for high TFP levels in order to reach the export market.

As regarding the ambiguous evidence for the gourmet value chain, it is worth to recall that introducing TFP implies losing many micro and small firms, exactly those that were more likely to operate in the gourmet value chain. For this reason, our results just do not contain enough information. Nonetheless, we believe that, taken altogether, the evidence from the previous section and the results from columns (5) and (6) of TABLE 9, which include more observations, suggest that also the gourmet value chain is positively correlated with the export probability, especially for small "niche" firms.

TABLE 8: TFP augmented model for all firms.

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Export	All	Small	Med-large	All	Small	Med-large
Food VC industrial	0.276*	0.148	0.675*	2.648***	3.297***	3.397
	(1.68)	(0.79)	(1.74)	(2.66)	(2.78)	(0.92)
Food VC gourmet	0.207	0.185	n.a.	1.734	2.746*	n.a.
	(0.96)	(0.84)		(1.28)	(1.93)	
Food VC ind X TFP lag				-0.506**	-0.696***	-0.448
				(-2.44)	(-2.71)	(-0.66)
Food VC gou X TFP lag				-0.343	-0.583*	n.a.
				(-1.15)	(-1.84)	
Other VC	0.235***	0.258***	0.145	0.564*	0.917**	-0.024
	(4.18)	(3.76)	(1.41)	(1.82)	(2.10)	(-0.05)
Other VC X TFP lag				-0.075	-0.155	0.036
				(-1.07)	(-1.51)	(0.33)
Food Sec X TFP lag				0.262*	0.422**	-0.863*
				(1.66)	(2.27)	(-1.67)
TFP lagged (ln)	0.099***	0.214***	0.091	0.112***	0.229***	0.126
	(2.66)	(4.86)	(1.22)	(2.80)	(4.77)	(1.58)
Subcontractor	-0.149**	-0.232***	0.072	-0.148**	-0.229***	0.082
	(-2.46)	(-3.24)	(0.61)	(-2.44)	(-3.20)	(0.69)
Own-branded fimr	0.008	-0.093	0.232**	0.008	-0.094	0.245**
	(0.14)	(-1.41)	(2.22)	(0.14)	(-1.43)	(2.33)
Final-good producer	0.292***	0.292***	0.299***	0.292***	0.293***	0.301***
	(7.02)	(5.95)	(3.64)	(7.02)	(5.96)	(3.64)
N. employees (ln)	0.229***			0.228***		
	(12.89)			(12.84)		
Domestic network	-0.173***	-0.136**	-0.206**	-0.175***	-0.141***	-0.193**
	(-3.86)	(-2.54)	(-2.39)	(-3.88)	(-2.62)	(-2.23)
Foreign network	1.318***	1.290***	1.455***	1.316***	1.290***	1.444***
	(12.55)	(11.31)	(4.95)	(12.52)	(11.29)	(4.90)
Product innovation	0.609***	0.617***	0.652***	0.611***	0.623***	0.645***
	(8.92)	(7.21)	(5.51)	(8.95)	(7.28)	(5.44)
Process innovation	0.144*	0.118	0.279**	0.145*	0.119	0.274**
	(1.92)	(1.21)	(2.29)	(1.94)	(1.22)	(2.25)
Group	0.118**	0.160**	0.280***	0.120**	0.169**	0.292***
	(2.25)	(2.24)	(3.38)	(2.29)	(2.36)	(3.51)
Age (ln)	0.007	0.042	0.033	0.003	0.039	0.026
	(0.18)	(0.98)	(0.46)	(0.08)	(0.91)	(0.37)
Constant	-1.373***	-1.353***	-0.541	-2.632***	-3.329***	3.993
	(-5.83)	(-4.77)	(-0.98)	(-3.53)	(-3.89)	(1.45)
Observations	5357	3755	1559	5357	3755	1559
Pseudo R-squared	0.235	0.180	0.278	0.236	0.182	0.283

t statistics in parentheses
All models have region and 2-digit sector f.e.
* p<0.1, ** p<0.05, *** p<0.01

TABLE 9: TFP augmented model for food processing firms.

