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edited by
Stefano Manzocchi - Gianmarco I.P. Ottaviano

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Contents

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Introduction

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Globalization as we have got accustomed to since the early 1990s appears to be at a crossroad. On the one hand, the international integration of financial markets is increasingly challenged in the public debate as being a driver of growing income and wealth inequality as well as a source of endemic economic instability. On the other hand, also the internationalization of the supply of goods and non-financial services is under attack from social and political forces. The international fragmentation of manufacturing and the rise of the so-called "global value chains" (henceforth, simply "GVCs") – together with immigration waves – are frequently associated in the public debate with vanishing job opportunities in the advanced world, and with falling purchasing power not only of blue collars but also increasingly of the middle class in both North America and Europe.[1]

Yet, the recent globalization wave has brought about many beneficial consequences that are often neglected as long as they accrue to the final consumer in the someway less visible form of lower prices and enhanced consumption opportunities. More international integration and the efficiency gains associated with multinational activities and GVCs foster productivity at the level of the individual firm as well as at the industry level, eventually leading to higher aggregate growth and welfare. The issue of how these gains are allocated to different firms, industries and countries, is however less straightforward as the papers collected in this volume show. This is particularly true of a country like today's Italy, severely hit

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1 See for instance Ottaviano G.I.P., Peri G., Wright G. (2013).

by the recent global crisis and characterized by pronounced differences in efficiency across firms, industries and regions.

As a matter of fact, the landscape of international production and trade has been largely reshaped by a new wave of foreign direct investments, offshoring strategies and intra-firm exchanges, which have redefined the notion of international trade itself as a consequence of the reorganization of industrial processes aimed at saving costs and supplying (and even creating) new markets. From an analytical point of view, the global industrial platforms that have emerged go much further than the traditional dichotomy between horizontal ("market-seeking") and vertical ("cost-saving") multinational activity, as their specific features are determined by the unbundling of increasingly finer stages of the value chain across national borders depending on technological constraints, logistics, intellectual property right, product characteristics, ownership structures and intangible assets. The motivation for editing this volume is that of providing recent contributions on two related issues. On the one hand, GVCs, their nature, determinants and effects. On the other hand, the position of the Italian economy *vis-à-vis* the changing landscape of international production and trade and its consequences for Italian productivity.

The reshaping of international production and trade has led to the fragmentation of countries' contributions to value added along the GVCs. Tracing the resulting fragments has become increasingly difficult and requires finely detailed data on global operations from the initial inputs to the final goods or services through several intermediate steps. The first part of this volume is devoted to contributions that present theoretical and empirical developments on the analysis of GVCs (definition, measurement and implications) with special attention to the intensity of engagement of individual countries, regions, sectors and firms as well as the quality of this engagement.

The conceptual and empirical reconstruction of GVCs is difficult and even controversial in some cases, but provides us with a fresh picture of the international exchanges as shown by the paper by Alessandro Borin e Michele Mancini. As they point out, the increased complexity of production networks within and across countries requires new analytical tools and data in order to address some basic issues, such as the extent to which a certain sector depends on foreign markets, where its demand is ultimately located, or where final goods and intermediate inputs are sourced from. This new perspective, which has also largely motivated this volume, helps us discard some naïve approaches that look at today's global economy as if it were the same as a couple of decades ago (sometimes even a couple of centuries

ago) making policy recommendations based on the old nation-based system of production. On the contrary, as Borin and Mancini stress, more sophisticated tools are needed in order to obtain a comprehensive picture of GVCs, considering both direct and indirect inter-linkages between countries and sectors that allow one to isolate the value added associated with each production stage. The picture that emerges for the international production networks and, in particular, for Italy's positioning helps to assess the economic implications of GVC participation and gauge the future prospects for Italian exports. On the one hand, many Italian firms operate as suppliers of intermediates for Germany and other European countries. This widens the range of final markets for Italian producers, in particular for small and medium enterprises that may find it difficult to export directly to extra-European countries. On the other hand, the greater distance from the final consumers may also prevent seizing all the opportunities available in those markets, especially in the most dynamic ones.

The paper by Cecilia Jona-Lasinio, Stefano Manzocchi and Valentina Meliciani contributes to a recent stream of literature that points out the importance of intangible assets, including R&D but also organizational capital, training, marketing and advertising for firms' and countries' productivity growth. This is especially relevant when one looks at the determinants and the quality of the participation of different countries and industries to the global value chains. The paper makes an attempt at bridging these various aspects by investigating whether and how intangible assets contribute to foster advanced countries' participation in GVCs. Not only intangible capital appears to be positively related to participation in GVCs, but intangibles contribute to forward and backward linkages in a different way: R&D is more relevant for forward linkages, while marketing and advertising appear to be more important for backward linkages, hence to play a major role in downstream production. Moreover, even if more detailed and disaggregated data will be required to refine the analysis in the future, the empirical findings support the idea that intangibles positively affect value appropriation along the value chain (measured as the domestic value added embodied in foreign exports relative to the foreign value added embodied in domestic exports). Among the different intangible capital items, training and organizational capital have a large positive effect on value appropriation, while marketing and advertising and architectural design do not. Although the paper does not directly address this issue, the (poor) economic performance in productivity and growth of the Italian economy could be partly accounted for by simultaneous low investment in intangible assets and low participation in GVCs.

A similar argument is developed in their paper by Carlo Altomonte, Francesca Bartoli and Valeria Negri. Based on evidence from an original sample of 650 manufacturing firms active in five of the most dynamic regions of Europe based in the four largest continental countries (Italy, Germany, France and Spain), the authors find not only that internationalized firms are likely to be more productive than domestic ones and that the productivity gap is higher the deeper the involvement in GVCs, but also that globalization patterns and performance are related to firms' characteristics and not to the specific region to which firms belong. More specifically, and close to what Jona Lasinio and coauthors find using sectoral and macro data, investment in managerial capital and organizational development is crucial for the transition to more sophisticated international strategies. Two policy implications stem from this contribution. First, so-called "horizontal" medium-term policies are needed in order to improve the local business environment and remove obstacles that hinder long-term investments, innovation capacity and functional upgrading. Second, regional cohesion policies are needed at the EU level as long as increasing polarization between the "happy few" (*i.e.* the large internationally active firms) and the "unhappy many" (*i.e.* the small domestic producers that suffer from global competition) also has an important regional dimension.

Davide Castellani and Claudio Fassio explore the microeconomics of the relation between imported inputs and firm export behavior with an emphasis on ownership structures and multinational enterprises (henceforth, simply MNEs). Using data on Swedish manufacturing firms from 2001 to 2012, they are able to assess whether companies are independent or part of a group and, in the latter case, whether they are controlled by a non-MNE, a domestic MNE or a foreign MNE. They show that imported inputs represent a very important factor promoting Swedish firms' export participation and export scope. Specifically, Castellani and Fassio find that it is the actual number of imported inputs and the geographical reach of imports that matters, rather than the simple fact of being an importer, and that the larger effect is associated with import of intermediates and capital goods, while import of final goods usually does not affect export behavior significantly. The policy implications of the paper are very relevant: the authors state that "allowing domestic firms an easy access to imported inputs can be as important as supporting their exporting activities", which actually sounds like a rebuttal of protectionist arguments based on efficiency grounds. The joint participation of a firm in a GVC as both an importer and an exporter makes the firm perform better, and provides a strong argument in favor of freer international trade.

The second part of the volume deals with the involvement of Italian firms, sectors and regions in GVCs and trade networks. The purpose here is to convey fresh evidence on the role of Italy in the evolving international division of labor and competences, and to formulate and test some conjectures on the implications of the transnational activities of firms for Italian productivity. Since the early 1990s, the productivity slowdown is the most quoted, and perhaps the most serious, economic problem affecting Italy. Ignazio Visco, Governor of the Bank of Italy, recently stated that «it is unfortunate – to say the least – that Italy's structural problems of today are broadly the same as those of 15 years ago and the key question remains how to resume Italy's growth. To this end, getting back "lost productivity" is obviously critical». [2]

The contribution of our volume to this debate is twofold. On the one hand, the papers by Mariarosaria Agostino, Anna Giunta, Domenico Scalera and Francesco Trivieri and by Luca De Benedictis and Lucia Tajoli provide additional evidence and novel insight on the changing fortunes of Italian firms, sectors and regions in the recent globalization wave. On the other hand, the papers by Sara Calligaris, Massimo Del Gatto, Fadi Hassan, Gianmarco Ottaviano and Fabiano Schivardi and by Matteo Bugamelli and Francesca Lotti establish connections between the international activity of Italian firms, their performance and eventually their impact on the productivity outcomes of the national economy.

Mariarosaria Agostino, Anna Giunta, Domenico Scalera and Francesco Trivieri find that although the participation of Italian firms in GVCs is high compared to other European countries, Italian firms most frequently adopt the least advanced modes of participation, as pure exporters and often as pure suppliers, unlike the case of Germany where the majority of firms are positioned at the downstream stages of the value chain oriented towards final customers. This finding is consistent with what Borin and Mancini highlight based on their new analytical reconstruction of GVCs. Moreover, Agostino and coauthors find that the participation and positioning of Southern Italian firms appear even worse. A third of them are not engaged in any kind of international activity and thus depend on domestic demand only; when they are part of GVCs, they tend to be sub-optimally positioned. This is likely to affect the (poor) economic performance of Italian Southern regions. GVC participation is associated with higher productivity, but this happens in a hierarchical way with greater productivity premia associated with more advanced modes of GVC participation.

[2] Visco I. (2017).

From a different perspective emphasizing the sectoral pattern of trade specialization of the Italian economy, Luca De Benedictis and Lucia Tajoli get to very similar conclusions. Increased participation to GVCs has allowed Italy not only to preserve some of its traditional comparative advantages even in the presence of dramatic changes in international markets, but also to venture into some new sectors of specialization. Nonetheless, Italy appears to be increasingly far from the main nodes of the global trade network, both in terms of final destination markets as well as for production links. The relative loss of centrality of the European bloc in the past decade, both at the aggregate level and in the examined sectors of Italian comparative advantage, impacted negatively positioning on the Italian productive system as a whole. This leads to interesting and only apparently contradictory policy insights. On the one hand, smaller Italian firms find it increasingly difficult to reach markets that are far away and different in terms of institutional environment. On the other hand, looking at the GVCs and not only at traditional analyses of comparative advantages reinforces the argument against neo-mercantilist trade policies: as when input and output flows are strongly interlinked both the promotion of export and the substitution of imports make little sense.

Matteo Bugamelli e Francesca Lotti study the role of international competition for the recent evolution of Italian productivity. While the productivity slowdown is a big concern around the world (especially after the Great Recession), Italy is a special case as it productivity growth has been unsatisfactorily (both in a historical perspective and compared with the main European countries) since the late Nineties.[3] After describing this sad state of affairs, Bugamelli and Lotti provide a discussion of the main candidate structural determinants of such a dismal performance with an emphasis on the link between productivity and competition. They conclude that lack of competition in some service sectors together with broader unfair competition due to diffused tax evasion has negatively affected productivity dynamics. Yet, the pressures exerted by international competition, through both exports and imports, have played a beneficial role in the opposite direction. This is consistent with the findings of other papers in the present issue that highlight the gains accruing to the Italian economy from involvement in international markets.

An after-crisis perspective is also taken by Sara Calligaris, Massimo Del Gatto, Fadi Hassan, Gianmarco Ottaviano and Fabiano Schivardi. Studying the allocation

[3] The slow dynamics of Italian productivity can be viewed as the combined result of firm-specific and external elements. See for instance Manzocchi S., Santoni G., Quintieri B. (2017).

of capital and labour in a representative sample of Italian manufacturers from 2001 to 2014, they emphasize the comparison between exporters and non-exporters before and after the global financial crisis. They find that, both before and after 2008, factors were misallocated leading to inefficiently small exporters and inefficiently large non-exporters. This pattern has become more pronounced after the crisis due to frictions that disproportionately reduce product and factor market access for exporters. Investigating firm characteristics significantly associated with misallocation, they conclude that, controlling for the export status, finance, innovation and growth strategies play a significant role. While these are crucial markers of firm performance also stressed in other papers in this issue, the main contribution of Calligaris, Del Gatto, Hassan, Ottaviano and Schivardi is a normative analysis highlighting that a major problem is not only that the Italian economy has few high productive firms and many low productive firms relative to peer countries, but also that the former firms tend to be inefficiently small while the latter tend to be inefficiently large. This way productive resources are "trapped" into unproductive uses.

The combined message of the two parts of this volume is that the changing landscape of international production and trade, though controversial in its consequences on employment and welfare in the short and medium run, is still conducive to economic efficiency. For a country like Italy where productivity is sluggish, being part of the international production and trade system appears to be more necessary than ever. Hence, economic policy at the global and national level should not disregard the benefits of globalization while addressing its drawbacks. As far as the Italian policymakers are concerned, measures should be taken to enhance a broader and more qualified participation of Italian firms to the global value chains.

BIBLIOGRAPHY

Manzocchi S. - Santoni G. - Quintieri B. (2017), «Local Manufacturing Productivity Markers: An Empirical Study of the Italian Counties», *Annals of Regional Science*, 59(1), pp. 255-279, ISSN 0570-1864.

Ottaviano G.I.P. - Peri G. - Wright G. (2013), «Immigration, Offshoring, and American Jobs», *American Economic Review*, 103(5), pp. 1925-1959, ISSN 0002-8282.

Visco I. (2017), *Opening Remarks*, Riccardo Faini Memorial Conference Italy's Lost Productivity and How to Get it Back, Bank of Italy, Rome, 13 January.

I - INTERNATIONAL EVIDENCE

Participation in Global Value Chains: Measurement Issues and the Place of Italy

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Owing to the spread of global value chains, new relevant questions have emerged in the analysis of world trade. In particular, it has become crucial to assess the level of participation of individual countries and sectors in the international sharing of production. In this paper we provide a critical review of some of the recent methods that have been proposed to measure trade in value added and countries' participation in GVCs through the use of the Inter-Country Input-Output tables. We apply these tools to Italy, to measure its trade in value added and its involvement in GVCs.
[JEL Classification: E16; F1; F14; F15].

Keywords: global value chains; input-output tables; trade in value added; trade elasticity.

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1. - Introduction

Due to the diffusion of global production networks, traditional (gross) trade statistics no longer provide an adequate representation of supply and demand linkages among the economies. In the past, when the production processes took place predominantly within the national borders, the lion's share of trade flows consisted of final goods (or services) and raw materials. Under these conditions, a few simple indicators (*i.e.* market shares, geographical composition of imports and exports, bilateral trade balances, sectoral indices of specialization, etc.) could provide a satisfactory picture of a country's role in international markets and its evolution over time. With the increased complexity of production networks within and across countries new tools and data are needed in order to address some basic issues, like the extent to which a certain sector depends on foreign markets, where its demand is ultimately located, or where final goods and intermediate inputs originate.

Even more interestingly, a bunch of new questions, relevant from a policy view point, have emerged (Backer and Miroudot, 2013). For instance, today it seems important to know the extent to which a country (or a sector) is involved in global value chains (GVC), how deep is the interconnectedness among certain sectors/economies, in which task and business function a country is specialized, in what manner a country's competitiveness relies on inputs sourced from abroad, etc. All these issues are of particular interest for countries like Italy, with a deep level of integration in international trade and financial networks, in particular within the so called *Factory Europe* (Baldwin and Lopez-Gonzales, 2013).

In recent years new statistical devices and methodological frameworks have been developed in the literature to tackle empirically this change in paradigm. In this paper we present some of these basic tools, but first of all it might be useful to recall the rationale that lies behind these methodologies. Gereffi and Fernandez-Stark (2011) define a value chain as the «full range of activities that firms and workers do to bring a product from its conception to its end use», and when these activities are dispersed across different countries we can denote this production process as a global value chain (GVC). Transferring this concept to the country-sectoral level, a GVC can be represented as series of production stages; in each stage a certain country-sector pair sources intermediate inputs from other country-sectors, adds its contribution in terms of value added, and delivers its output either to other country-sectors as intermediate products, or to a final market. Thus GVC can be studied by tracing the value added along these production chains.

Empirically this issue has been addressed by extending the basic Input-Output analysis to take into account all the linkages between industries located in different countries. These cross-country and cross-sector interconnections are mapped in Inter-Country Input-Output tables (ICIO) that have been developed by combing traditional I-O tables with detailed trade data that distinguish between shipments in intermediate sand in final products. By applying to the ICIO tables the basic accounting relationships that date back to the early studies by Leontief (1936) it is possible to address some relevant questions that can no longer be tackled properly with traditional trade statistics. For instance, it is possible to relate the value added originated in a certain country-sector to the market of ultimate consumption. Nevertheless, more sophisticated tools are needed in order to get a more comprehensive picture of GVCs and to properly characterize them. In particular, it is necessary to consider direct and indirect interlinkages between countries and sectors and to isolate the value added associated to each production stage.

The emergence of GVCs has deepened the gap between gross flows, as recorded by traditional trade statistics, and the data on production and final demand as accounted for in statistics based on value added. Indeed, the value added embedded in intermediate goods could cross the national borders many times giving rise to double counting in traditional trade flows. In the recent literature, a few methodologies have been developed aiming to pin down the domestic and the foreign content embedded in gross export flows (see Hummels, Ishii and Yi, 2001; Johnson and Noguera, 2012; Koopman, Wang and Wei, 2014). Drawing on these contributions, different indicators have been proposed to measure the portion of trade flows and overall economic activity related to GVCs (Hummels *et* al., 2001; Koopman *et* al., 2011; Borin and Macini, 2015). Finally other specific measures have been designed to gauge in which phases of the production process a country (or a sector) is primarily involved (Fally, 2012; Antras *et* al., 2012; Antras and Chor, 2013; Wang *et* al., 2016).

The aim of this paper is twofold. First, we want to provide a critical review of some of the recent methodologies intended to measure trade in value added and countries' participation into GVCs through ICIO tables. Second, we use some of these tools to measure Italy's trade in value added and its involvement in GVCs, exploiting two different Inter-Country Input Output databases: OECD-WTO Trade in Value Added (TiVA) and the two releases of the World Input-Output Database (WIOD, Timmer *et* al., 2015).

The rest of the paper is organized as follows. The second section presents the main characteristics of a general Inter-Country Input-Output model and some of

the basic accounting relationships used to measure trade in value added. We first use these tools to evaluate how the value added generated in Italy is distributed across the different markets of final consumption and how this differs from the composition of exports based on traditional gross statistics. Then, we repeat the same exercise for the Italian imports. The third section reviews some new methods to decompose gross exports in value added terms, focusing in particular on the framework proposed by Koopman *et* al. (2014). The bilateral version of this decomposition developed by Borin and Mancini (2015) is then used to describe the direct upstream and downstream connections of Italy in GVCs. The fourth section deals directly with the measures of GVC participation and the indicators of positioning within the vertical production networks. Some of these measures are employed to characterize the role of Italy in GVCs. Section five concludes.