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Export						
Food VC industrial	0.292	3.753**	0.238	3.060**	0.193	1.680*
	(1.25)	(2.55)	(1.09)	(2.25)	(1.03)	(1.86)
Food VC gourmet	-0.244	-0.408	-0.203	-0.144	0.278	0.669
	(-0.72)	(-0.19)	(-0.68)	(-0.07)	(1.21)	(0.47)
Food VC ind X TFP lag		-0.725**		-0.590**		
		(-2.38)		(-2.10)		
Food VC ind X TFP						-0.334*
						(-1.68)
Food VC gou X TFP lag		0.041		-0.003		
		(0.09)		(-0.01)		
Food VC gou X TFP						-0.088
						(-0.26)
TFP lagged (ln)	0.448***	0.706***	0.401***	0.602***		
	(2.83)	(3.31)	(2.74)	(3.09)		
TFP (ln)					0.498***	0.620***
					(4.86)	(4.71)
LSR (supermarkets)	0.560**	0.565**	0.543***	0.537**	0.455**	0.460**
	(2.47)	(2.47)	(2.60)	(2.55)	(2.50)	(2.51)
Subcontractor	-0.182	-0.186	-0.203	-0.187	-0.293	-0.296
	(-0.52)	(-0.52)	(-0.61)	(-0.56)	(-1.03)	(-1.04)
Own-branded fimr	0.053	0.054	0.025	0.026	0.014	-0.005
	(0.21)	(0.21)	(0.10)	(0.11)	(0.07)	(-0.02)
Final-good producer	0.597**	0.632***	0.552**	0.584***	0.524***	0.547***
	(2.53)	(2.64)	(2.51)	(2.61)	(2.85)	(2.95)
Small firm	-0.895***	-0.983***	-0.796***	-0.876***	-0.683***	-0.703***
	(-2.73)	(-2.93)	(-2.62)	(-2.79)	(-2.70)	(-2.72)
Domestic network	-0.121	-0.132	-0.104	-0.121	-0.172	-0.199
	(-0.54)	(-0.57)	(-0.49)	(-0.57)	(-1.01)	(-1.16)
Foreign network	1.400***	1.363***	1.234***	1.197***	1.290***	1.282***
	(3.12)	(2.99)	(3.04)	(2.94)	(3.20)	(3.19)
Product innovation	1.267***	1.347***	1.014**	1.020**	1.091***	1.101***
	(2.70)	(2.79)	(2.42)	(2.42)	(3.05)	(3.05)
Process innovation	-0.029	0.024	-0.187	-0.159	-0.130	-0.111
	(-0.05)	(0.04)	(-0.36)	(-0.30)	(-0.34)	(-0.29)
Group	-0.393	-0.308	-0.261	-0.197	-0.472*	-0.430
	(-1.17)	(-0.91)	(-0.86)	(-0.64)	(-1.66)	(-1.51)
Age (ln)	-0.286*	-0.352**	-0.247*	-0.293**	-0.143	-0.137
	(-1.84)	(-2.17)	(-1.74)	(-2.00)	(-1.17)	(-1.11)
Constant	-0.737	-1.670	-1.205	-1.956*	-1.763**	-2.303***
	(-0.68)	(-1.33)	(-1.24)	(-1.73)	(-2.24)	(-2.65)
Observations	270	270	270	270	417	417
Pseudo R-squared	0.267	0.283	0.205	0.218	0.243	0.248

t statistics in parentheses
Models (1)-(2) and (5)-(6) have region f.e. Models (3)-(4) have area f.e.
* p<0.1, ** p<0.05, *** p<0.01

All the previous models consistently show that firms operating in downstream phases of the production process are more likely to export. In what follows, we focus on possible differences between firms operating in different positions along the value chain and/or with different roles in the production process. To this aim, we define three subgroups, i.e. subcontractors, own-branded firms and final good producers. Splitting our sample allows us to check whether the behaviors of firms is heterogeneous between these subgroups and what type of firm is more likely to gain the most from participating in a value chain. Due to data constraints, we apply our model to the whole sample including TFP.