2. - The Building Blocks

2.1 *Linking the Origin of Value Added to the Final Market*

The diffusion of GVC has definitively rendered obsolete the traditional way of gauging production and demand linkages. In particular, gross trade flows are no longer a precise measure of how final demand in importing countries activates the exporters' production. Indeed, exports also embed value added produced in other countries and the first destination of exports often does not coincide with the final market, given that an increasing share of imports is processed and then re-exported to third countries. Similar considerations apply also to the analyses conducted at the sectoral level.

Inter-Country Input-Output (ICIO) tables can be used in combination with long-established accounting relationships (Leontief, 1936) to pin down the links between the country-sector where the value of production originates and the market where it is absorbed in final demand. In order to show how this framework works, we consider a general ICIO model where countries produce goods (or services), corresponding to different sectors. The production requires a certain amount of intermediate inputs purchased in the domestic market or imported from abroad. Then each sector contributes with a given amount of value added to produce the gross output, which can be used as intermediate inputs or it can be sold as a final product. This production system is recorded in the ICIO tables, that can be described with the scheme proposed by Wang *et* al., 2016 and reported in Figure 1.

FIGURE 1

A SCHEME OF INTER-COUNTRY INPUT-OUTPUT TABLES

Outputs / Inputs		Intermediate Use				Final Demand				Total Output
		1	2	⋯	*G*	1	2	⋯	*G*	
Intermediate Inputs	1	Z_{11}	Z_{12}	⋯	Z_{GG}	Y_{11}	Y_{12}	⋯	Y_{1G}	X_1
	2	Z_{21}	Z_{22}	⋯	Z_{GG}	Y_{21}	Y_{22}	⋯	Y_{2G}	X_2
	⋮	⋮	⋮	⋱	⋮	⋮	⋮	⋱	⋮	⋮
	G	Z_{G1}	Z_{G2}	⋯	Z_{GG}	Y_{G1}	Y_{G2}	⋯	Y_{GG}	X_G
Value-added		V_{a1}	V_{a2}	⋯	V_{aG}					
Total input		$(X_1)'$	$(X_2)'$	⋯	$(X_G)'$					

where $\mathbf{Z}_{sr}$ is the $N\times N$ matrix of intermediate inputs produced in country *s* and used in country *r*; $\mathbf{Y}_{sr}$ is the $N\times 1$ vector of final goods and services completed in country *s* and absorbed in country *r*; $\mathbf{X}_s$ is the $N\times 1$ vector of gross output produced in country *s*; and $\mathbf{Va}_s$ is the $N\times 1$ vector of value added generated in country *s*.

Each unit of gross output can be either consumed as a final good or used as an intermediate good at home or abroad:

$$\mathbf{X}_s = \sum_{r}^{G} \left(\mathbf{A}_{sr} \mathbf{X}_r + \mathbf{Y}_{sr} \right) \tag{1}$$

where $\mathbf{A}_{sr}$ is the $N\times N$ matrix of coefficients for intermediate inputs produced in *s* and used in the production of *r*, which is computed dividing the elements in each column of intermediate matrix $\mathbf{Z}_{sr}$ by the corresponding total gross output of the sector (e.g. to produce one unit of gross output, sector *i* of country *r* uses a constant amount $a^{sr}_{i,j}$ of intermediate input *j* produced in country *s*, which is equal to $a^{sr}_{i,j} = z^{sr}_{i,j} / x^{r}_{j}$).

From *(1)* it is straightforward to derive the basic relationship between gross output and final demand:

$$\mathbf{X} = \left(\mathbf{I} - \mathbf{A}_{rr} \right)^{-1} \mathbf{Y} = \mathbf{B}\mathbf{Y}$$

or using block matrix notation

$$\begin{bmatrix} \mathbf{X}_1 \\ \mathbf{X}_2 \\ \vdots \\ \mathbf{X}_G \end{bmatrix} = \begin{bmatrix} \mathbf{B}_{11} & \mathbf{B}_{12} & \cdots & \mathbf{B}_{1N} \\ \mathbf{B}_{21} & \mathbf{B}_{22} & \cdots & \mathbf{B}_{2N} \\ \vdots & \vdots & \ddots & \vdots \\ \mathbf{B}_{G1} & \mathbf{B}_{G2} & \cdots & \mathbf{B}_{GG} \end{bmatrix} \begin{bmatrix} \sum_r^G \mathbf{Y}_{1r} \\ \sum_r^G \mathbf{Y}_{2r} \\ \vdots \\ \sum_r^G \mathbf{Y}_{1G} \end{bmatrix} \tag{2}$$

where $\mathbf{B}_{sr}$ is the $N \times N$ block of the Leontief (global) inverse matrix in a ICIO setting. It denotes how much of country's s gross output of a certain good is required to produce one unit of country's final production.

The direct value added share in each unit of gross output produced by country s is equal to one minus the sum of the direct intermediate input shares of all the domestic and foreign suppliers:

$$\mathbf{V}_s = \mathbf{u}_N \left(\mathbf{I} - \sum_r^G \mathbf{A}_{rs} \right) \tag{3}$$

where $\mathbf{u}_N$ is the $1 \times N$ unit row vector.

Then we can define the direct domestic value added matrix for all countries as follows:

$$\mathbf{V} = \begin{bmatrix} \mathbf{V}_1 & \mathbf{0} & \cdots & \mathbf{0} \\ \mathbf{0} & \mathbf{V}_2 & \cdots & \mathbf{0} \\ \vdots & \vdots & \ddots & \vdots \\ \mathbf{0} & \mathbf{0} & \cdots & \mathbf{V}_G \end{bmatrix} \tag{4}$$

and multiply it by the Leontief inverse $\mathbf{B}$ to get the overall $G \times GN$ value added share matrix as $\mathbf{VB}$. In particular, the $\mathbf{V}_s\mathbf{B}_{sr}$ vector reports the shares of total value added generated in country s that is embedded in county r's sectors of final production. Notice that, since the domestic value shares of different countries in final demand have to sum to one, the following property holds:

$$\sum_r^G \mathbf{V}_s \mathbf{B}_{sr} = \mathbf{u}_N \tag{5}$$

Finally, we can derive the $G \times G$ value added matrix by country pairs of source and absorption

$$\mathbf{VBY} = \begin{bmatrix} \mathbf{V}_1 \sum_r^G \mathbf{B}_{1r} \mathbf{Y}_{r1} & \mathbf{V}_1 \sum_r^G \mathbf{B}_{1r} \mathbf{Y}_{r2} & \cdots & \mathbf{V}_1 \sum_r^G \mathbf{B}_{1r} \mathbf{Y}_{rG} \\ \mathbf{V}_2 \sum_r^G \mathbf{B}_{2r} \mathbf{Y}_{r2} & \mathbf{V}_2 \sum_r^G \mathbf{B}_{2r} \mathbf{Y}_{r2} & \cdots & \mathbf{V}_2 \sum_r^G \mathbf{B}_{2r} \mathbf{Y}_{rG} \\ \vdots & \vdots & \ddots & \vdots \\ \mathbf{V}_G \sum_r^G \mathbf{B}_{Gr} \mathbf{Y}_{rG} & \mathbf{V}_G \sum_r^G \mathbf{B}_{Gr} \mathbf{Y}_{rG} & \cdots & \mathbf{V}_G \sum_r^G \mathbf{B}_{Gr} \mathbf{Y}_{rG} \end{bmatrix} \tag{6}$$

To keep track of the sector of origin, one must apply a different form of the direct value added matrix. Defining $\hat{\mathbf{V}}_s$ as the $N \times N$ diagonal matrix with the sectoral direct value added coefficients along the principal diagonal, we can accordingly redefine the block diagonal matrix in *(4)* as $\hat{\mathbf{V}}$, which is now of $GN \times G$ dimension. Then $\hat{\mathbf{V}}\mathbf{BY}$ represents the $GN \times G$ matrix that reproduces the composition of value added by sector-county of origin and country of final destination. The off-diagonal elements of this matrix correspond to the value added exports as defined in Koopman, Wang and Wei (2014), *i.e.* the vector of domestic value added originated in country s and finally absorbed in country r:

$$\mathbf{VA}_{sr} = \hat{\mathbf{V}}_s \sum_g^G \mathbf{B}_{sg} \mathbf{Y}_{gr} \tag{7}$$

Finally, we may be interested in relating the sector-country in which the value added is generated with the sector-country of final demand. Following the same logic employed to derive the decomposition by sectors of origin, this is obtained simply by modifying the final demand matrix $\mathbf{Y}$. In particular we can define $\hat{\mathbf{Y}}_{sr}$ as the $N \times N$ diagonal matrix with country r's demand for final goods produced in countryalong the principal diagonal. Then, the decomposition of global value added by combinations of county-sector of origin and country-sector of final destination is represented by the $GN \times GN$ matrix $\hat{\mathbf{V}}\mathbf{B}\hat{\mathbf{Y}}$.

2.2 *Focus on Italy: Gross Exports* vs. *Domestic Value Added in Foreign Final Demand*

We apply the basic accounting relationships presented in the previous section to analyze the differences between gross and net statistics for Italian trade flows. In particular, we compute the shares of the main regions and countries in total Italian imports and exports, where the net figures are calculated as the value added originated in a given country (the "exporter" in value added terms) and ultimately absorbed in a certain market of destination (the new "importer").

TiVA tables seem more suited to this exercise, since they cover a larger number of countries than the WIOD database (61 countries the former, 40 the latter). Moreover, they take explicitly into account China's and Mexico's processing-trade, providing a more reliable assessment of value added trade flows, especially for these countries.[1] Nevertheless, also the WIOD tables present their own advantages. For instance, they are available at yearly frequency (from 1995 to 2011 in the 2013 release and from 2000 to 2014 in the 2016 release), while TiVA tables exist only for 1995, 2000, 2005 and for each year from 2008 to 2011. Besides providing the most updated figures available, the recent version of the WIOD tables also present a finer sectoral breakdown compared to TiVA. We try to exploit all the advantages offered by the different sources, by choosing in each analysis the one that seems more adequate to address that specific issue.

As shown in Tables 1 and 2, the most remarkable differences between the shares computed in gross and in net terms regard the Italian imports and exports with the other European countries. Although still well above 50%, Europe's weight drops by more than 4 p.p. when calculated in value added terms. This is due to the large amount of trade in intermediates that takes place within the European production networks. Indeed, the same goods and services cross the national borders many times before reaching the final market, leading to a positive wedge between gross and net trade figures. Conversely, the gross statistics tend to underestimate the actual relevance of North America, both as a destination of Italian products and as the origin of goods and services consumed in Italy. Regarding the export side, this is due to the fact that a significant share of Italian value added sold in the US market is embedded in other European countries' exports. Similarly, a non-negligible share of US value added reaches the Italian market indirectly.

Gross and value added shares of Italian exports for East and South East Asia are quite similar. On the import side it seems that Asia is more relevant for Italy than one could expect from traditional statistics (+1.2 p.p. in value added terms), despite the negative gap recorded for China due to the high share of processing trade. These aspects are investigated in greater detail in Section 3.1, where we analyze Italian backward and forward connections in international production chains.

[1] Chinese and Mexican goods and services destined for the local market embed a very high share of domestic VA while productions destined to meet the demand of foreign markets embed a higher share of foreign VA. In the WIOD database these two different technologies are collapsed into a single I-O table, leading to an underestimation of the foreign value added in exports. Conversely, in TiVA data the two different production technologies are kept separate, providing a more precise representation of VA trade.

Table 1

ITALIAN EXPORT SHARES, GROSS AND VALUE ADDED
(year 2011)

	Gross Exports		Domestic VA embodied in final demand		Difference between Gross and VA shares
	US Dollar, Millions	*% of total*	*US Dollar, Millions*	*% of total*	*% points*
Europe	371,828	59.5	240,738	54.9	-4.6
France	*66,149*	*10.6*	*43,302*	*9.9*	*-0.7*
Germany	*76,355*	*12.2*	*48,812*	*11.1*	*-1.1*
Spain	*33,768*	*5.4*	*20,608*	*4.7*	*-0.7*
United Kingdom	*32,980*	*5.3*	*24,775*	*5.7*	*0.4*
CEE	*67,642*	*10.8*	*40,196*	*9.2*	*-1.7*
Russia	*19,230*	*3.1*	*14,229*	*3.2*	*0.2*
East and South East Asia	56,448	9.0	42,050	9.6	0.5
China	*24,511*	*3.9*	*15,886*	*3.6*	*-0.3*
India	*8,850*	*1.4*	*7,302*	*1.7*	*0.2*
Japan	*11,617*	*1.9*	*11,208*	*2.6*	*0.7*
NAFTA	62,343	10.0	55,355	12.6	2.6
United States	*47,994*	*7.7*	*44,444*	*10.1*	*2.4*
South and Central America	13,915	2.2	12,121	2.8	0.5
Brazil	*9,343*	*1.5*	*7,944*	*1.8*	*0.3*
Other regions	119,899	19.2	88,226	20.1	0.9
World	627,828		454,681		

Source: Our elaboration on Oecd-TiVA.

The differences between gross and net statistics could affect also our assessment of trade balances. Despite the fact that the overall net trade position of a country with the rest of the world is the same whether it is measured in gross or in value added terms, its bilateral external balances might change substantially. In order to evaluate the actual degree of interdependence between two economies, it is crucial to trace the value added from the source country to the final market of destination. Therefore the value added statistics provide a more meaningful assessment of the size of bilateral trade (im)balances. In Figure 2 we report the bilateral positions of Italy with the 15 partners that exhibit the largest deficits and surpluses. Compared to gross imbalances, value added net exports are smaller for almost every Italian bilateral partner. In particular, the deficit with Germany and

China is reduced by around one fourth (5 billion dollars), while the surplus with the US shrinks by more than 3 billion dollars. It is worth noting that the surplus with Switzerland (around 5 billion dollars in gross terms) is reduced to almost zero when computed in value added terms; something similar occurs with the trade deficit *vis-à-vis* Luxembourg.

TABLE 2

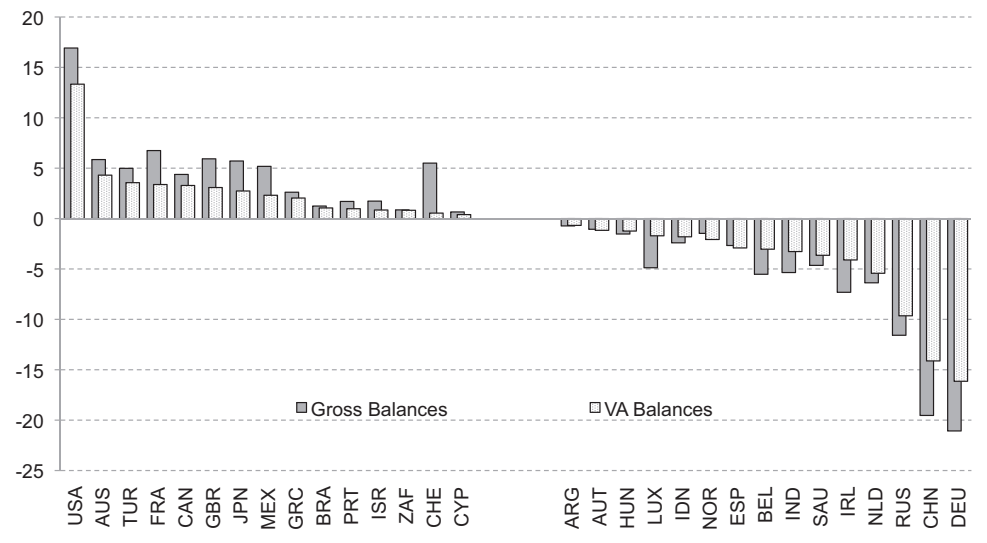
ITALIAN IMPORT SHARES, GROSS AND VALUE ADDED
(year 2011)

	Gross Exports		Foreign VA embodied in final demand		Difference between Gross and VA shares
	US Dollar, Millions	*% of total*	*US Dollar, Millions*	*% of total*	*% points*
Europe	412,583	62.4	279,327	58.1	-4.3
France	*59,401*	*9.0*	*39,924*	*8.3*	*-0.7*
Germany	*97,426*	*14.7*	*64,955*	*13.5*	*-1.2*
Spain	*36,439*	*5.5*	*23,522*	*4.9*	*-0.6*
United Kingdom	*27,052*	*4.1*	*21,695*	*4.5*	*0.4*
CEE	*64,440*	*9.7*	*38,835*	*8.1*	*-1.7*
Russia	*30,808*	*4.7*	*23,875*	*5.0*	*0.3*
East and South East Asia	70,920	10.7	57,464	12.0	1.2
China	*44,045*	*6.7*	*30,011*	*6.2*	*-0.4*
India	*14,204*	*2.1*	*10,575*	*2.2*	*0.1*
Japan	*5,905*	*0.9*	*8,471*	*1.8*	*0.9*
NAFTA	35,861	5.4	36,423	7.6	2.2
United States	*31,072*	*4.7*	*31,108*	*6.5*	*1.8*
South and Central America	14,910	2.3	12,110	2.5	0.3
Brazil	*8,100*	*1.2*	*6,890*	*1.4*	*0.2*
Other regions	126,830	19.2	95,518	19.9	0.7
World	661,103		480,843		

Source: Our elaboration on OECD-TiVA.

Figure 2

GROSS AND VALUE ADDED BILATERAL BALANCES
(billions of dollars, year 2011)

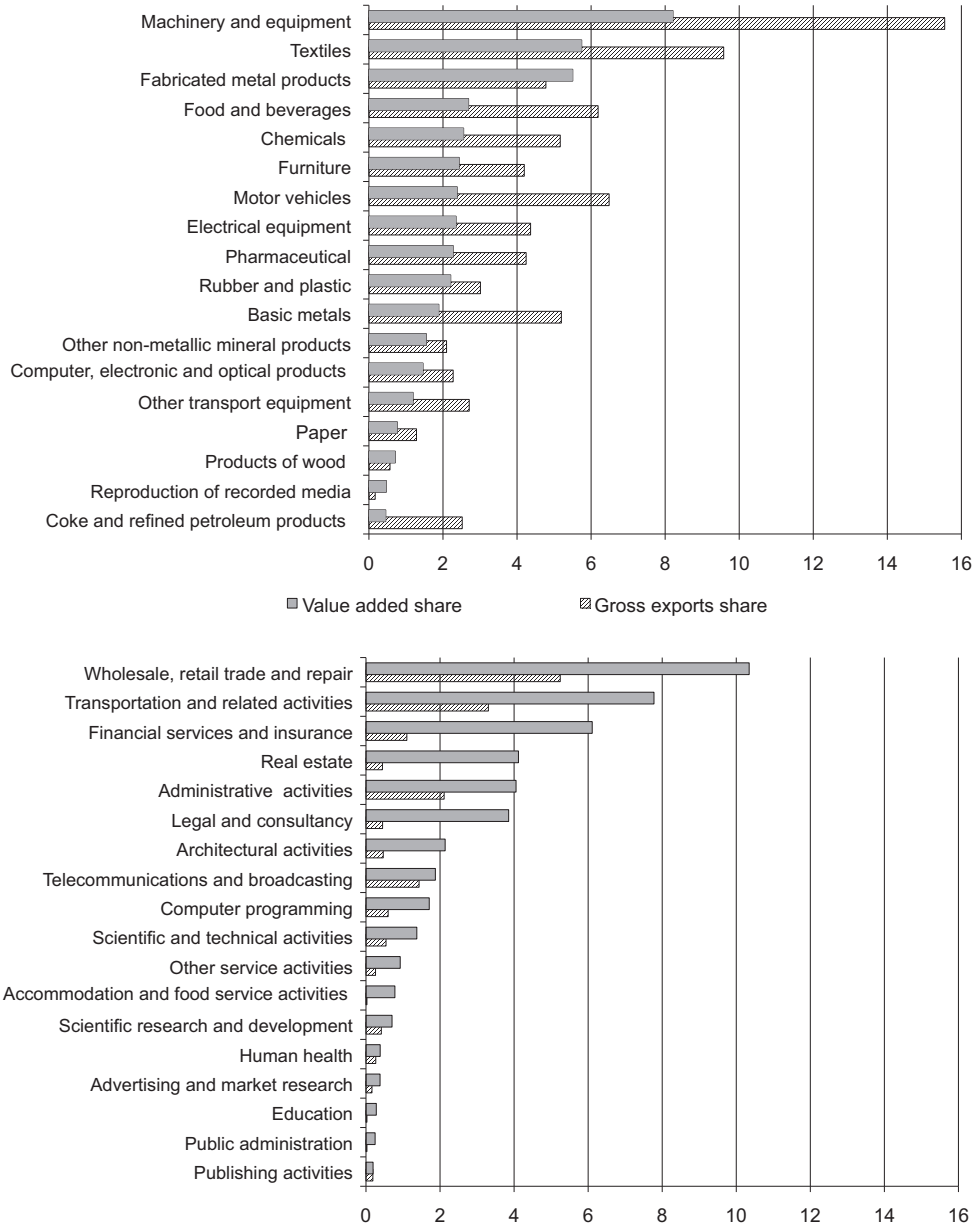


Source: Our elaboration on OECD-TiVA.

Finally, we analyze the Italian specialization patterns looking at both gross and net trade statistics. The bulk of Italian gross exports consist of manufacturing goods (80%), more or less as for Germany (78%) and China (82%). On the contrary, US and French exports in services are much more relevant (39% and 36%, respectively). In value added terms, however, the shares of manufacturing drop substantially. Almost 50% of the Italian and German total value added incorporated in foreign final demand is generated in the domestic service sectors; the share is even higher (about 60%) for France and US. In the case of Italy (Figure 3), machinery and textiles are the two most important exporting sectors both in gross and value added terms. However, when measured in value added terms their shares are almost halved. Conversely, since fabricated metal products are used as inputs in many other sectors, their value added share increase. Not surprisingly, the shares of many service sectors increase substantially in value added terms; among the most significant ones, financial services and insurance (from 1.1% to 6.1% of the total Italian value added in foreign final demand) and transportation (from 3.3% to 7.7%). Therefore, compared to what we could infer from traditional trade statistics, foreign demand is relevant in activating domestic productions for a much larger set of industries.

FIGURE 3

EXPORT SHARES, GROSS AND VALUE ADDED TERMS, MANUFACTURING AND SELECTED SERVICE SECTORS
(year 2014)



Source: Our elaboration on WIOD.

Since all countries show substantial differences between gross and net figures, it might be interesting to evaluate the changes compared to the world average. To this aim, we compute the revealed comparative advantages (RCA) indices both in net and gross terms, using the traditional Balassa[2] indicator. If the indicator for a particular sector has a value above 1, the country has a revealed comparative advantage in that sector. In Figure 4 the Italian sectors are ranked by Balassa indices based on gross exports (*x-axis*) and on domestic value added in foreign final demand (*y-axis*). The north-east region encloses the sectors with a RCA both in gross and net terms (Balassa indices greater than 1). Traditional "made in Italy" sectors are in this region, scoring high in both indicators. Among them, textile gains 3 positions in the overall ranking in value added terms relative to the ranking in terms of gross exports figures (from 5 to 2). Three sectors (basic metals, motor vehicles, other transport equipment), show a comparative advantage in gross terms, but a disadvantage when measured in value added (south-east region). Many services with a Balassa index below 1 in gross terms become relatively specialized in value added terms (north-west region); in particular, financial services gain 36 positions in value added terms (from 39 to 3). Therefore the core of the Italian specialization pattern remains unaltered, but there are some notable exceptions and, in particular, the role of some services appears more relevant when looking at RCA through value added flows.

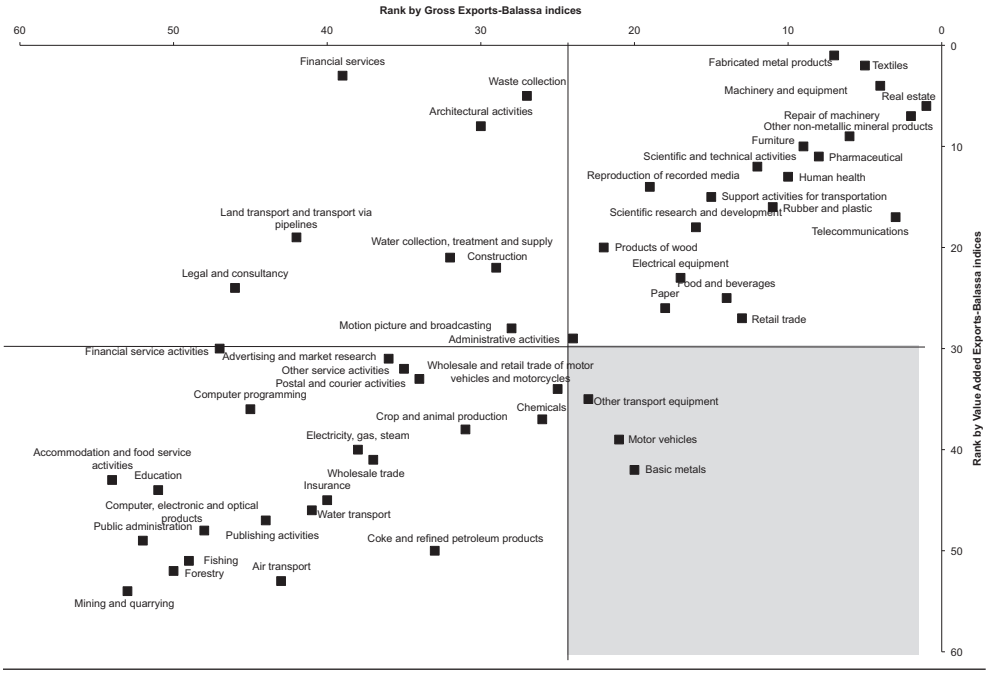
[2] Balassa index for a particular country *s* and sector *i* is obtained as

$$\frac{x_{si} / \sum_{i}^{N} x_{si}}{\sum_{S}^{G} x_{si} / \sum_{i}^{N} \sum_{S}^{G} x_{si}}$$

where *x* is gross exports or domestic value added in foreign final demand. The index measures whether a country holds a strong position in a certain sector (index > 1). It compares the export share of a certain country in a particular sector with the export share at the world level for the same sector.

FIGURE 4

REVEALED COMPARATIVE ADVANTAGES IN GROSS AND VALUE ADDED TERMS



Source: Our elaboration on WIOD.

3. - Bridging Value Added and Gross Trade

3.1 *A Value Added Decomposition of Gross Exports*

The fragmentation of production within and across countries is what generates the differences between trade in value added and in gross exports. The accounting relationships presented in the previous section provide a satisfactory picture of the links between production and final demand in net terms, however they do not tell much about production processes and cross country relationships.

To analyze how countries and sectors participate in production networks it is necessary to consider their direct and indirect interlinkages and to isolate the value added associated to each production stage. New methods have been recently introduced that reconcile gross trade statistics with value added accounting (e.g. Hummels, Ishii and Yi, 2001; Daudin *et* al., 2009; Johnson and Noguera, 2012; Koopman, Wang and Wei, 2014). In particular Koopman, Wang and Wei (hereafter KWW) propose a decomposition of total gross exports that classifies trade

flows by the source and destination of their embedded value added, encompassing most of the methods proposed previously. KWW show that different patterns of international fragmentation of production yield different proportions of value added content in gross exports. In particular, they break gross exports down into different components of domestic and foreign value added plus two items of "pure" double counting.[3]

In the literature, trade in value added had been traditionally measured as in Hummels *et* al., 2001, *i.e.* simply pre-multiplying the matrix of gross exports $\mathbf{E}$ by the value added share matrix $\mathbf{VB}$. Then the domestic value added in exports of country s was computed as $\mathbf{V}_s\mathbf{B}_{ss}\mathbf{E}_{s*}$, and the foreign component as $\sum_r^G \mathbf{V}_s\mathbf{B}_{ss}\mathbf{E}_{s*}$ (see section 2.1). While confirming that these two components are indeed generated respectively at home and abroad, KWW point out that they cannot be considered as shares of the GDP produced by the different countries, since the same value added might be counted many times in a given gross trade flow.

This issue can be exemplified considering a simple sequential production chain. Suppose that 1 USD of value added originally produced in country 1 is first exported to country 2 as intermediate inputs, processed there, then shipped back to 1 and used to produce final goods for re-export to country 3. The value added generated in the very first stage of production in 1 is counted twice: one in its gross bilateral exports with 2 and one in its exports to 3.

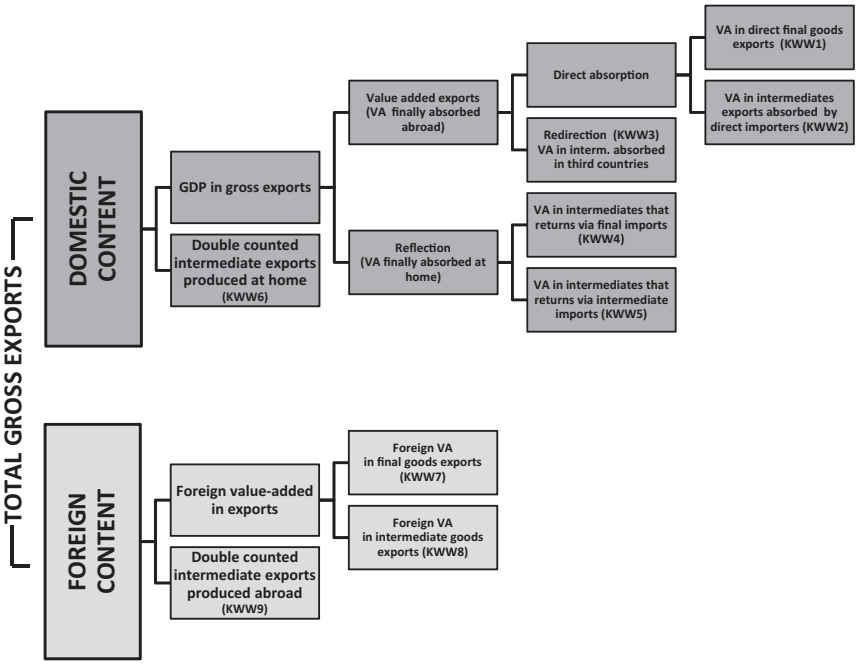
A similar mechanism applies also to the value added originally generated in foreign markets. This is why the KWW breakdown of gross exports includes two components of purely double counted value added: the first one originally generated at home, the second abroad. Moreover, in the spirit of Johnson and Noguera (2012), their classification takes into account also the different markets of final absorption. For instance, they distinguish between the domestic value added component that is ultimately absorbed abroad, directly ("absorption") or through other countries' exports ("redirection"), and the part that is embedded in intermediate exports that are processed abroad and re-imported to be consumed at home ("reflection").

In Appendix A we report the detailed analytic expression of each component of the KWW decomposition, while the scheme in Figure 5 provides a graphical representation of the taxonomy.

[3] KWW show that the "pure" double counted component consists of value added that cannot be traced back to GDP generated either at home or abroad. Trade flows are purely double-counted in gross trade statistics when the same intermediate inputs cross a country's borders several times at different stages of the production process.

FIGURE 5

A SCHEME OF THE KOOPMAN ET AL. (2014)
VALUE ADDED DECOMPOSITION OF GROSS EXPORTS



Source: KOOPMAN R., WANG Z. and WEI S. (2014).

The method proposed by KWW constitutes a rigorous and comprehensive accounting framework for total gross exports. However their decomposition neglects the bilateral dimension of trade flows and might be inadequate for the analysis of such other features as a country's backward and forward linkages within the global value chains. Borin and Mancini (2015) extend KWW's methodology in order to obtain a consistent decomposition of bilateral trade flows. Following the rationale proposed by Nagengast and Stehrer (2016), two different ways to account for value added in bilateral trade are developed: the first one takes the perspective of the country where the value added originates (the source-based approach), the second one takes the perspective of the country of final demand (the sink-based approach). In both cases the original components in KWW can be exactly retrieved by summing the bilateral export flows across all destinations. This property does not hold in the original framework of Nagengast and Stehrer (2016). Also Wang *et* al. (2013) propose a bilateral version of the KWW decomposition that can be exactly mapped into the original KWW components. Nev-

ertheless in their decomposition the two different approaches (sink and source) are mixed, so that their approach is internally inconsistent.[4] Then it turns out to be inappropriate to address some relevant issues. For instance, in order to measure properly countries' participation in GVCs it is necessary to distinguish between the value added absorbed by direct importers and that going to final uses in a third country (see section 4.1). Albeit this distinction appears also in the KWW taxonomy, in practice it is not properly dealt with in their decomposition, for they consider only aggregate trade flows (see Figure 5).[5] Similarly, the bilateral decomposition proposed by Wang *et* al. (2013) falls short in this respect, as it does not precisely single out the share of domestic value added that is directly absorbed in the country of first destination.

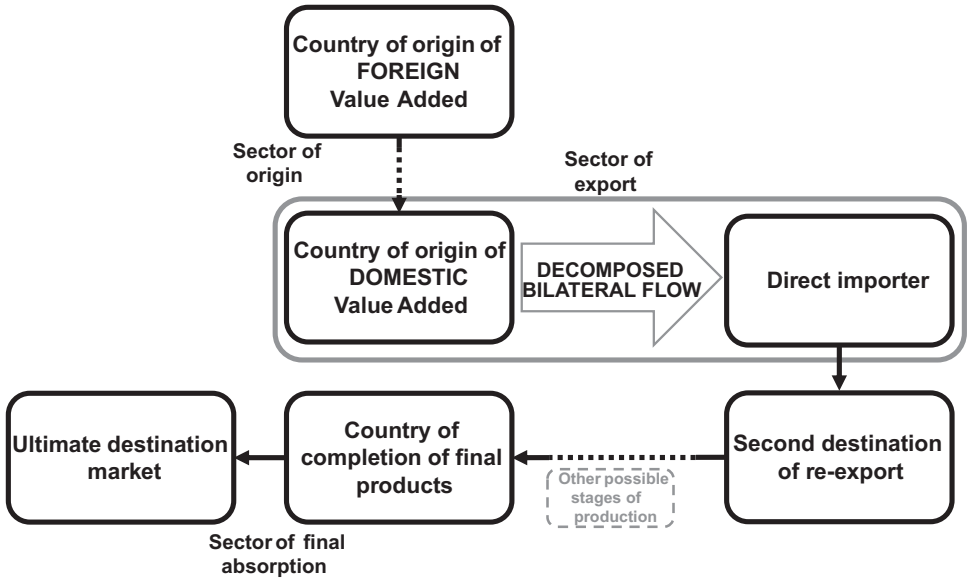
Since the input-output framework potentially allows for infinite rounds of production, it is not feasible to trace the value added in exports along all these rounds. As illustrated in Figure 6, Borin and Mancini (2015) decompose gross bilateral trade flows identifying up to six actors: *i*) the country of origin of foreign value added; *ii*) the country of origin of domestic value added; *iii*) the direct importer; *iv*) the (eventual) second destination of re-export; *v*) the country of completion of final products; *vi*) the ultimate destination market. Note that in many cases the same country can play more than one role. The analytical expressions and the detailed descriptions of the items of the bilateral decompositions are reported in Appendix A.

[4] In particular the first term of the decomposition by Wang Z. *et* al. (2013) is based on a sink based approach. As we will see in the next section, this feature makes their framework unsuitable to single out the GVC related component of gross exports, defined as the value added that crosses at least two national borders (Hummels D. *et* al., 2001).

[5] See Borin A. and Mancini M. (2015) and Nagengast A.J. and Stehrer R. (2016) for a detailed discussion on this point.

FIGURE 6

THE ACTORS IDENTIFIED IN BORIN AND MANCINI (2015) BILATERAL DECOMPOSITION OF GROSS EXPORTS.



Source: BORIN A. and MANCINI M. (2015).

In the first section we saw how to get a sectoral breakdown of the source-absorption value added matrix **VBY** by sector of origin and/or by sector of final consumption. The same procedure can be applied to the KWW decomposition and to its bilateral extension.[6] Moreover, Wang *et* al. (2013) present a version of the KWW decomposition by sectors of exports, which can been applied also at the bilateral level.[7]

[6] To get a decomposition by sectors of origin, it is necessary to substitute in each item the $\mathbf{V}_s$ and $\mathbf{V}_r$ vectors with $\widehat{\mathbf{V}}_s$ and $\widehat{\mathbf{V}}_t$, the $N \times N$ diagonal matrices with the direct value added coefficients along the principal diagonal and zeros elsewhere. The decomposition by sectors of final absorption is obtained replacing the vectors of final demand, for instance for country *s* and *r*, $\mathbf{Y}_{sr}$, with $\widehat{\mathbf{Y}}_{sr}$, the $N \times N$ diagonal matrices with country's *r* demand for final goods produced in *s* along the principal diagonal and zeros elsewhere.

[7] The breakdown by sectors of export is obtained simply substituting $\mathbf{V}_s\mathbf{B}_{ss}$ and $\mathbf{V}_r\mathbf{B}_{rs}$ with $\widehat{\mathbf{V}_s}\mathbf{B}_{ss}$ and $\widehat{\mathbf{V}_r}\mathbf{B}_{rs}$, the $N \times N$ diagonal matrices with the value added shares in final production along the principal diagonal and zeros elsewhere.