Results are shown in TABLE 10. Our main control variables are again consistent across the subgroups, confirming their importance in determining firms' likelihood to export. In particular, number of employees, network participation and product innovation are quite robust for all the subgroups. A few differences characterize firms operating in different positions. Subcontractors are found to significantly increase their export probability when they do process innovation, while it is not significant for the other groups. On the contrary TFP seems to have a positive effect on export only for own-branded firms and final good producers; the effect is positive but non-significant for subcontractors. Participating to a value chain is not found to have any significant correlation with export for the group of subcontractors, with or without the TFP interactions. Results for own-branded firms and final good producers are instead in line with our previous results. Participating to a value chain generally seems to be positively associated with export. Without TFP interactions, the food VC coefficients are positive, but not significant for own-branded firms, while the food industrial VC dummy is significant for final good producers. The introduction of TFP interactions has two main effects: first, it makes the food industrial VC significant and yields a negative interaction coefficient, thus suggesting that increases in TFP have a reduced impact on the export probability for food firms in a value chain; second, it shows that own-branded firms operating in the food processing sector are the group of firms which benefits more from increases in productivity.

TABLE 10: TFP augmented model by positioning of the firms.

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Xport	subc.	subc.	own-br.	own-br.	final	final
Food VC industrial	0.538	-4.508	0.277	3.743***	0.398*	3.820***
	(1.07)	(-0.96)	(1.37)	(3.33)	(1.96)	(3.03)
Food VC gourmet	-0.388	-27.173	0.130	2.281	0.108	1.499
	(-0.46)	(-0.47)	(0.52)	(1.48)	(0.39)	(0.91)
Food VC ind X TFP lag		1.104		-0.736***		-0.718***
		(1.06)		(-3.15)		(-2.76)
Food VC gou X TFP lag		5.189		-0.482		-0.319
		(0.46)		(-1.42)		(-0.86)
Other VC	0.122	0.788	0.240***	0.567	0.383***	0.734
	(1.20)	(1.27)	(2.94)	(1.32)	(4.11)	(1.27)
Other VC X TFP lag		-0.155		-0.074		-0.079
		(-1.09)		(-0.76)		(-0.61)
Food Sec X TFP lag		0.137		0.329*		0.215
		(0.25)		(1.72)		(1.14)
TFP lagged (ln)	0.103	0.122	0.112**	0.136**	0.159***	0.181***
	(1.33)	(1.48)	(2.28)	(2.54)	(2.78)	(2.91)
N. employees (ln)	0.223***	0.224***	0.279***	0.279***	0.257***	0.255***
	(6.61)	(6.62)	(11.33)	(11.31)	(9.07)	(8.98)
Domestic network	-0.229***	-0.228***	-0.216***	-0.220***	-0.208***	-0.214***
	(-2.73)	(-2.71)	(-3.36)	(-3.41)	(-2.99)	(-3.06)
Foreign network	1.263***	1.264***	1.254***	1.254***	1.433***	1.432***
	(6.05)	(6.04)	(9.30)	(9.29)	(8.26)	(8.22)
Product innovation	0.578***	0.560***	0.700***	0.708***	0.655***	0.662***
	(3.68)	(3.55)	(7.53)	(7.60)	(6.70)	(6.76)
Process innovation	0.286*	0.290*	0.020	0.019	0.038	0.037
	(1.84)	(1.86)	(0.19)	(0.18)	(0.35)	(0.33)
Group	0.099	0.095	0.103	0.106	0.085	0.095
	(0.99)	(0.95)	(1.42)	(1.46)	(1.04)	(1.16)
Age (ln)	-0.002	-0.002	-0.029	-0.034	-0.020	-0.026
	(-0.03)	(-0.03)	(-0.58)	(-0.68)	(-0.37)	(-0.48)
Constant	-1.346***	-2.111	-1.188***	-2.805***	-1.335***	-2.403***
	(-2.76)	(-0.83)	(-3.94)	(-3.09)	(-4.04)	(-2.75)
Observations	1498	1498	2948	2948	2450	2450
Pseudo R-squared	0.189	0.190	0.267	0.269	0.231	0.234

t statistics in parentheses
All models have region and 2-digit sector f.e.
* p<0.1, ** p<0.05, *** p<0.01

5. Conclusion

We have described the Italian food processing industry with some detail, using simple descriptive statistics and econometric analysis to estimate the probability to internationalize and the role of global value chains. All our results suggest that the Italian food processing firms have some characteristics that make them particularly subject to competition in the international market. They tend to be substantially smaller than already small manufacturing firms and have a lower propensity to export and to be involved in more complex forms of internationalization such as FDI. At the sector level, the main consequence of this fragmented productive structure is that Italy is not specialized in the processed food at the international level. Its normalized trade balance is negative even though it shows an improvement over time. Hence, despite being a large world exporter and exporting some very high quality and highly priced products, and contrary to "common opinion", Italy is despecialized in food.