3.2 *Focus on Italy: VA in Gross Exports, Upstream and Downstream Direct Linkages*

In the following subsections we apply the methods sketched above to answer three sets of questions concerning Italian trade and participation in GVCs: *i*) *VA in gross exports*: which share of Italian exports consists of domestic value added? Is this comparable with the domestic value added shares of other top exporters? How has the value added content of exports evolved over time? *ii*) *Italian downstream linkages*: which share of Italian exports is actually consumed in the importing country? How much is re-exported and where? Where is the Italian value added finally consumed? *iii*) *Italian upstream linkages*: where has Italian imports' value added been produced? How much of it is directly consumed? Which part is re-exported?

3.2*a VA in Gross Exports*

We breakdown Italy's and other major economies' exports with the KWW decomposition to retrieve the domestic and foreign VA in export. As shown in Figure 7, only 73.5% of Italy's gross exports stems from value added actually originated in Italy, while 19.3% comes from other countries and the rest consists of goods and services crossing the same national borders several times (*i.e.* pure double counting). This breakdown in VA shares of total gross exports is typical also of other European countries and the resulting domestic VA share is well below the world average.

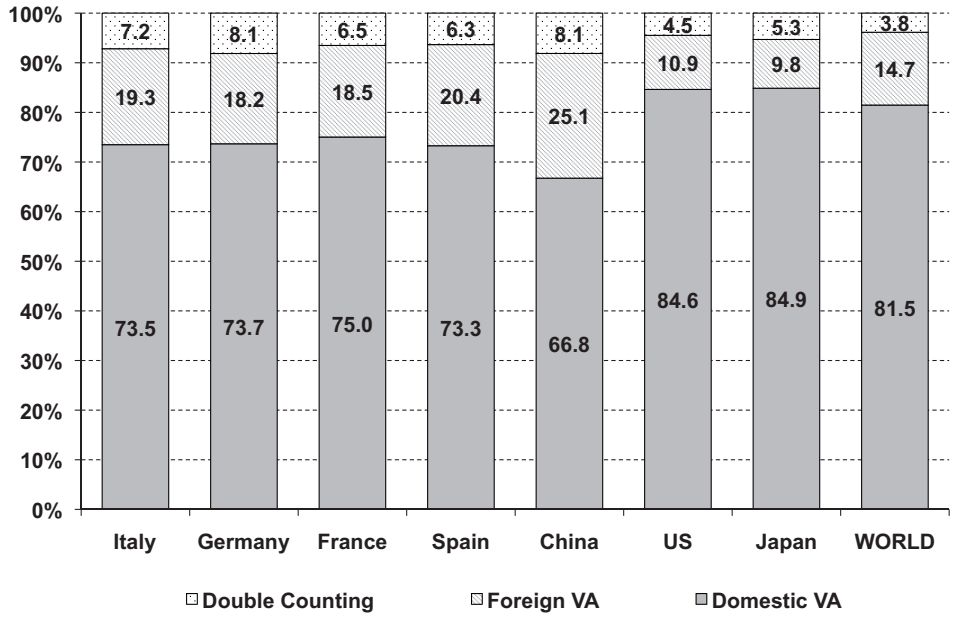
On aggregate, between 1995 and 2014, the share of domestic value added in global trade has declined by 7.4 p.p. The major European countries have experienced the sharpest contraction (Figure 8). In particular, they show similar dynamics between 1995 and 2010; after that, the share of domestic VA in exports has remained almost unchanged for Italy, it has fallen marginally for France and Germany and it has dropped considerably for Spain. Japan has experienced a very steep decrease in the domestic VA content of its exports since 1995, so that in 2014 its share was in line with that of the major European economies, while in the mid-nineties it was about 10 p.p. higher. Also in the US the domestic value added share started from a relatively high level, but it has shrunk only modestly over the last two decades.

The figures for China vary substantially depending on the data source employed. As already mentioned, WIOD data do not properly take into account China's processing trade, underestimating the foreign value added in exports. TiVA tables give a more reliable picture and in this case Chinese VA in exports

fluctuates between 60% and 70%, well below the values obtained with WIOD tables. Moreover, after declining from 1995 to 2005, China's VA share in exports bounced back, and in 2011 had returned to the level of the mid-nineties.

FIGURE 7

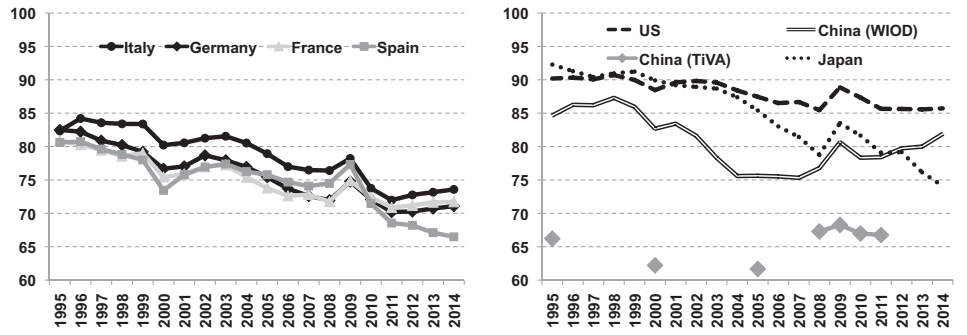
VALUE ADDED CONTENT OF EXPORTS
(year 2011)



Source: Our elaboration on OECD-TiVA and WIOD.

FIGURE 8

VALUE ADDED CONTENT OF EXPORTS EVOLUTION



Source: Our elaboration on OECD-TiVA and WIOD.

3.2*b* *Italy's Downstream Linkages*

We investigate the downstream structure of the production networks in which Italy is involved using Borin and Mancini (2015) bilateral decomposition of exports (Table 3). In particular, we analyze the channels through which Italian exports reach the markets of final destination.[8] We consider Italy's top sixteen exports destinations, which take two-thirds of total Italian exports of goods and services.[9]

The share of domestic VA in Italian exports turns out to be smaller than average in exports to the other EU economies except the UK, and particularly smaller in those to Spain and Austria. Conversely, the double-counting shares in those export flows are relatively large. Since this component is generated by trade flows that cross the same borders more than once, this finding should be taken as evidence of the deep interconnection of intra-EU production networks. At the same time, the export flows that embed the largest shares of domestic VA are those to the major emerging economies, such as China, Russia and Brazil.

The domestic VA embedded in exports can be further broken down according to country of final absorption.[10] The non-European markets have the largest proportion of direct absorption of value added generated and exported by Italy. Conversely, about a third of the domestic VA exported to Germany is embedded in intermediate goods that are processed there and re-exported to third markets. Similar shares for the redirection term are registered in exports to Austria and Poland. Thus Germany and these other EU economies play an important role in the downstream stages of the international production chains in which Italy takes part: between 40% and 60% of Italian domestic value added that passes through

[8] For this exercise the sink-based decomposition presented in Appendix A is better suited since it accounts the value the last time it crosses the national borders, which is the export flow more closely related with the market of ultimate absorption. The same approach is used in section 3.2c to explore Italian upstream linkages.

[9] We compute the shares of domestic VA, foreign VA and pure double-counting embedded in Italian exports in 2011 (the last year for which we have both WIOD and TiVA data). The first component is the sum of the following items of the sink based decomposition of the Appendix A: 1, 2 (*i.e.* 2a+2b+2c), 3, 4 and 5 (divided by the total exports to each country). Similarly the foreign VA of exports is obtained by summing items 7 and 8. Finally, pure double-counting comes from items 6 and 9. The bottom rows in Table 3 report the shares in Italy's bilateral exports to each importer.

[10] In particular, three sub-components can be defined: the domestic VA that serves the final demand in the direct importing country (*i.e.* 1+2a+2b+3c, direct absorption); the VA that ultimately comes back to the country of origin to be consumed there (*i.e.* 4a+4b+4c, reflection); and the domestic VA absorbed by final demand in third countries (*i.e.* 2c+3a+3b+3d, redirection).

EU trade partners before being re-exported is ultimately absorbed in other European markets. But Italian exports to Germany are different, since a substantial portion is used in the production of goods that are finally consumed outside Europe, notably in the US and China.

TABLE 3

VALUE ADDED DECOMPOSITION OF ITALIAN BILATERAL GROSS EXPORTS
(year 2011)

	DEU	FRA	USA	ESP	GBR	CHE	CHN	RUS
Italian VA	**72.4**	**70.9**	**73.3**	**62.7**	**74.5**	**72.3**	**74.6**	**75.8**
Absorption	47.0	53.9	67.2	48.0	60.0	54.3	45.3	70.8
Reflection	1.4	1.1	0.1	1.1	0.6	1.2	0.7	0.4
Redirection	24.0	15.8	6.0	13.5	13.9	16.8	28.6	4.6
to EU27	*39.6*	*42.7*	*18.0*	*53.4*	*36.2*	*40.2*	*17.1*	*31.4*
to USA	*11.5*	*9.8*	*0.0*	*6.7*	*15.9*	*14.8*	*25.1*	*10.0*
to Japan	*2.5*	*2.8*	*6.0*	*1.6*	*2.7*	*4.1*	*10.9*	*4.3*
to EME ASIA excl. China	*9.3*	*8.3*	*16.0*	*5.6*	*11.7*	*12.4*	*18.4*	*10.2*
to China	*8.2*	*5.0*	*7.3*	*2.9*	*4.8*	*6.5*	*0.0*	*7.4*
Foreign VA	16.2	21.0	24.0	27.0	19.7	19.9	14.9	22.1
Double counting	11.4	8.1	2.7	10.3	5.8	7.8	10.6	2.1
Share on total gross exports	*12.2*	*10.5*	*7.6*	*5.4*	*5.3*	*4.3*	*3.9*	*3.1*

	TUR	POL	AUT	JPN	BRA	IND	ROU	GRC
Italian VA	**71.8**	**72.4**	**69.3**	**74.7**	**78.4**	**75.1**	**72.8**	**72.9**
Absorption	61.5	47.3	45.1	69.3	71.4	63.1	57.6	64.6
Reflection	0.7	1.8	1.5	0.1	0.2	0.2	2.0	0.2
Redirection	9.6	23.2	22.8	5.3	6.8	11.8	13.2	8.1
to EU27	*39.6*	*60.1*	*52.8*	*11.5*	*14.2*	*21.5*	*52.5*	*45.1*
to USA	*7.7*	*5.9*	*9.2*	*20.3*	*15.0*	*19.0*	*6.1*	*10.0*
to Japan	*1.1*	*1.0*	*1.8*	*0.0*	*4.4*	*2.8*	*1.5*	*1.0*
to EME ASIA excl. China	*7.6*	*3.9*	*6.7*	*25.3*	*10.1*	*14.4*	*4.9*	*6.9*
to China	*2.6*	*2.5*	*4.6*	*18.3*	*12.1*	*6.1*	*2.6*	*2.2*
Foreign VA	23.4	16.9	19.2	23.1	19.6	20.8	21.1	24.5
Double counting	4.7	10.6	11.5	2.2	2.1	4.1	6.1	2.6
Share on total gross exports	*2.9*	*2.3*	*2.1*	*1.9*	*1.5*	*1.4*	*1.4*	*1.3*

Source: Our elaboration on OECD-TIVA and WIOD.

3.2*c Italy's Upstream Linkages*

We explore the upstream structure of the production networks in which Italy is involved (Table 4), considering its bilateral imports from the main sixteen partners, which account for around the two thirds of total goods and services imported by Italy. In particular, we retrieve the foreign value added in Italian imports, highlighting where this value added originated, using again the Borin

and Mancini (2016) bilateral decomposition of trade flows. We compute the share of domestic value added in these flows, tracing what is immediately absorbed in Italy (direct absorption), what is exported back to the importing country (reflection) and what is exported to other economies by Italy (redirection). Then, we analyze in more detail the foreign content of exports.[11]

Around one fourth of the Italian imports originated in countries different from the direct exporter. The foreign content of Italian imports is slightly less than 30% for Germany, France and Spain, around 35% for Netherlands, Austria and Poland and much higher for Belgium and Ireland (around 45%). These shares are generally lower for extra-EU economies (around 20% for India and Turkey, even less for the US), but quite high (about 30%)in the case of China due to its extensive processing trade activity. Imports from Russia and Saudi Arabia consist almost entirely of domestic value added, since they are mainly made up of energy and fuels. Nevertheless, only around 65% of the value added imported from these two countries is consumed in Italy, the rest being re-exported.

Breaking down each bilateral import flow according to the country of origin, it emerges that about 50% of foreign value added in China's exports to Italy is originated in other countries of the "actory Asia". Similarly, on average around one half of the foreign value added in imports from any given European country comes from other European countries, signaling the strong interlinkages existing within the European production networks. We can conclude that the analysis of bilateral exports and imports proves Italy's thorough integration into the "factory of Europe" in which Germany plays the leading role (see also Amador *et* al., 2015).

[11] The foreign content of exports consists of foreign value added embedded in goods and services imported by the Italian partner to produce intermediate and final goods then exported to Italy, both to meet the local demand (foreign VA, term 7 and 8 of the KWW decomposition, also reported in Table 4) both to be re-exported again by Italy itself (foreign component of the double counting, term 9). This latter term, despite being already accounted for in other bilateral flows, is particularly relevant to assess where the entire value added imported by Italy has been truly originated.

TABLE 4

VALUE ADDED DECOMPOSITION OF ITALIAN BILATERAL GROSS IMPORTS
(year 2011)

	DEU	FRA	CHN	ESP	USA	RUS	GBR	CHE
Domestic VA	**70.0**	**70.2**	**69.4**	**71.4**	**85.5**	**94.7**	**77.9**	**77.7**
Absorption	53.7	54.0	54.9	54.8	65.8	63.6	61.1	60.3
Reflection	1.8	1.5	0.6	0.7	1.9	0.7	0.8	0.8
Redirection	14.6	14.7	14.0	15.8	17.9	30.4	16.1	16.6
Domesic Double Counting	1.2	0.6	0.4	0.3	0.2	0.1	0.2	0.3
Foreign Content of Exports	28.7	29.3	30.1	28.3	14.3	5.2	21.9	22.0
from EU27	*47.5*	*48.8*	*17.3*	*48.0*	*19.2*	*43.4*	*44.8*	*63.2*
from USA	*8.2*	*8.0*	*9.5*	*6.4*	*0.0*	*7.4*	*11.9*	*11.0*
from Japan	*3.0*	*2.1*	*14.3*	*1.8*	*5.9*	*5.4*	*3.4*	*2.1*
from EME ASIA excl. China	*7.2*	*7.6*	*34.9*	*8.4*	*14.9*	*9.7*	*10.0*	*5.3*
from China	*5.1*	*6.1*	*0.0*	*5.2*	*9.9*	*10.1*	*6.7*	*3.0*
memorandum: Foreign VA	*21.3*	*22.0*	*23.4*	*21.3*	*11.2*	*3.5*	*17.2*	*16.7*
Share on total gross imports	*14.7*	*9.0*	*6.7*	*5.5*	*4.7*	*4.7*	*4.1*	*3.2*
	IND	**AUT**	**BEL**	**POL**	**TUR**	**NLD**	**IRL**	**SAU**
Domestic VA	**78.5**	**65.1**	**52.7**	**61.0**	**76.9**	**64.4**	**56.5**	**97.7**
Absorption	58.8	47.7	39.4	48.8	57.1	49.3	44.0	64.8
Reflection	0.2	0.3	0.2	0.2	0.6	0.2	0.0	0.3
Redirection	19.4	17.1	13.1	12.0	19.2	15.0	12.4	32.7
Domesic Double Counting	0.0	0.2	0.2	0.2	0.1	0.2	0.1	0.0
Foreign Content of Exports	21.5	34.7	47.1	38.8	23.0	35.4	43.5	2.3
from EU27	*14.5*	*59.9*	*56.2*	*57.5*	*37.7*	*48.3*	*52.0*	*29.8*
from USA	*8.8*	*4.1*	*8.9*	*4.4*	*6.9*	*15.3*	*30.9*	*9.6*
from Japan	*2.5*	*1.1*	*1.5*	*2.9*	*2.4*	*1.9*	*1.2*	*3.0*
from EME ASIA excl. China	*24.1*	*4.0*	*6.7*	*6.1*	*10.5*	*8.0*	*4.0*	*14.7*
from China	*8.8*	*2.9*	*2.9*	*6.7*	*6.2*	*3.8*	*1.9*	*5.9*
memorandum: Foreign VA	*16.6*	*24.4*	*33.9*	*31.1*	*16.4*	*27.0*	*34.4*	*1.6*
Share on total gross imports	*2.1*	*2.1*	*2.1*	*2.1*	*2.0*	*1.8*	*1.7*	*1.5*

Source: Our elaboration on OECD-TiVA and WIOD.

4. - GVC Participation and Positioning

4.1 *Measures of Participation in GVCs*

A basic question in the GVC empirical literature has been to what extent individual countries and sectors are involved in international production networks. Following the seminal article of Hummels *et* al. (2001), one of the most commonly used measure of GVC participation is the "vertical specialization" index ()that measures the share of imported inputs in the overall exports of a given

country *s*:

$$VS_s = \frac{\sum_{r \neq s}^{G} \mathbf{V}_r \mathbf{B}_{rs} \mathbf{E}_{s*}}{\mathbf{u}_N \mathbf{E}_{s*}} \quad (8)$$

However, *VS*, that corresponds to the "foreign content" components of gross exports in KWW (*i.e.* **7**+**8**+**9** in Figure 5), is only a partial measure of GVC participation, as it considers only the backward linkages. Since a country also participates in GVCs by being a supplier of inputs processed abroad for further exports, Hummels *et* al. (2001) propose a different indicator, labeled *VS*1, that should take into account also the forward production linkages. This index was not specified analytically by Hummels *et* al. (2001), but they suggest that it should correspond to the domestic value added in country's exports that is embodied in other countries' exports. In the literature, *VS*1 has been usually computed as follows (see among others Koopman *et* al., 2011, Backer and Mirodout, 2013):

$$VS1_s = \frac{\sum_{r \neq s}^{G} \mathbf{V}_s \mathbf{B}_{sr} \mathbf{E}_{r*}}{\mathbf{u}_N \mathbf{E}_{s*}} \quad (9)$$

So, the overall GVC participation index has been calculated as the sum of VS_s and $VS1_s$ shares.

It is worth noting that the same value added produced in *s* can be counted many times in other countries' exports, generating what KWW call the double counting in exports originated abroad. Therefore the numerator in *(9)* is not consistent with the denominator, and hence $VS_s + VS1_s$ cannot be considered an accurate measure of the share of country *s* exports related to GVC.

To tackle backward and forward production linkages in a consistent way, Cappariello and Felettigh (2015) measure the "international fragmentation of production" of a country as the share of total exports consisting in components **3** to **9** in KWW's breakdown (see Figure 5 and Appendix A). The idea is that all trade flows are related in some way to GVCs, except for the exports of domestic value added that is directly absorbed by the first importer (**1**+**2** in KWW's classification). As already mentioned, however, the original KWW taxonomy does not properly allocate the domestic VA embedded in intermediate exports between the share going to direct importers and that absorbed in third markets.