With such an apparently "fragile" productive structure, there is scope for improvements. We showed that food processing firms are found to significantly increase their probability to export when they produce within a value chain. Additionally, participating in distribution chains, for instance being able to sell products through large supermarkets, also significantly contributes to successfully enter the international market. Another dimension where marginal benefits seem to be particularly large for food processing firms is productivity. Our results show that increases in productivity are likely to increase the probability to export of food processing firms by relatively more than for firms in other sectors.

In all our models, we consistently find that the food industrial value chain benefits food processing firms. An increase in the export probability is found also for the high quality/gourmet value chain, but findings are less robust. This is possibly due to fact that firms operating in the gourmet value chain tend to be even smaller than average and to focus on artisanal/niche preparations, which are not likely to allow significant economies of scale and are likely to imply relatively high costs.

For the food industrial value chain, we uncover an interesting interaction between the value chain and productivity. One the one hand, food processing firms have relatively more to gain than other firms from increases in productivity; on the other hand, when they operate in an industrial value chain they are more likely to export, other things equal, and further increases in productivity become relatively less necessary. Food processing firms outside the value chain need relatively higher levels

of productivity to reach the same export probability of similar firms producing in a value chain. This finding suggests that food processing firms, once they produce in a value chain, benefit from some kind of spillovers that make productivity a less stringent requirement for export. While clearly operating in a value chain and having high levels of productivity is associated with the highest export probability, the food industrial value chain may constitute an additional factor, and perhaps a strategy, contributing to internationalization of firms.

With regard to firms positioning along value chains, we show that Italian food processing firms are mainly in downstream positions, being final good producers or own-branded firms. Downstream food processors have a higher probability to export and gain more from value chain participation. On the contrary, subcontractors seem to be penalized in terms of likelihood to export and they gain significantly less from value chain participation.

Our findings have interesting policy implications and raise a few questions for further research.

The first consideration follows from the relatively small size of Italian food processors. Small size and a fragmented production structure are generally regarded as a weakness. Our results seem to suggest room for policy interventions While a standard policy would be to devise incentive for firms to grow larger, our findings support the view that helping (food processing) firms to participate in value chains, particularly the smaller ones, is likely to increase their competitiveness on the international market. This could apply also to micro firms and firms producing high quality artisanal food products. As already discussed, existing evidence suggests that high quality and certified products perform well on the international market. We believe that this kind of firms, for which higher levels of productivity are more difficult to be obtained through economies of scale, may greatly benefit from value chain participation. To this regard policies specifically devised to help firms to participate in value chains and the use of private and public standards may help the entire Italian food sector to become more competitive.

Of course there may be some concerns. The first, particularly relevant for the food sector, is an increasing dominance of few large multinationals, often operating in downstream phases or as large retailers. This threatens small processing firms operating as suppliers and subcontractors, but the risks of marginalization are likely to

be even higher for small farmers and other suppliers in upstream phases production[21]. Further research and an appropriate assessment of policy implications should indeed consider the effects along the entire value chain.

The large diffusion of GVC implies new ways of understanding competition between firms and countries. Actors are becoming increasingly interconnected and competition regards tasks more than goods or sectors. In such a context, firms are likely to further specialize in specific tasks within the value chain. Even domestic producers may depend on international trade, since they may need inputs with a direct or indirect import content and they may sell products that contribute to exports of other firms, if not directly exported. As a result, the scope for national policies might be reduced and GVC may amplify the effect of protectionist measures. Tariffs and other protection measures at the border are cumulative when intermediate inputs are traded across borders multiple times. Hence, protection can end up in a significantly higher cost of the finished good. This in turn can affect production and investment decisions of firms involved in GVCs. Calculations from OECD, quantify the effect of a 5% tariff on imported goods for an hypothetical value chain involving 10 countries as having an impact of 25% on the price of the final good, while a 20% tariff would have an impact of 160% (OECD, 2013). Moreover, it is easy to see how firms, sectors or countries that operate in downstream activities are more likely to be negatively affected by their own trade barriers.