Through the decomposition of bilateral exports, Borin and Mancini (2015) provide a more precise definition of "direct absorption". They are able to single

out the trade flows involved in global value chains, conventionally defined as production processes that require at least two international shipments of goods (Hummels *et* al., 2001). To this end, they identify the fraction of domestic value added in gross trade flows that *i)* is exported for the very first time and *ii)* never leaves the first importing country.

To comply with requirement *i)*, the source-based decomposition of bilateral exports is better suited, since it accounts the entire domestic value added the first time it crosses the national border; on the contrary, the sink-based decomposition accounts the entire domestic value added the last time it leaves a country (*i.e.* as close as possible to the final demand).[12] Two items of the breakdown proposed by Borin and Mancini (2015) identify the fraction of domestic value added that is directly absorbed by the importing country (**1a*** and **2a*** of the source-based decomposition in Appendix A). Summing across the bilateral destinations, it is possible to measure the entire domestic value added exported by country *s* that can be considered as traditional "Ricardian" trade:

$$(10)\ DAVAX_s = \left[\mathbf{V}_s\left(\mathbf{I}-\mathbf{A}_{ss}\right)^{-1}\sum_{r\neq s}^{G}\mathbf{Y}_{sr} + \mathbf{V}_s\left(\mathbf{I}-\mathbf{A}_{ss}\right)^{-1}\sum_{r\neq s}^{G}\mathbf{A}_{sr}\left(\mathbf{I}-\mathbf{A}_{rr}\right)^{-1}\mathbf{Y}_{rr}\right]$$

Thus, it is possible to measure GVC-related trade flows simply by excluding from total exports the entire domestic value added absorbed directly by the importers ($DAVAX_s$):

$$(11)\qquad GVCX_s = \mathbf{u}_N\mathbf{E}_{s*} - DAVAX_s.$$

[12] A detailed description of the two approaches is provided by Nagengast A.J. and Stehrer R. (2016). However one can get a feel of these differences by comparing the analytic expressions of two decompositions proposed by Borin A. and Mancini M. (2015) and reported in Appendix A. In both cases two items identify the fraction of domestic value added that is directly absorbed by the importing country. However in the source-based decomposition the terms **1a*** and **2a*** differ from those of the sink-based one (**1** and **2a**) in the fact that the share of domestic value added is calculated using the local inverse Leontief matrix (*i.e.* $(\mathbf{I}-\mathbf{A}_{ss})^{-1}$), instead of the global inverse Leontief matrix (*i.e.* $\mathbf{B}_{ss}$). This allows to exclude all the backward linkages of the domestic country within the international production networks.

Therefore, the share of GVC-related trade in total exports is

$$GVC\ exp_s = \frac{GVCX_s}{\mathbf{u}_N \mathbf{E}_{s*}} \tag{12}$$

This notion of GVC related trade is adopted also by Wang *et* al. (2016), who further distinguish between a "deep GVC participation" defined analogously to and a "shallow GVC participation" that is computed subtracting from total trade just the first term of (10), therefore considering as part of GVC also the domestic VA in intermediate exports absorbed by direct importers as local final goods. The latter refers to value added that crosses only one national border, although the production process is shared by two countries (the exporter and the importer). In what follows we maintain the definition of "GVC related activity" presented in equation 11 (*i.e.* we consider only the "deep" component in the Wang *et* al., 2016 wording).

Relying on the assumptions of the ICIO model and on the definition of GVC by Hummels *et* al. (2001), we are now able to precisely single out the share of gross trade flows that stem from countries' participation in global production sharing. This allows us to assess how import and export dynamics are driven by the evolution of GVCs. Nevertheless, in order to gauge the overall degree of involvement of a country (or of a specific sector) we cannot limit the analysis to trade flows. Indeed, in some countries the exporting sectors might be deeply integrated in GVCs, but they might account only for a small fraction of the whole economic activity. It was the case, for instance, of China at the beginning of its opening up process in the late '80s and early '90s, when the exporting firms, mainly located in the Special Economic Zones, where highly involved in the international production chains, while the remaining part of economic activity was still generally domestically oriented. Moreover, regarding the sectoral participation in GVCs, it is necessary to take into account that some industries might be indirectly involved in the production networks in spite of their limited export activity (e.g. often services are supplied as inputs to manufacturing sectors that directly participate in GVCs).

In order to obtain a more general assessment of country/sector participation in GVCs, Wang *et* al. (2016) develop two separate indicators: the first one, labeled GVC_v, focuses on forward production linkages and it is based on a breakdown of the total value added generated in a specific sector; the second one, named GVC_y

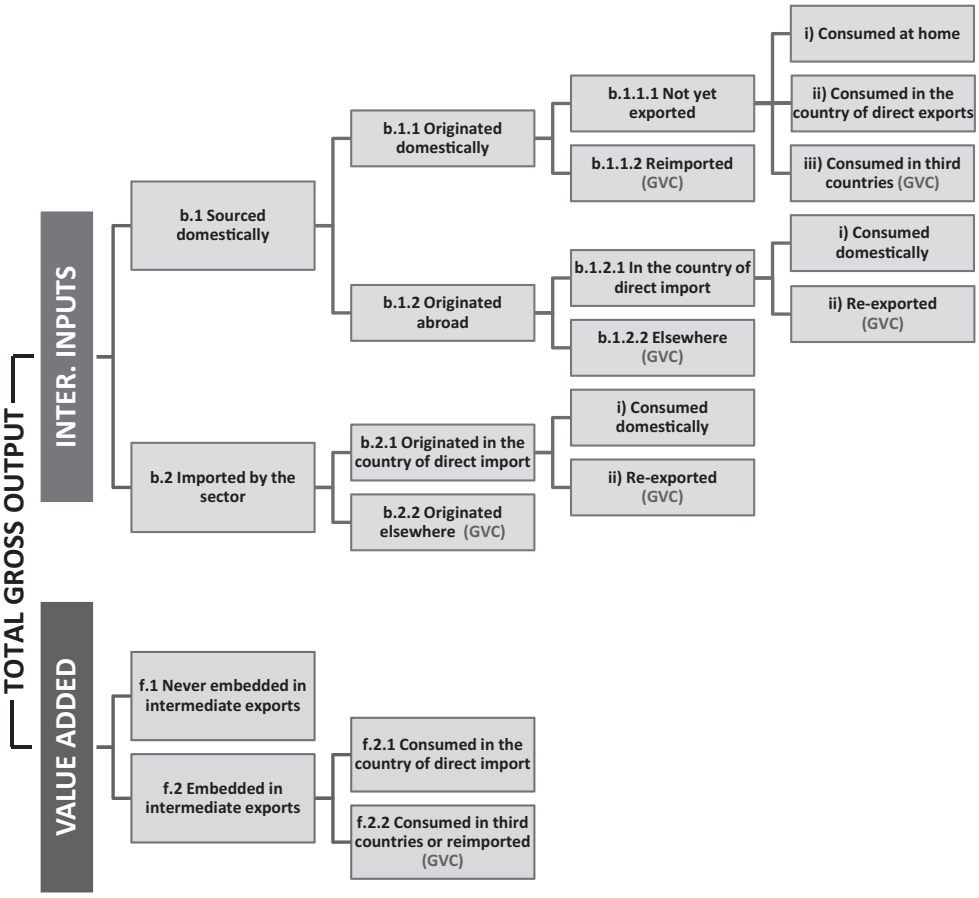
is backward oriented and it relies on a decomposition by sector of final production. In both cases the GVC related component of value added is identified by embracing the same rationale of the *GVC* exp index.

An alternative way to generalize the measures of participation in gross exports is to look at gross output, which is the natural extension to consider also the domestic networks. The scheme in Figure 9 shows a decomposition of gross output in terms of intermediate inputs and direct value added that isolates the components related to GVCs from those that attain exclusively to the domestic production or to the traditional "Ricardian" trade, as defined in *(10)*. As for the other cases, the analytical expression for some key elements of the decomposition is provided in Appendix A. Here we want only to recall the basic logic adopted. As regards the input component, we consider as GVC related the items that have already crossed at least two national borders before entering in the production of a given sector (*i.e.* **b.1.1.2**+**b1.2.2**+**b.2.2** in Figure 9) and those that overall cross at least two borders, considering also the following downstream production stages (**b.1.1.iii**+**b.1.2.1.ii**+**b.2.1.ii**). As regards the value added directly generated in the sector, only the portion that will be re-exported by the country of import is classified as GVC related (**f.2.2**). Then, the share of GVC related gross output for sector in country can be measured as:

$$(13)\ GVCout_s = \frac{\mathbf{X}_s^i - \mathbf{b.1.1.1.i} - \mathbf{b.1.1.1.ii} - \mathbf{b.1.2.1.i} - \mathbf{b.2.1.i} - \mathbf{f.2.1}}{\mathbf{X}_s^i}.$$

Figure 9

A BREAKDOWN OF GROSS OUPUT INTO GVC AND NON-GVC COMPONENTS



Source: Authors' own elaboration.

4.2 *A Measure of Relative Position in GVCs*

One possible way to better characterize the participation in GVCs is to assess the position of countries and sectors along the production line.

The possibility to slice up the production process into a number of different locations allows countries to specialize in different tasks and business functions (Grossman and Rossi-Hansberg, 2008). Indeed, some analyses point out that the benefits coming from GVC participation are unevenly distributed across different phases of the production process (OECD-WTO-World Bank Group Report, 2014). In particular, the GVC diffusion has favored a shift of value added shares

in manufacturing away from the fabrication stages to pre- and post-fabrication services (Baldwin *et* al., 2015). Being positioned further upstream (or downstream) along the value chain does not necessary entail a more favorable position. Gereffi *et* al. (2005) propose a detailed taxonomy of the different types of governance in production chains: in some cases, firms close to the final customer play a leading role, in other cases the key functions take place in the first phases of the production (see Giovannetti and Marvasi, 2016).

Measuring the relative position of countries and sectors in GVCs remains a necessary condition in order to gauge economic implications and to evaluate differences and similarities of specialization patterns across countries. Moreover, the relative upstream (or downstream) positioning of an industry also affects how it reacts to final demand shocks, as the propagation of these shocks varies along the production line (mainly through changes in inventories, see Alessandria, 2011; Altomonte *et* al., 2012).

Different indicators of "upstreamness" and "downstreamness" have been proposed in the literature (see Fally, 2012; Antras and Chor, 2013; Miller and Temurshoev, 2015) in order to measure a sector/country's position in GVCs. Wang *et* al. (2016) bring together most of these measures using a unified framework. They define a general measure of the length of a value chain as the average number of production stages between the primary inputs in a country-sector pair and the final products in another country-sector. It corresponds to the average number of times that value-added generated in the country-sector of origin has been counted as gross output in the production process until it is embodied in a final products. For instance, when the sector of origin *i* coincides with the sector of ultimate absorption *j* the number of steps are equal to 1 and the value added generated in this final stage of production is equal to $v_i y_i$. When the sectoris one step away from the final good *j* the corresponding value added can been computed as $v_i a_{ij} y_j$.

Following the same logic, we can consider all the possible patterns through which the value-added created in sectorenters (directly and indirectly) in final goods of sector. Then, summing all the production lengths, with the corresponding value added as weights, we obtain the following:

$$\delta_{ij} v_i y_j + 2 v_i a_{ij} y_j + 3 v_i \sum_k^N a_{ik} a_{kj} y_j + \ldots = v_i \sum_k^N b_{ik} b_{kj} y_j$$

where $\delta_{ij} = 1$ when $i = j$ and 0 otherwise.

Dividing this expression by the total value added of sector i embedded in final goods of j, we can obtain the average length of the production process that originates in i and ends in j:

$$Pl_{ij} = \frac{v_i \sum_k^N b_{ik} b_{kj} y_j}{v_i b_{ij} y_j} \tag{14}$$

It can be generalized to a ICIO model with N industries and G countries using matrix algebra:

$$Pl = \frac{\hat{\mathbf{V}}\mathbf{B}\mathbf{B}\hat{\mathbf{Y}}}{\hat{\mathbf{V}}\mathbf{B}\hat{\mathbf{Y}}} \tag{15}$$

where is a matrix of production lengths by pairs of country-sector of origin and country-sector of final completion.

Starting from equation *(15)* two basic measures have been computed in the literature. The first one is the average distance of a given country-sector pair from the entire final demand. This indicator, labeled "upstreamness index" in Fally (2012) and Antras *et* al. (2012), can be obtained as a weighted average of all the production lengths in *(15)*, by summing across all the country-sector pairs of final completion, with the value added embedded in each final product as weights. Wang *et* al. (2016) show that it can be computed as:

$$Plv = \frac{\hat{\mathbf{V}}\mathbf{B}\mathbf{B}\hat{\mathbf{Y}}\mathbf{u}'_N}{\hat{\mathbf{V}}\mathbf{B}\hat{\mathbf{Y}}\mathbf{u}'_N} \tag{16}$$

The second indicator focuses on the country-sector of the final good and measures the average production length through all the backward industrial linkages. It is named "downstreamness index" in Antras and Chor (2013) and it can be computed from the basic production lengths in *(15)* by averaging across all the country-sectors of origin:

$$Ply = \frac{\mathbf{u}_N \hat{\mathbf{V}}\mathbf{B}\mathbf{B}\hat{\mathbf{Y}}}{\mathbf{u}_N \hat{\mathbf{V}}\mathbf{B}\hat{\mathbf{Y}}} \tag{17}$$

The position in GVCs is a relative measure depending both on the total length of the production process and on the distance from the final demand. Therefore a possible way to measure the relative position of a sector along the production line is to take the *ratio* between the average number of forward production linkages, measured as *Plv*, and the average number of backward production linkages, measured as *Ply*:

$$Ps_s^i = \frac{Plv_s^i}{Ply_s^i} \tag{18}$$

4.3 *Focus on Italy: Participation and Positioning of Italian Sectors*

The first question that we would like to address in this section is how relevant are GVCs for Italian trade and, more in general, for its economic activity. To this end we compute the different indicators of GVC participation, discussed in the previous section, for Italy and other major exporting countries. Table 5 shows the results for 1995 and 2011, obtained from TiVA dataset.[13] Regarding the participation in exports, we showed that the index provides the most precise estimates as it is based on a comprehensive breakdown of bilateral trade flows. For Italy it indicates that 43.7% of total exports in 2011 was related to international production chains. This figure is in line with the other major European exporters, except Germany that exhibits a slightly higher index, akin to China. By contrast, the share of US exports related to GVCs is well below the world average. As expected, the *GVC*exp index is always higher than that based on the aggregate KWW decomposition, while it is lower than the sum of *VS* and *VS*1, as the latter also includes some items that are not part of a country's exports. Focusing on the evolution between 1995 to 2011, we can say that Italy increased its export participation more than the world average. On the contrary, although it started from

[13] TiVA tables are more suitable to compute these indicators for China as they include a correction for processing trade. For all the other countries considered we obtain similar results using WIOD tables.

a high level, the GVC share for China's exports has risen only modestly (4.5 p.p.), and even less in the case of imports (2.8 p.p.). This result is mainly driven by a reduction in the foreign content of exports, as suggested by the reduction of the *VS* indicator, meaning that China's has been reducing its dependence on foreign inputs to produce its exports.

Table 5

GVC PARTICIPATION MEASURES

	GVCexp			GVCimp			GVCout		
	1995	2011	delta	1995	2011	delta	1995	2011	delta
Italy	30.5	43.7	13.2	34.9	44.1	9.2	11.0	15.9	4.9
Germany	33.1	46.0	12.9	32.7	49.1	16.4	9.8	20.7	10.9
Spain	31.7	42.7	11.1	34.1	44.1	10.0	9.4	15.5	6.2
France	33.2	43.0	9.8	34.5	43.4	9.0	10.0	14.2	4.3
US	29.9	36.4	6.5	29.5	35.8	6.4	5.2	7.2	2.0
China	41.8	46.4	4.5	50.2	53.0	2.8	6.3	11.6	5.3
Japan	26.0	41.6	15.6	22.8	34.5	11.8	4.0	9.4	5.3
World	*33.8*	*44.8*	*10.9*	*33.8*	*44.8*	*10.9*	*8.5*	*13.9*	*5.4*
	Exports (KWW)			**VS**			**VS1**		
	1995	2011	delta	1995	2011	delta	1995	2011	delta
Italy	25.0	36.2	11.2	17.2	26.4	9.2	15.4	21.1	5.7
Germany	26.0	37.4	11.4	14.8	25.5	10.6	20.7	24.1	3.4
Spain	31.7	42.7	11.1	19.1	26.8	7.7	14.3	19.7	5.4
France	26.7	35.0	8.3	17.2	25.0	7.8	17.9	21.9	4.0
US	24.5	28.8	4.2	11.4	15.0	3.5	19.4	24.9	5.5
China	38.4	40.7	2.4	33.3	32.1	-1.2	9.5	15.6	6.1
Japan	18.1	30.3	12.3	5.6	14.6	9.0	23.8	32.8	9.0
World	*27.6*	*36.2*	*8.7*	*17.9*	*24.2*	*6.3*	*17.9*	*24.2*	*6.3*

Source: Our elaboration on Oecd-TiVA.

The *GVCout* indices, which provide a more general assessment of the GVCs' role in overall economic activity, are obviously smaller than those computed on exports and imports but they also provide a slightly different picture. Italy and the other major European countries show a level of participation above the world average. In particular, GVC related production in Germany reached 20.7% of total gross output in 2011, more than double the level of 1995. The *GVCout* index for China was very modest in 1995 but has increased substantially since then. Indeed in the mid-nineties China's exporting firms were already highly integrated in GVCs, but they accounted only for a small fraction of economic activity; today a much larger share of Chinese firms are involved in global production networks, even if the GVC intensity of exports has remained generally stable.

Table 5 shows that countries participate to a different extent in GVCs, but also within each single country there might be remarkable differences across industries. In order to investigate this aspect, we compute the *GVCout* indicators at sectoral level for Italy and for the world average. Using a measure of GVC participation based on gross output allows us to have a reliable indicator also for industries with a modest direct export (or import) activity. The results for 2000 and 2014, computed drawing on the 2016 release of the WIOD tables, are displayed in Figure 10. As expected, there is a strong heterogeneity across industries, and generally Italian sectors exhibit a pattern in line with the world average. Unsurprisingly manufacturing is more involved in GVCs compared to services; nevertheless, the *GVCout* indices for sectors like transportation, repair and installation of machinery and equipment and waste management are comparable to the manufacturing average. In recent years the international production chains have increasingly involved several types of business services (*i.e.* the legal and accounting activities, the activities of head offices, the management consultancy activities, advertising and market research).

In 2014 almost all the Italian manufacturing sectors show a level of GVC participation above the world average, with the only exception of the production of computer, electronic and optical products. The evidence is more mixed for services. The difference relative to the world average has widened considerably since the early 2000s. The highest shares of GVC related output are recorded in the production of basic metals, in the manufacture of electrical equipment, in the chemical and pharmaceutical industry, in the manufacture of refined petroleum products and in the manufacture of rubber and plastic products. But also some other key Italian sectors present a *GVCout* index well above the world average, with a strong upward trend between 2000 and 2014: the non-metallic mineral productions, the manufacture of textiles, wearing apparel and leather products and the production of motor vehicles.