The food industry, given the specificities highlighted in the paper, is among the sectors in which standard policies are more likely to have unexpected impacts. One notable example comes from the unilateral Canadian import tariff elimination in March 2010. Food products are found to be those with the highest effective rate of protection (ERP), equal to 54%. Surprisingly, calculations based on cross-country input-output tables show that food products actually slightly increased their ERP after the tariff elimination (food and agriculture are the only sectors that show an increase; OECD, 2013). This result is due to positioning along the value chain: food processing firms, as our findings corroborate, tend to operate downstream and to be close to final demand: for the food sector. Hence, benefits from lower tariffs on inputs are larger than the possible costs stemming from reduced protection on imported competing products.

[21] We do not deal with these firms in our analysis, since we focus on food processing firms only.

Other aspects in which policy may be particularly relevant for the food industry are regulations and non-tariff barriers. As discussed in the paper, the food GVC requires an intense vertical coordination that leads to the rise of private standards and certifications, applied both to products and processes, together with public standards and safety requirements. The increasing importance of GVC entails an augmented scope for simplification and convergence of standards as a possible means to reduce transaction and coordination costs between actors in the value chain. Similar concerns are expressed in Beghin *et al* (2015) and Hoekman (2013).

In summary, the process of producing goods is increasingly carried out wherever the necessary skills and materials are available at competitive cost and quality. This is particularly true for the food sector, where more firms than the average belong to value chains. However, the growing fragmentation of production highlights the need to have a very clear policies, since restrictive measures (both tariffs and non-tariff barriers) impact not only on those foreign suppliers to which they are directed, but also on domestic producers and, as mentioned above, increase the domestic prices with negative effects on welfare as well as on competitiveness. The above reasoning triggers therefore a general consideration. Our findings suggest that helping food processing firms to participate in value chains is likely to increase their propensity to export. On the other hand, traditional trade policies such imposing tariffs or other non-tariff barriers may have unexpected impacts, because they may affect (in different ways) other actors along the value chain. Thus, the specific policies that can be devised should actually take a global value chain perspective. Impacts of policies on all actors along the value chain must be considered as well as their feedbacks. This is not a simple task since it may imply considering a cross-country general equilibrium setting. These considerations highlight an increasing need for analytical tools and data for policy oriented future research.

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APPENDIX

Data description

Our firm level data comes from a survey conducted by MET (Monitoraggio Economia e Territorio s.r.l) in 2011 and including information on the previous three years of activity. The total number of firms included in the survey is 25,090. All firms are Italian and the sample is built so to be representative at the national level along several dimensions such as firms' size (notably firms with less than 10 employees are included), sector and region of the firms. Sectors included belong to manufacturing and related services. The information obtained from the survey is mostly qualitative, ranging from employment to investments, innovation and internationalization. In the empirical part of the paper, the need to estimate productivity required us to obtain balance sheet data as well. This data, not originally included in the survey, comes from the AIDA database (Bureau Van Dijk). As noted in the text, the matching procedure implies a loss of information, mainly due to smaller firms, subject to less stringent reporting requirements, for which balance sheet data is not available. Also for this reason, we performed a consistency check on the 2-digit sectors and the region of the firms, so to avoid measurement errors. The merged sample includes 10,459 firms, of which 7,590 provide all the information required for the TFP estimation.

Correlation matrices

TABLES A1, A2 and A3 report the correlation matrices for the variable used in the econometric analysis. The variables are numerated according to the following list: (1) Export; (2) Food VC; (3) Food VC industrial; (4) Food VC gourmet; (5) Other VC; (6) LSR (supermarkets); (7) Subcontractor; (8) Own-branded firm; (9) Final good producer; (10) N. employees (ln); (11) Domestic network; (12) International network; (13) Product innovation; (14) Process innovation; (15) Group; (16) Age (ln); (17) TFP (ln).

TABLE A1: Correlation matrix for the whole sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1)	1.00																
(2)	0.02	1.00															