The last aspect considered in this section is the relative position of Italian sectors within the international production chains. To this end, we compute the relative position index *Ps* presented in the previous section for all the manufacturing sectors and for the tertiary industries with the highest participation in GVCs. The results for Italy and for the world average in 2014 are presented in Figure 11 and Figure 12. Notice that the higher (lower) is the value of the index, the more upstream (downstream) is the industry; by construction the average (weighted by value added)for all country-sector pairs is equal to one.

The ranking of industries based on their relative upstreamness index appears largely in line with what we would expect *a priori*. Business and financial services are the most upstream sectors; in manufacturing, the sectors producing intermediate goods like basic metals and metal products, non-metallic mineral products, basic chemical products, wood and wood products are among those with the highest *Ps* index. On the contrary, sectors like construction, accommodation and food services, health and social work activities, production of motor vehicles and other transport equipment, furniture manufacture and the production of food, beverages and tobacco are the closest to the final demand.

The relative position of Italy along the value chains often resembles the world average for a given sector, with some exceptions. In typical upstream manufacturing sectors (*i.e.* basic metals, basic chemical productions, coke and refined petroleum productions) Italy seems relatively more downstream than the world average. This might stem from the fact that Italy imports from abroad a large share of the raw materials employed in these productions. On the contrary, Italy turns out to be an international supplier of intermediates of fabricated metal products. Finally, Italian firms are on average specialized in the relatively downstream production stages of some advanced industries, such as pharmaceutical products and computer, electronic and optical products.

We then analyze in more detail the role of Italy in some selected manufacturing sectors that produce a large share of the domestic value added destined for foreign markets. The scatters in Figure 13 compare the country's participation to GVCs (on the vertical axis) with its relative position along the production chain (on the horizontal axis) for the following industries: *i)* machinery and equipment; *ii)* textiles, wearing apparel and leather products; *iii)* motor vehicles; *iv)* chemicals and chemical products. We consider only the countries with a relative specialization in the sector and/or those that appear among the first ten exporters in terms of domestic value added absorbed abroad, omitting those countries that play only a marginal role in the industry.[14]

Compared to the other main exporters, Italy presents an intermediate level of GVC participation in all the sectors considered, while in general the share of these sectors' gross output related to GVCs is below the average for some large non-European economies (*i.e.* USA, China, Japan and India).

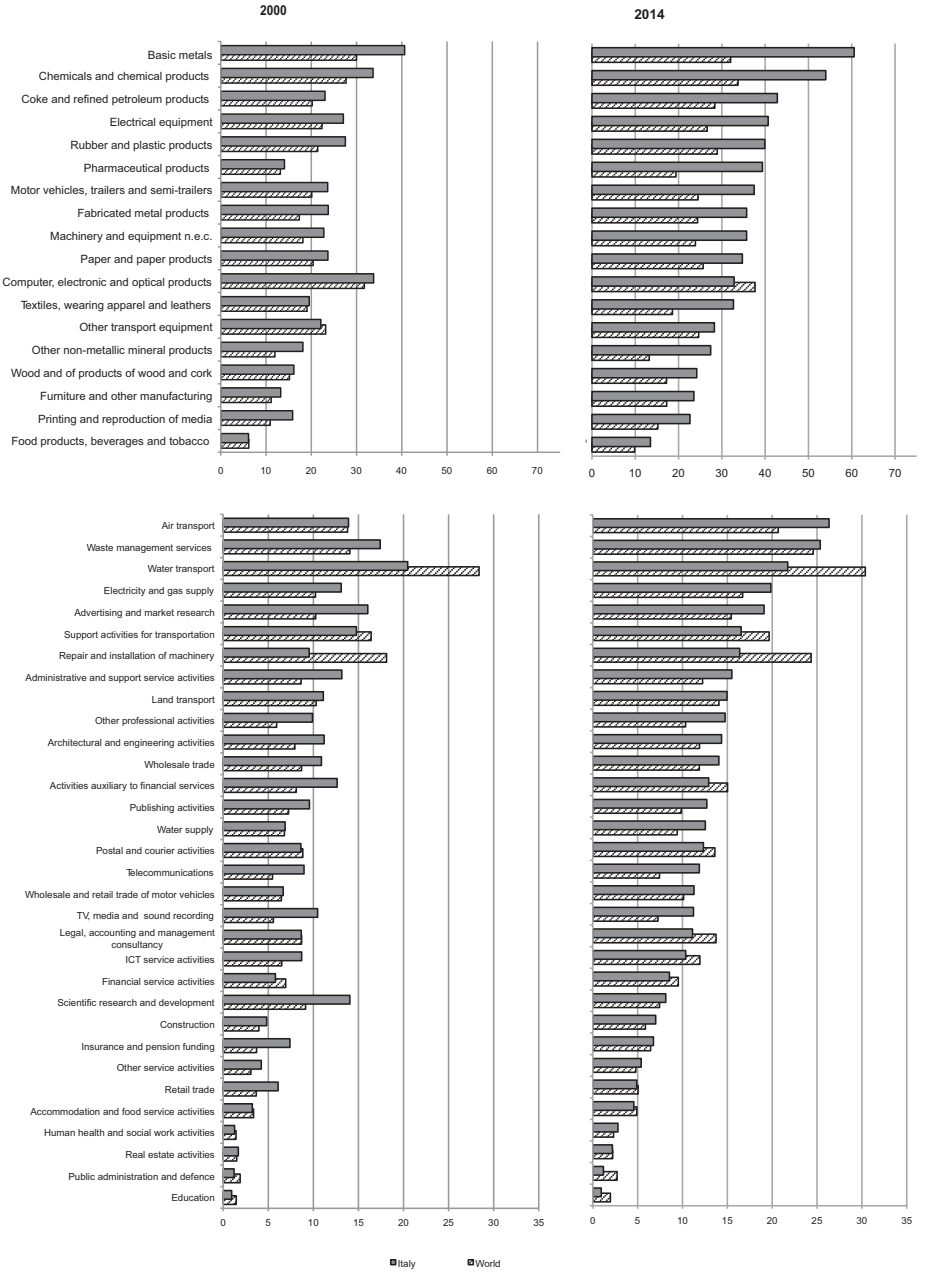
[14] The specialization is based on the Balassa index computed on the domestic value added ultimately consumed abroad.

The manufacture of textiles, wearing apparel and leather products presents a high cross-country dispersion of the indicator of positioning. Italy seems to be specialized in the upper stages of the production chains (to the right in the chart), a position similar to that of China. Only South Korea shows a higher level of upstreamness among the main producers of textiles and apparels. Down the production chain we find several Balkan and Eastern European countries that are known to have relevant trade and investment ties with the Italian firms that operate in this sector (e.g. Romania, Bulgaria, Croatia, Turkey, see Giovannetti and Luchetti, 2007; Prota and Viesti, 2007).

Italy takes a totally different position in the chemical industry, where Italian firms seem to be engaged mainly in production stages close to the final demand. Finally, in the production of machinery and equipment and in the manufacture of motor vehicles, Italy is in the middle-upper positions of the value chains. Some Eastern European countries deeply involved in GVCs, such as Hungary, Poland and the Czech Republic, are more upstream than Italy, while Germany, one of the most important global player in these sectors, turns out to be more downstream. These results seem consistent with the evidence that emerged from the analysis of the direct backward and forward linkages of the Italian industries (see section 3.2). In particular, it seems to confirm the fact that many Italian firms operate as suppliers of intermediate components for machineries and motor vehicles produced in Germany.

Figure 10

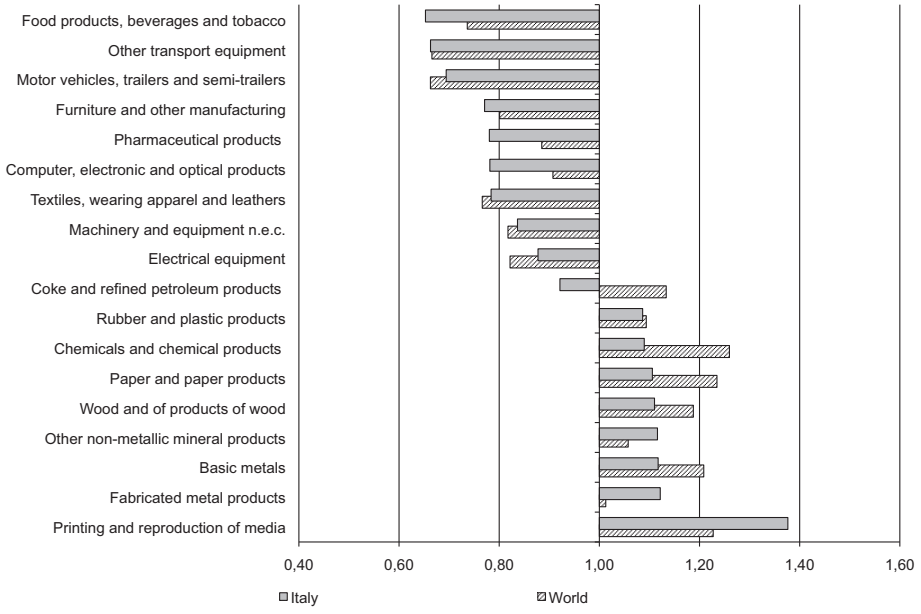
SECTORAL GVC PARTICIPATION IN GROSS OUTPUT, MANUFACTURING AND SERVICES



Source: Our elaboration on Wiod.

FIGURE 11

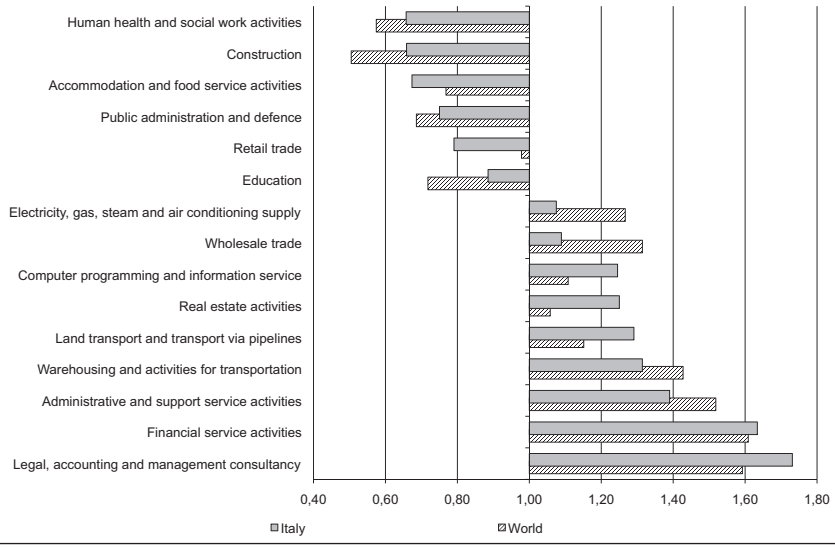
POSITION INDEX FOR MANUFACTURING SECTORS.
(year 2014)



Source: Our elaboration on WIOD.

FIGURE 12

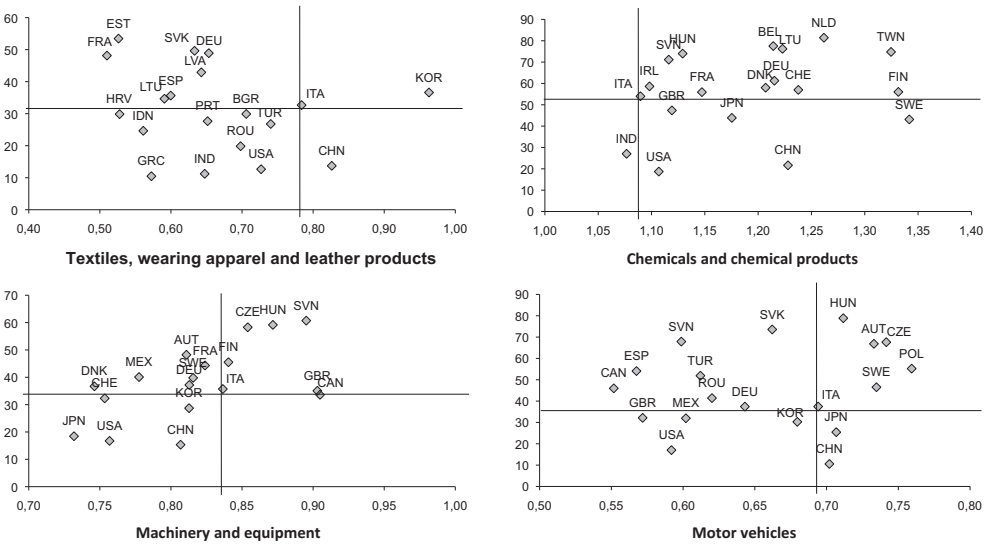
POSITION INDEX FOR SELECTED SERVICE SECTORS
(year 2014)



Source: Our elaboration on WIOD.

Figure 13

POSITION AND PARTICIPATION INDICES FOR SELECTED SECTORS AND COUNTRIES
(year 2014)



Source: Our elaboration on Wiod.

5. - Concluding Remarks

Due to the diffusion of global production networks, traditional trade statistics no longer provide an adequate representation of supply and demand linkages among the economies. Moreover, analyzing the connections between production and final demand has become increasingly complex. New data and measurement methods have been developed to tackle these new issues. The development of Inter-Country Input-Output (ICIO) tables has provided a major contribution to the analysis of trade and production under this new paradigm. In the recent literature specific analytical tools have been proposed to exploit the information content of ICIO tables. In this work, we present a critical assessment of the main methods developed to measure value added trade and GVC participation; in some case we also suggest novel solutions to address some specific issue.

We show that the traditional I-O accounting, combined with new ICIO data, is sufficient to pin down the links between the country-sector where the value of production originates and the market where it is absorbed in final demand. Nevertheless, in order to analyze how countries and sectors participate in production networks more sophisticated tools are needed.

In particular, Koopman *et* al. (2014) provide the first rigorous and comprehensive framework to decompose gross exports in value added terms. This tool and its extensions to bilateral and sectoral trade flows are essential to map out value added paths along the international production chains. Moreover, through the analysis of bilateral trade flows it is possible to distinguish between the value added absorbed by direct importers and that consumed in third countries, identifying in this way the share of trade related to GVCs (Borin and Mancini, 2015). This measure of participation in global production networks refines in several ways the indicators previously proposed in the literature (as and suggested by Hummels *et* al, 2001). In this paper we show how to extend the notion of participation in GVCs from exports to gross output. This allows us to have a solid measure also for industries with a modest direct export (or import) activity.

Another relevant issue that has been addressed by some recent contributions regards the positioning of countries and sectors in terms of relative upstreamness/downstreamness along the production line. These indicators complete the characterization of countries' role in GVCs and provide a first assessment on the specialization patterns across the different tasks and business functions.

Drawing on ICIO tables, we use some of these tools to provide empirical evidence on the Italian trade in value added and its involvement in GVCs. The empirical analysis is carried out combining the information content of the main ICIO databases available (OECD-WTO TiVA, WIOD, 2013 release, WIOD, 2016 release). In this way we can exploit all the advantages offered by the different sources.

First and foremost the data show the deep integration of Italy within the so called "Factory Europe". Italy and the other major European economies exhibit a level of participation in GVCs above the world average, in particular in terms of gross output. On the one hand, a relevant share of the Italian value added exported to other European countries is embedded in intermediate goods that are processed and re-exported to third markets; on the other hand a large fraction of Italian imports from the EU consists in value added that originates in other European countries.

Due to this deep regional integration, gross trade statistics, that include a lot of back and forth shipments of intermediates, tend to overestimate the role of Europe both as a market of destination of Italian productions and as a supplier of goods and services consumed in Italy. Indeed, in value added terms extra-European destinations, and in particular North America and Japan, gain in importance as final markets. In particular Germany delivers a relevant share of "made

in Italy" products toward more distant destinations. The pivotal role of Germany within the European production networks is confirmed by the high values of its indicators of GVC participation. The GVC related share of gross output of Germany is the highest among the major economies and the share of exports is similar to that of China, whose exporting firms are deeply involved in GVCs. Nevertheless, China's productions related to GVCs still represent only small fraction of the country's overall economic activity.

Despite these differences between gross and value added figures, looking at the sectoral level, the core of the Italian specialization pattern remains unaltered, with some notable exceptions. For instance, the role of some service activities seems much more relevant when looking at value added flows, even compared to the world average.

Since the mid-nineties Italy has increased its GVC participation more than the average, in particular in manufacturing. In 2014 almost all the Italian manufacturing sectors show a level of GVC participation above the world average, while the evidence is more mixed for services. The relative position of Italy along the value chains often resembles the world pattern (level of upstreamness/downstreamness) for a given sector, with some specific features. In some typical upstream manufacturing sectors (*i.e.* basic metals, basic chemical productions, coke and refined petroleum productions) Italy appears relatively downstream compared to the world average, probably because it is mainly an importer of raw materials. Also in advanced industries, like pharmaceutical productions and electronics, Italian firms are on average specialized in relative downstream activities. Conversely, in the traditional "made in Italy" sectors (*i.e.* textiles, wearing apparel, leather products) it is relatively upstream, akin to China, while down the production chain we find several Balkan and Eastern European countries with relevant trade and investment ties with Italy. Finally, in the production of machinery and equipment and in the manufacture of motor vehicles, Italy is in the middle-upper positions of the value chains. Further upstream the value chain we find some Eastern European countries like Hungary, Poland and Czech Republic, while Germany, a key global player in these sectors, appears closer to the final demand as compared to Italy.

Information on the positioning of Italy's production sectors along GVCs is important in order to assess the economic implications of GVC participation and to gauge the future prospects for Italian exports. For example, on the one hand the fact that many Italian firms operate as suppliers of intermediates for Germany and other European countries could widen the range of final markets for Italian productions. It may represents a particular advantage for Italian small and

medium firms that more rarely export directly to extra-European countries. On the other hand, the greater distance from the final consumers might also hamper the possibility to fully seize the opportunities that come from these markets, especially from the most dynamic ones. Some contributions in the literature have already pointed out that risks and benefits from GVC participation are unevenly distributed along the different stages of the production process (see for instance Altomonte *et* al., 2012; Balwin and Lopez-Gonzalez, 2013; Accetturo and Giunta, 2016), although we can hardly claim that a particular position in the value chains represents an advantage or a disadvantage in absolute terms (Alfaro *et* al., 2015). Further investigation, both at macro and micro level, is needed in order to evaluate all the pros and cons and to fully assess the economic implications of the evidence presented here.

APPENDIX

The Koopman, Wang and Wei (2014) decomposition of total exports

The essential decomposition of total exports of country () in KWW is summarized by the following accounting relationship:

$$
\begin{aligned}
\mathbf{u}_N \mathbf{E}_{s*} = & \left\{ \mathbf{V}_s \sum_{r \neq s}^{G} \mathbf{B}_{ss} \mathbf{Y}_{sr} + \mathbf{V}_s \sum_{r \neq s}^{G} \mathbf{B}_{sr} \mathbf{Y}_{rr} + \mathbf{V}_s \sum_{r \neq s}^{G} \sum_{t \neq s,r}^{G} \mathbf{B}_{sr} \mathbf{Y}_{rt} \right\} \\
& + \left\{ \mathbf{V}_s \sum_{r \neq s}^{G} \mathbf{B}_{sr} \mathbf{Y}_{rs} + \mathbf{V}_s \sum_{r \neq s}^{G} \mathbf{B}_{sr} \mathbf{A}_{rs} (\mathbf{I} - \mathbf{A}_{ss})^{-1} \mathbf{Y}_{ss} \right\} \\
& + \mathbf{V}_s \sum_{r \neq s}^{G} \mathbf{B}_{sr} \mathbf{A}_{rs} (\mathbf{I} - \mathbf{A}_{ss})^{-1} \mathbf{E}_{s*} \\
& + \left\{ \sum_{t \neq s}^{G} \sum_{r \neq s}^{G} \mathbf{V}_t \mathbf{B}_{ts} \mathbf{Y}_{sr} + \sum_{t \neq s}^{G} \sum_{r \neq s}^{G} \mathbf{V}_t \mathbf{B}_{ts} \mathbf{A}_{sr} (\mathbf{I} - \mathbf{A}_{rr})^{-1} \mathbf{Y}_{rr} \right\} \\
& + \sum_{t \neq s}^{G} \sum_{r \neq s}^{G} \mathbf{V}_t \mathbf{B}_{ts} \mathbf{A}_{sr} (\mathbf{I} - \mathbf{A}_{rr})^{-1} \mathbf{E}_{r*}
\end{aligned}
\qquad (A.1)
$$

KWW defines the nine items in equation *(A.1)* as follows:

1) $\mathbf{V}_s \sum_{r \neq s}^{G} \mathbf{B}_{ss} \mathbf{Y}_{sr}$: domestic value added in direct final goods exports;

2) $\mathbf{V}_s \sum_{r \neq s}^{G} \mathbf{B}_{sr} \mathbf{Y}_{rr}$: domestic value added in intermediate exports absorbed by direct importers;

3) $\mathbf{V}_s \sum_{r \neq s}^{G} \sum_{t \neq s,r}^{G} \mathbf{B}_{sr} \mathbf{Y}_{rt}$: domestic value added in intermediate goods re-exported to third countries;

4) $\mathbf{V}_s \sum_{r \neq s}^{G} \mathbf{B}_{sr} \mathbf{Y}_{rs}$: domestic value added in intermediate exports reimported as final goods;

5) $\mathbf{V}_s \sum_{r \neq s}^{G} \mathbf{B}_{sr} \mathbf{A}_{rs} (\mathbf{I} - \mathbf{A}_{ss})^{-1} \mathbf{Y}_{ss}$: domestic value added in intermediate inputs reimported as intermediate goods and finally absorbed at home;

6) $\mathbf{V}_s \sum_{r \neq s}^{G} \mathbf{B}_{sr} \mathbf{A}_{rs} (\mathbf{I} - \mathbf{A}_{ss})^{-1} \mathbf{E}_{s*}$: double-counted intermediate exports originally produced at home;

7) $\sum_{t \neq s}^{G} \sum_{r \neq s}^{G} \mathbf{V}_t \mathbf{B}_{ts} \mathbf{Y}_{sr}$: foreign value added in exports of final goods;

8) $\sum_{t\neq s}^{G}\sum_{r\neq s}^{G}\mathbf{V}_t\mathbf{B}_{ts}\mathbf{A}_{sr}(\mathbf{I}-\mathbf{A}_{rr})^{-1}\mathbf{Y}_{rr}$: foreign value added in exports of intermediate goods;

9) $\sum_{t\neq s}^{G}\sum_{r\neq s}^{G}\mathbf{V}_t\mathbf{B}_{ts}\mathbf{A}_{sr}(\mathbf{I}-\mathbf{A}_{rr})^{-1}\mathbf{E}_{r*}$: double-counted intermediate exports originally produced abroad.

The value added decomposition of bilateral exports

A full **sink-based** decomposition of bilateral exports can be expressed by the following accounting relationship:

$$
\begin{aligned}
\mathbf{u}_N\mathbf{E}_{sr} &= \overset{1}{\mathbf{V}_s\mathbf{B}_{ss}\mathbf{Y}_{sr}} + \\
&+\mathbf{V}_s\mathbf{B}_{ss}\mathbf{A}_{sr}(\mathbf{I}-\mathbf{A}_{rr})^{-1}\left[\overset{2a}{\mathbf{Y}_{rr}}+\sum_{j\neq r}^{G}\mathbf{A}_{rj}\overset{2b}{\widehat{\mathbf{B}}^{s}_{jr}}\mathbf{Y}_{rr}+\sum_{j\neq r}^{G}\mathbf{A}_{rj}\sum_{k\neq s,r}^{G}\overset{2c}{\widehat{\mathbf{B}}^{s}_{jk}}\mathbf{Y}_{kk}\right]+ \\
&+\mathbf{V}_s\mathbf{B}_{ss}\mathbf{A}_{sr}(\mathbf{I}-\mathbf{A}_{rr})^{-1}\left[\sum_{j\neq r,s}^{G}\overset{3a}{\mathbf{Y}_{rj}}+\sum_{j\neq r}^{G}\mathbf{A}_{rj}\sum_{l\neq s,r}^{G}\overset{3b}{\widehat{\mathbf{B}}^{s}_{jr}}\mathbf{Y}_{rl}+\sum_{j\neq r}^{G}\mathbf{A}_{rj}\sum_{k\neq s,r}^{G}\overset{3c}{\widehat{\mathbf{B}}^{s}_{jk}}\mathbf{Y}_{kr}\right. \\
&\qquad\left.+\sum_{j\neq r}^{G}\mathbf{A}_{rj}\sum_{k\neq s.r.l}^{G}\sum_{l\neq s,r}^{G}\overset{3d}{\widehat{\mathbf{B}}^{s}_{jk}}\mathbf{Y}_{kl}\right|+ \\
&+\mathbf{V}_s\mathbf{B}_{ss}\mathbf{A}_{sr}(\mathbf{I}-\mathbf{A}_{rr})^{-1}\left[\overset{4a}{\mathbf{Y}_{rs}}+\sum_{i\neq r}^{G}\mathbf{A}_{rj}\overset{4b}{\widehat{\mathbf{B}}^{s}_{jr}}\mathbf{Y}_{rs}+\sum_{j\neq r}^{G}\mathbf{A}_{rj}\sum_{k\neq s,r}^{G}\overset{4c}{\widehat{\mathbf{B}}^{s}_{jk}}\mathbf{Y}_{ks}\right]+ \\
&+\mathbf{V}_s\mathbf{B}_{ss}\mathbf{A}_{sr}(\mathbf{I}-\mathbf{A}_{rr})^{-1}\sum_{j\neq r}^{G}\mathbf{A}_{rj}\overset{5}{\widehat{\mathbf{B}}^{s}_{js}}\mathbf{Y}_{ss}+ \\
&+\mathbf{V}_s\mathbf{B}_{ss}\mathbf{A}_{sr}(\mathbf{I}-\mathbf{A}_{rr})^{-1}\sum_{j\neq r}^{G}\mathbf{A}_{rj}\overset{6}{\widehat{\mathbf{B}}^{s}_{js}}\mathbf{E}_{s*}+ \\
&+\sum_{t\neq s}^{G}\overset{7}{\mathbf{V}_t\mathbf{B}_{ts}\mathbf{Y}_{sr}}+\sum_{t\neq s}^{G}\mathbf{V}_t\mathbf{B}_{ts}\mathbf{A}_{sr}\overset{8}{(\mathbf{I}-\mathbf{A}_{rr})^{-1}\mathbf{Y}_{rr}}+ \\
&+\sum_{t\neq s}^{G}\overset{9}{\mathbf{V}_t\mathbf{B}_{ts}\mathbf{A}_{sr}(\mathbf{I}-\mathbf{A}_{rr})^{-1}\mathbf{E}_{r*}}
\end{aligned}
\tag{A.2}
$$

where $\widehat{\mathbf{B}}^{s} = (\mathbf{I}-\mathbf{A}^{s})^{-1}$. is the Leontief inverse matrix derived from the input coefficient matrix $\mathbf{A}^{s}$, which excludes the input requirement of other economies from country *s*:

(A.3)

$$\mathbf{A}^{\mathcal{S}} = \begin{bmatrix} \mathbf{A}_{11} & \mathbf{A}_{12} & \cdots & \mathbf{A}_{1S} & \cdots & \mathbf{A}_{1G} \\ \vdots & \vdots & \ddots & \vdots & \vdots & \vdots \\ 0 & 0 & \cdots & \mathbf{A}_{SS} & \cdots & 0 \\ \vdots & \vdots & \cdots & \vdots & \ddots & \vdots \\ \mathbf{A}_{G1} & \mathbf{A}_{G2} & \cdots & \mathbf{A}_{G1} & \cdots & \mathbf{A}_{GG} \end{bmatrix}$$

We can define the items in *(A.2)* as follows:

1 domestic value added (VA) in direct final good exports;
2a domestic VA in intermediate exports absorbed by direct importers as local final goods;
2b domestic VA in intermediate exports absorbed by direct importers as local final goods only after additional processing stages abroad;
2c domestic VA in intermediate exports absorbed by third countries as local final goods;
3a domestic VA in intermediate exports absorbed by third countries as final goods from direct bilateral importers;
3b domestic VA in intermediate exports absorbed by third countries as final goods from direct bilateral importers only after further processing stages abroad;
3c domestic VA in intermediate exports absorbed by direct importers as final goods from third countries;
3d domestic VA in intermediate exports absorbed by third countries as final goods from other third countries;
4a domestic VA in intermediate exports absorbed at home as final goods of the bilateral importers;
4b domestic VA in intermediate exports absorbed at home as final goods of the bilateral importers after additional processing stages abroad;
4c domestic VA in intermediate exports absorbed at home as final goods of a third country;
5 domestic VA in intermediate exports absorbed at home as domestic final goods;
6 double-counted intermediate exports originally produced at home;
7 foreign VA in exports of final goods;
8 foreign VA in exports of intermediate goods;
9 double-counted intermediate exports originally produced abroad.

The enumeration of the items recalls the original KWW components, which can be obtained as a simple summation over the importing countries *r* of the cor-

responding items in our bilateral decomposition (e.g. the second term in KWW is equal to the sum across the *r* destinations of **2a**+**2b**+**2c**).

The decomposition of bilateral exports in a **source-based** approach can be expressed as follows:

$$
\begin{aligned}
\mathbf{u}_N\mathbf{E}_{sr} &= \overset{1a^*}{\mathbf{V}_s\left(\mathbf{I}-\mathbf{A}_{ss}\right)^{-1}\mathbf{Y}_{sr}} + \\
&+\mathbf{V}_s\left(\mathbf{I}-\mathbf{A}_{ss}\right)^{-1}\mathbf{A}_{sr}\left(\mathbf{I}-\mathbf{A}_{rr}\right)^{-1}\left[\overset{1b^*}{\sum_{j\neq r}^{G}\mathbf{A}_{rj}\mathbf{B}_{js}\mathbf{Y}_{sr}}+\sum_{j\neq r}^{G}\mathbf{A}_{rj}\overset{1c^*}{\sum_{k\neq s,r}^{G}\mathbf{B}_{js}\mathbf{Y}_{sk}}+\right]+ \\
&+\mathbf{V}_s\left(\mathbf{I}-\mathbf{A}_{ss}\right)^{-1}\mathbf{A}_{sr}\left(\mathbf{I}-\mathbf{A}_{rr}\right)^{-1}\left[\overset{2a^*}{\mathbf{Y}_{rr}}+\sum_{i\neq r}^{G}\mathbf{A}_{rj}\overset{2b^*}{\mathbf{B}_{jr}\mathbf{Y}_{rr}}+\sum_{j\neq r}^{G}\mathbf{A}_{rj}\sum_{k\neq s,r}^{G}\mathbf{B}_{jk}\overset{2c^*}{\mathbf{Y}_{kk}}+\right]+ \\
&+\mathbf{V}_s\left(\mathbf{I}-\mathbf{A}_{ss}\right)^{-1}\mathbf{A}_{sr}\left(\mathbf{I}-\mathbf{A}_{rr}\right)^{-1}\left[\sum_{j\neq r,s}^{G}\overset{3a^*}{\mathbf{Y}_{rj}}+\sum_{j\neq r}^{G}\mathbf{A}_{rj}\sum_{l\neq s,r}^{G}\overset{3b^*}{\mathbf{B}_{jr}\mathbf{Y}_{rl}}+\sum_{j\neq r}^{G}\mathbf{A}_{rj}\sum_{k\neq s,r}^{G}\overset{3c^*}{\mathbf{B}_{jk}\mathbf{Y}_{kr}}\right. \\
&\qquad\left.+\sum_{j\neq r}^{G}\mathbf{A}_{rj}\sum_{k\neq s,r,l}^{G}\sum_{l\neq s,r}^{G}\overset{3d^*}{\mathbf{B}_{jk}\mathbf{Y}_{kl}}\right]+ \\
&+\mathbf{V}_s\left(\mathbf{I}-\mathbf{A}_{ss}\right)^{-1}\mathbf{A}_{sr}\left(\mathbf{I}-\mathbf{A}_{rr}\right)^{-1}\left[\overset{4a^*}{\mathbf{Y}_{rs}}+\sum_{j\neq r}^{G}\mathbf{A}_{rj}\overset{4b^*}{\mathbf{B}_{jr}\mathbf{Y}_{rs}}+\sum_{j\neq r}^{G}\mathbf{A}_{rj}\sum_{k\neq s,r}^{G}\overset{4c^*}{\mathbf{B}_{jk}\mathbf{Y}_{ks}}+\right]+ \\
&+\mathbf{V}_s\left(\mathbf{I}-\mathbf{A}_{ss}\right)^{-1}\mathbf{A}_{sr}\left(\mathbf{I}-\mathbf{A}_{rr}\right)^{-1}\sum_{j\neq r}^{G}\overset{5^*}{\mathbf{A}_{rj}\mathbf{B}_{js}\mathbf{Y}_{ss}}+ \\
&+\mathbf{V}_s\left(\mathbf{I}-\mathbf{A}_{ss}\right)^{-1}\sum_{t\neq s}^{G}\mathbf{A}_{st}\overset{6^*}{\mathbf{B}_{ts}\mathbf{E}_{sr}}+ \\
&+\sum_{t\neq s}^{G}\overset{7}{\mathbf{V}_t\mathbf{B}_{ts}\mathbf{Y}_{sr}}+\sum_{t\neq s}^{G}\mathbf{V}_t\mathbf{B}_{ts}\mathbf{A}_{sr}\overset{8}{\left(\mathbf{I}-\mathbf{A}_{rr}\right)^{-1}\mathbf{Y}_{rr}}+ \\
&+\sum_{t\neq s}^{G}\overset{9}{\mathbf{V}_t\mathbf{B}_{ts}\mathbf{A}_{sr}+\mathbf{Y}_{rr}}+\left(\mathbf{I}-\mathbf{A}_{rr}\right)^{-1}\mathbf{E}_{r*}
\end{aligned}
\qquad (A.4)
$$

We can define the items in *(A.4)* as follows:

1a* domestic value added (VA) in final good exports directly absorbed by bilateral importers;

1b* domestic VA in intermediate exports absorbed by bilateral importers as domestic final goods after additional processing stages;

1c* domestic VA in intermediate exports absorbed by third countries as domestic final goods after additional processing stages;

2a* domestic VA in intermediate exports absorbed by direct importers as local final goods;

2b* domestic VA in intermediate exports absorbed by direct importers as local final goods only after further processing stages;

2c* domestic VA in intermediate exports absorbed by third countries as local final goods;
3a* domestic VA in intermediate exports absorbed by third countries as final goods from direct bilateral importers;
3b* domestic VA in intermediate exports absorbed by third countries as final goods from direct bilateral importers only after further processing stages;
3c* domestic VA in intermediate exports absorbed by direct importers as final goods from third countries;
3d* domestic VA in intermediate exports absorbed by third countries as final goods from other third countries;
4a* domestic VA in intermediate exports absorbed at home as final goods of the bilateral importers;
4b* domestic VA in intermediate exports absorbed at home as final goods of the bilateral importers after further processing stages;
4c* domestic VA in intermediate exports absorbed at home as final goods of a third country;
5* domestic VA in intermediate exports absorbed at home as domestic final goods;
6* double-counted intermediate exports originally produced at home;
7 foreign VA in exports of final goods;
8 foreign VA in exports of intermediate goods;
9 double-counted intermediate exports originally produced abroad.

As for the sink-based decomposition, the enumeration of the items here above recalls the original KWW components, which can be obtained as a simple summation over the importing countries of the corresponding items in our bilateral decomposition (a formal proof is available upon request). Note that terms **7**, **8** and **9** are precisely equal to those of the sink-based methodology.

The share of GVC related gross output

In this section we present only the analytical expressions for the items that are not related to GVCs. As shown in equation, the GVC related gross output of country *s* can be computed subtracting these items from the total gross output $\mathbf{X}_s$. Recalling the definitions presented in the scheme of Figure 9, the items non

related to GVCs are the following:
b.1.1.1.*i*: $\mathbf{V}_s\left(\mathbf{I}-\mathbf{A}_{ss}\right)^{-1}\mathbf{A}_{ss}\left(\mathbf{I}-\mathbf{A}_{ss}\right)^{-1}\mathbf{Y}_{ss}$ domestic intermediate inputs that are absorbed at home without any processing stage abroad;
b.1.1.1.*ii*: $\mathbf{V}_s\left(\mathbf{I}-\mathbf{A}_{ss}\right)^{-1}\mathbf{A}_{ss}\left[\mathbf{Y}_{sr}+\sum_{r\neq s}^{G}\mathbf{A}_{sr}\left(\mathbf{I}-\mathbf{A}_{rr}\right)^{-1}\mathbf{Y}_{rr}\right]$ domestic intermediate inputs that cross just one border before being absorbed by the bilateral importers;
b.1.2.1.*i*+**b.2.1.*i***: $\sum_{t\neq s}^{G}\mathbf{V}_t\left(\mathbf{I}-\mathbf{A}_{tt}\right)^{-1}\mathbf{A}_{ts}\left(\mathbf{I}-\mathbf{A}_{ss}\right)^{-1}\mathbf{Y}_{ss}$ foreign intermediate inputs that cross just one border before being absorbed at home;
f.2.1: $\mathbf{V}_s\left(\mathbf{I}-\mathbf{A}_{ss}\right)^{-1}\mathbf{Y}_{ss}$ domestic value added absorbed at home without any processing stage abroad.