(3)	0.04	0.70	1.00														
(4)	0.00	0.73	0.04	1.00													
(5)	0.16	-0.05	-0.03	-0.03	1.00												
(6)	-	-	-	-	-	-											
(7)	-0.09	-0.05	-0.03	-0.05	0.01	-	1.00										
(8)	0.03	0.03	0.02	0.02	-0.05	-	-0.74	1.00									
(9)	0.12	0.10	0.06	0.08	-0.01	-	-0.11	0.08	1.00								
(10)	0.40	0.01	0.04	-0.02	0.15	-	-0.06	0.02	0.04	1.00							
(11)	-0.01	0.03	0.03	0.01	0.09	-	0.02	-0.04	0.00	0.08	1.00						
(12)	0.25	0.01	0.02	-0.01	0.09	-	-0.03	0.02	0.05	0.13	-0.11	1.00					
(13)	0.25	0.00	0.00	0.00	0.10	-	-0.09	0.03	0.08	0.20	0.05	0.08	1.00				
(14)	0.18	0.00	0.00	-0.01	0.08	-	-0.05	0.02	0.04	0.20	0.04	0.07	0.45	1.00			
(15)	0.24	0.00	0.02	-0.02	0.11	-	-0.04	0.02	0.02	0.42	0.05	0.11	0.13	0.14	1.00		
(16)	0.17	0.04	0.05	0.01	0.05	-	-0.07	0.04	0.03	0.33	0.03	0.06	0.06	0.06	0.12	1.00	
(17)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE A2: Correlation matrix for food processors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1)	1.00																
(2)	0.16	1.00															
(3)	0.21	0.63	1.00														
(4)	0.01	0.71	-0.08	1.00													
(5)	-	-	-	-	-												
(6)	0.29	0.12	0.12	0.05	-	1.00											
(7)	0.00	0.05	0.07	0.00	-	0.01	1.00										
(8)	0.02	-0.08	-0.05	-0.07	-	0.00	-0.52	1.00									
(9)	0.04	0.03	0.00	0.04	-	0.07	-0.05	0.00	1.00								
(10)	0.54	0.15	0.25	-0.03	-	0.33	0.03	-0.02	0.01	1.00							
(11)	0.03	0.13	0.14	0.06	-	0.03	0.05	-0.05	0.04	0.09	1.00						
(12)	0.31	0.08	0.13	-0.01	-	0.10	-0.01	0.04	0.01	0.19	-0.08	1.00					
(13)	0.19	0.06	0.05	0.04	-	0.11	-0.04	-0.02	0.01	0.16	0.07	0.05	1.00				
(14)	0.17	0.04	0.03	0.02	-	0.10	0.00	-0.01	0.03	0.11	0.07	0.09	0.48	1.00			
(15)	0.21	0.08	0.14	-0.01	-	0.14	-0.02	0.02	0.02	0.33	0.13	0.15	0.11	0.10	1.00		
(16)	0.18	0.09	0.16	-0.03	-	0.09	0.05	-0.05	-0.04	0.34	0.09	0.05	-0.03	0.00	0.11	1.00	
(17)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE A3: Correlation matrix for the TFP sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1)	1.00																
(2)	0.03	1.00															
(3)	0.03	0.80	1.00														
(4)	0.01	0.62	0.06	1.00													
(5)	0.16	-0.06	-0.05	-0.04	1.00												
(6)	-	-	-	-	-	-											
(7)	-0.09	-0.06	-0.05	-0.05	0.01	-	1.00										
(8)	0.04	0.05	0.04	0.03	-0.05	-	-0.71	1.00									
(9)	0.17	0.08	0.07	0.04	-0.03	-	-0.10	0.10	1.00								
(10)	0.31	-0.02	0.01	-0.03	0.14	-	-0.03	0.00	0.02	1.00							
(11)	-0.08	0.04	0.04	0.02	0.06	-	0.04	-0.06	-0.06	0.02	1.00						
(12)	0.24	0.01	0.02	-0.01	0.09	-	-0.03	0.03	0.05	0.07	-0.15	1.00					
(13)	0.24	0.00	0.01	-0.01	0.11	-	-0.11	0.04	0.08	0.17	0.03	0.07	1.00				
(14)	0.16	-0.02	-0.01	-0.02	0.07	-	-0.07	0.04	0.05	0.18	0.03	0.06	0.44	1.00			
(15)	0.17	-0.01	0.01	-0.03	0.09	-	-0.04	0.02	0.00	0.38	0.02	0.08	0.10	0.13	1.00		
(16)	0.12	0.09	0.06	0.07	0.06	-	-0.05	0.04	0.09	0.19	0.01	0.04	0.03	0.03	0.06	1.00	
(17)	0.18	0.05	0.06	0.01	0.05	-	-0.06	0.05	0.04	0.35	-0.03	0.04	0.10	0.08	0.21	0.14	1.00

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