BIBLIOGRAPHY

Accetturo A. - Giunta A. (2016), «Value Chains and the Great Recession: Evidence from Italian and German Firms», Questioni di Economia e Finanza, *Occasional Papers*, 304, Bank of Italy.

Alessandria G. - Kaboski J.P. - Midrigan V. (2010), «The Great Trade Collapse of 2008-09: An Inventory Adjustment?», *IMF Economic Review*, vol. 58, pp. 254-294.

Alfaro L. - Antràs P. - Chor D. - Conconi P. (2015), «Internalizing Global Value Chains: A Firm-Level Analysis», *NBER Working Papers*, 21582.

Altomonte C. - Di Mauro F. - Ottaviano G.I. - Rungi A. - Vicard V. (2012), «Global Value Chains During the Great Trade Collapse: A Bullwhip Effect?», Banque de France, *Working Paper*.

Amador J. - Cappariello R. - Stehrer R. (2015), «Global Value Chains: A View from the Euro Area», *ECB Working Paper Series*, no. 1761.

Antràs P. - Chor D. (2013), «Organizing the Global Value Chain», *Econometrica*, 81(6), pp. 2127-2204.

Antràs P. - Chor D. - Fally T. - Hillberry R. (2012), «Measuring the Upstreamness of Production and Trade Flows», *The American Economic Review, Papers and Proceedings*, 102(3), pp. 412-416.

Backer K.D. - Miroudot S. (2013), «Mapping Global Value Chains», OECD, *Trade Policy Papers*, no. 159.

Baldwin R. - Forslid R. - Ito T. (2015), «Unveiling the Evolving Sources of Value Added in Exports», draft, *http://www.ide.go.jp/English/Publish/Download/Jrp/pdf/161.pdf.*

Baldwin R. - Lopez-Gonzalez J. (2013), «Supply-Chain Trade: A Portrait of Global Patterns and Several Testable Hypotheses», *NBER Working Paper*, no. 18957.

Borin A. - Mancini M. (2015), «Follow the Value Added: Bilateral Gross Exports Accounting», Temi di Discussione, *Working Papers*, no. 1026, Bank of Italy.

Cappariello R. - Felettigh A. (2015), «How does Foreign Demand Activate Domestic Value Added? A Comparison Among the Largest Euro-Area Economies», Temi di Discussione, *Working Papers*, no. 1001, Bank of Italy.

Daudin G. - Rifflart C. - Schweisguth D. (2009), «Who Produces for Whom in the World Economy?», *Document de travail de l'OFCE*, no. 2009, 18, July.

Dietzenbacher E. - Los B. - Stehrer R. - Timmer M.P. - de Vries G.J. (2013), «The Construction of World Input-Output Tables in the WIOD Project», *Economic Systems Research*, 25, pp. 71-98.

Fally T. (2012), *On the Fragmentation of Production in the US*, University of Colorado, mimeo.

Gereffi G. - Fernandez-Stark K. (2011), *Global Value Chain Analysis: A Primer*, Center on Globalization, Governance & Competitiveness, Duke University.

Gereffi G. - Humphrey J. - Sturgeon T. (2005), «The Governance of Global Value Chains», *Review of International Political Economy*, 12(1), pp. 78-104.

Giovannetti G. - Luchetti F. (2007), «Dinamica dell'interscambio commerciale e degli investimenti diretti esteri tra l'Italia e i Paesi della nuova Europa», in Fortis M. - Curzio A.Q. (eds), *L'Europa allargata, l'Est, l'Italia*, Bologna, Il Mulino, pp. 123-141.

Giovannetti G. - Marvasi E. (2016), «Positioning and Internalization in Global Value Chains: The Case of Tuscan Firms», Università di Firenze, DISEI, *Working Paper*, no. 14.

Grossman G.M. - Rossi-Hansberg E. (2008), «Trading Tasks: A Simple Theory of Offshoring», *American Economic Review*, vol. 98(5), pp. 1978-1997.

Hummels D. - Ishii J. - Yi K.M. (2001), «The Nature and Growth of Vertical Specialization in World Trade», *Journal of International Economics*, 54, pp. 75-96.

Johnson R.C. - Noguera G. (2012), «Accounting for Intermediates: Production Sharing and Trade in Value Added», *Journal of International Economics*, 86, Issue 2, pp. 224-236.

Koopman R. - Powers W. - Wang Z. - Wei S. (2011), «Give Credit Where Credit is Due: Tracing Value-added in Global Production Chains», *NBER Working Paper*, no. 16426.

Koopman R. - Wang Z. - Wei S. (2014), «Tracing Value-Added and Double Counting in Gross Exports», *American Economic Review*, 104(2), pp. 459-494.

Leontief W. (1936), «Quantitative Input and Output Relations in the Economic System of the United States», *Review of Economics and Statistics*, 18, pp. 105-125.

Nagengast A.J. - Stehrer R. (2016), «Collateral Imbalances in Intra-European Trade? Accounting for the Differences between Gross and Value Added Trade Balances», *The World Economy*, forthcoming.

Oecd-Wto (2012), «Trade in Value Added: Concepts, Methodologies and Challenges», *http://www. oecd.org/sti/ind/49894138.pdf*.

Oecd-Wto-World Bank Group Report (2014), «Global Value Chains: Challenges, Opportunities, and Implications for Policy», *https://www.oecd.org/tad/gvc_report_g20_july_2014.pdf*.

Prota F. - Viesti G. (2007), «La delocalizzazione internazionale del made in Italy», *L'Industria*, no. 3.

Timmer M.P. - Dietzenbacher E. - Los B. - Stehrer R. - de Vries G.J. (2015), «An Illustrated User Guide to the World Input-Output Database: The Case of Global Automotive Production», *Review of International Economics*, 23, pp. 575-605.

Wang Z. - Wei S. - Yu X. - Zhu K. (2016), «Characterizing Global Value Chains», mimeo, available at *http://www.gtap.agecon.purdue.edu/resources/download/8178.pdf*.

Wang Z. - Wei S. - Zhu K. (2013), «Quantifying International Production Sharing at the Bilateral and Sector Levels», *NBER Working Paper*, no. 19677.

Intangible Assets and Participation in Global Value Chains: An Analysis on a Sample of European Countries

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This paper investigates the role of intangible assets as factors influencing participation in global value chains (GVC). We distinguish between different forms of participation in GVC entailing a different degree of capability to generate value added domestically and we examine how different intangibles affect countries' engagement in GVC and the reaping of benefits from such participation. The data cover 11 European countries in manufacturing and services over the period 1995-2011. We find that investing in intangible assets favours participation in GVC and contributes to value appropriation along the chain. Moreover, different intangible assets contribute differently to forward and backward participation. [JEL Classification: F23; O30].

Keywords: intangible assets; global value chains; forward and backward participation; R&D expenditure.

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1. - Introduction

International fragmentation of production, which implies that countries specialise in portions of the value chain and trade other portions of it, has led to widespread processes of *globalisation of value chains* (GVC) over the past two decades (for recent reviews, see Kaplinsky, 2013; De Backer and Miroudot, 2013; Timmer *et* al., 2014). Baldwin (2011) has defined these as a "second unbundling" of globalisation, which has transformed the terms of international competition and shifted the barycentre of the world's global headquarters and peripheries.

While the international fragmentation of production has allowed more countries to be involved in the production of a final good, not all countries have retained the same benefits from such process. A growing number of studies have pointed out that gains are unevenly distributed across the value chain (Kaplinsky, 2000; Gereffi *et* al., 2005; Dedrick *et* al., 2010; Shin *et* al., 2009 and 2012; OECD, 2013*b*). It becomes, therefore, crucial to assess which factors help explaining this uneven distribution.

In this respect, some authors have observed that the balance of power often favors nodes with high technology which would imply that firms which control technology through mechanisms like patents or licenses are in extremely powerful positions and are likely to extract maximum rents in GVCs (Mudambi, 2007; Dedrick *et* al., 2010). However, together with technology also better organizational skills and better marketing capabilities might be crucial. Overall, to extract maximum rents, governance becomes an important ingredient in the value chain (Gereffi *et* al., 2005). Therefore, firms investing in intangible assets (research, marketing, organizational capital, etc.) should be able to generate higher returns, *ceteris paribus*, with respect to other firms.

Despite the acknowledgement of the important role of intangible assets in determining gains along the value chain, the sole study looking at the relationship between one specific intangible asset and backward GVC participation is Marcolin *et* al. (2016). They provide evidence about the linkages between global value chain and organizational capital. Their analysis supports the assumption that industry-level investment in intangibles is causally linked to GVCs in the form of backward linkages with the foreign market.

The purpose of this paper is to provide a contribution in this respect but taking a broader perspective by estimating the relationship between countries' investment in intangible assets and some indicators of participation in GVC and value creation from this participation. In particular, we use information on countries'

stocks of intangible assets (R&D, marketing and advertising, design, training, organizational capital) for 11 European countries over the period 1995-2011 for manufacturing and total market services taken from INTAN-Invest.net. We merge intangible data with EUKLEMS information about value added, and hours worked and with different measures of participation in global value chains gathered from OECD-WTO Trade in Value Added (TiVA) database: domestic value added embodied in foreign exports and in foreign final demand (or forward participation); foreign value added embodied in domestic exports and in domestic final demand or backward participation.

The paper is structured as follows. Section 2 provides an overview of both the literature on Global value chain participation and on intangibles and growth. Section 3 illustrates our research hypotheses while section 4 offers some descriptive evidence on the extent of countries' participation in GVC and the gains from such participation. Section 5 focuses on the empirical strategy and main results while Section 6 concludes.

2. - Background Literature

Two streams of literature are relevant for developing the arguments put forward in this paper: the recent literature on factors allowing participation in global value chains and the new contributions on the role of intangible assets for productivity growth.

2.1 *Factors Affecting Participation in Global Value Chain*

There is general consent that integration into GVCs brings benefits beyond those traditionally associated with international trade in final goods, allowing countries to specialize in single tasks and benefiting from economies of scale and scope. Indeed, empirical evidence shows that joining GVCs brings positive and significant gains in productivity (see, e.g. Baldwin and Yan, 2014).

But what are the factors facilitating countries participation in GVC? To the best of our knowledge there are only few empirical analyses aiming at disentangling the determinants of countries' capability to engage in GVC participation. These studies find that the level of development, infrastructure and human capital favor participation, while tough regulation, tariffs and other trade impediments are detrimental (Hummels and Schaur, 2012; WTO, 2014; Cheng *et* al., 2015; López-Gonzalez *et* al., 2015).

Whilst the literature mainly agrees that participating in GVCs is largely beneficial, it has also been stressed that advantages are not equally divided among GVC participants. The classic example of the iPod supply chain discussed by Dedrick *et* al. (2010) shows that Apple captures between one-third and one-half of an iPod's retail value, Japanese firms such as Toshiba and Korean firms such as Samsung capture another major share while firms and workers in China capture no more than 2 percent from assembling the product. Overall, there is evidence that a great part of the value added of a final product is created in the first and last stages of the production process (R&D, design, marketing and sales), while firms involved in intermediate stages (such as the production of components and assembly) reap only a small part of the final value of the good or service produced (Mudambi, 2007 and 2008). The pattern of value-added along the value chain may, therefore, be represented by the "smiling curve" (Everatt *et* al., 1999) or the "smile of value creation" (Mudambi, 2007): ranking activities on the x-axis along the value chain (activities at the left or "input" end are supported by R&D knowledge while activities at the right or "output" end are supported by marketing knowledge), value added will be higher in the first and last stages of the value chain. Given that capturing a bigger slice of the GVC pie is positively associated with productivity gains and higher per capita growth, an important under investigated issue is to disentangle the factors allowing countries not only to take part into GVC but also to maximize benefits from such participation.

In this respect it can be useful to distinguish between forward linkages (where the country provides inputs into exports of other countries, generating domestic value-added which goes into other countries' gross exports) and backward linkages (where the country imports intermediate products to be used in its exports, leading other countries to generate foreign value added that goes into the domestic country gross exports). While the share of a country in total value-added created by forward and backward linkages in GVCs (*i.e.*, summing over all countries) can provide a measure of the extent of a country's participation, a break-up of forward linkages and backward linkages in GVCs can provide a useful insight into the gains that go to a country from its participation in GVCs (Banga, 2013). If gains are measured in terms of "net value-added" by participation in GVCs, then higher the forward linkages as compared to backward linkages, higher are the gains. This would imply that by its participation in GVCs, a country is creating and exporting more domestic value-added than the foreign value added which it is importing. Using these two measures, Banga (2013) finds that in case of US, Japan and UK, forward linkages are much stronger than backward link-

ages, indicating net value-added gains from linking into GVCs. China and Korea, on the other hand, have negative net value added gains.

2.2 *Intangibles and Productivity Growth*

The changing nature of the global economy has placed a novel attention on intangible capital as a new source of growth. The structural and technological changes associated with the rapid progress in Information and Communication Technologies (ICT), the rising role of the service sector and the emergence of new business models make intangible investment a key element of global competition. The seminal paper by Corrado *et* al. (2005) is the first of a number of studies showing that intangible capital is an essential ingredient for economic growth.

The literature on the sources of economic growth considers the accumulation of intangible capital expanding the core concept of business investment in national accounts by treating much business spending on "intangibles" – computerized databases, R&D, design, brand equity, firm-specific training, and organizational efficiency – as investment (e.g., see Corrado *et* al., 2005, 2009).

When this view is adopted empirical evidence shows that business investments in intangible assets are fundamental drivers of growth and productivity. Corrado *et* al. (2016) found that once intangible capital is included in a sources-of-growth analysis it accounts for 20-33% of labor productivity growth in the market sector of the US and EU economies.

First empirical work on intangibles dates back to Nakamura (1999 and 2001) who found that in 2000 US investment in intangibles was US$1 trillion (approximately equal to that in nonresidential tangible assets), with an intangible capital stock of at least US$5 trillion.

Starting form Nakamura's work, Corrado *et* al. (2005) developed expenditure-based measures of a larger range of intangibles for the United States. They calculated that previously unmeasured intangible capital contributed 0.24 percentage point (18 per cent) to conventionally-measured Multifactor Productivity (MFP) growth in the United States between the mid-1990s and early 2000s. The same methodology has been applied in a number of other country studies with estimates of the contribution of previously unmeasured intangible capital to MFP growth of 14 per cent (United Kingdom in Marrano *et* al., 2007), and 3 per cent (Finland in Jalava *et* al., 2007) over a similar period. Other country studies estimated only the contribution of all intangibles to MFP growth – 19 per cent in Japan (Fukao *et* al., 2008), 19 per cent in France, 18 per cent in Germany, 9 per cent in Spain and 0 per cent in Italy (Hao *et* al., 2008).

More recently, Corrado *et* al. (2017) found that intangibles generate spillovers to the economic system thus fostering also indirectly productivity growth.

3. - Intangible Assets and Participation in Global Value Chains: Research Hypotheses

Empirical studies have shown that export specialization in skill intensive industries is positively correlated with intangible intensity (OECD, 2013*a*)[1]. Thus the more a country invests in intangible assets, the more likely is to foster comparative advantages in international trade in such industries. In this respect, organizational capital has the biggest impact among the intangible assets.

But is there a role for investment in intangible assets to affect participation in Global Value Chains? This will probably depend on the tasks along the value chain in which a country becomes specialized. Advanced countries are expected to organize their production along a value chain by keeping at home those activities that have a higher strategic value, are more complex in nature (involve higher transaction costs) and allow them to keep control over the value chain. Assets such as R&D expenditures, training, organizational capital may play a strategic role in creating domestic value added in these activities. Therefore, we put forward our first hypothesis:
*HP*1 *Advanced countries investing more in intangible assets display a higher participation in global value chains.*

While participation in GVC can be important in itself by allowing countries at different stages of development to exploit foreign demand and specialised in tasks along the value chain rather than having to set up entire processes of production from scratch (see also OECD, 2013*b*; Baldwin and López-Gonzalez, 2015), not all forms of participation entail the same gains (Gereffi *et* al., 2005; Kaplinsky, 2000; Schmitz and Strambach, 2009).

Overall, there is evidence that a great part of the valued added of a final product is created in the first and last stages of the production process, while firms involved in intermediate stages (such as the production of components and assembly) reap only a small part of the final value of the good or service produced (Mudambi, 2007 and 2008). This pattern of value-added creation along the value chain has been represented by the "smiling curve" (Everatt *et* al., 1999) or the "smile of value creation" (Mudambi, 2008).

[1] Laursen K. and Meliciani V. (2010) show the role of ICT knowledge flows for international competitiveness at the sectoral level.

We argue that, although this might not necessarily be true in all countries (e.g. in many resource intensive countries upstream activities can consist in providing raw materials in the value chain), in Europe activities at both ends of the value chain are intensive in their application of knowledge and creativity, which are strictly linked to investing in intangible assets. Moreover, generally, the allocation of value created in a GVC varies according to the ability of participants to supply sophisticated products or services. The supply of these products or services critically depends on intangible assets such as R&D, brands, organizational structure. Therefore we introduce our second hypothesis:
HP2 Benefits from participation in GVC (in terms of value added creation) increase with investment in intangible assets in advanced economies.

Finally, the role of intangible assets might differ according to the position of a country in the GVC. While assets such as R&D and design may be strategic in the upstream activities stages of the value chains, other assets such as marketing and advertising may be more important in downstream activities. Following Koopman *et* al. (2010), total GVC participation can be decomposed in foreign value added embodied in one country's exports and the value of exports of intermediates in value added exports of other countries. The former indicates the extent to which a country's exports are dependent on imported content, the so-called backward integration. It is therefore likely to be higher if a country (or sector) is involved in downstream production. Conversely, the second measure is likely to be higher for countries (and sectors) involved in upstream production, with output and exports of that country feeding into the production and exports of downstream producers (*i.e.* forward integration). The analysis of backward and forward integration can provide hints on where within a GVC a particular country is. We, therefore, put forward our third hypothesis:
HP3 intangible assets provide a different contribution to forward and backward participation in GVC. R&D, and design contribute more to forward linkages while marketing and advertising more to backward linkages.

4. - Data Description

Our measures of GVC participation are gathered from the OECD-WTO Trade in Value Added (TiVA) database[2]. They track the origin of value added, by country and sector, which is embodied in gross exports. The indicators are based on the work of Koopman *et* al. (2010, 2014) and extend the work of Hummels *et* al. (2001) and Johnson and Noguera (2012). Hummels *et* al. (2001) compute an index of vertical specialization given by the use of imported inputs in producing goods that are exported. However, this indicator does not take into account that a country exports intermediates that are used to produce final goods absorbed at home. By using input-output data for source and destination countries simultaneously, Johnson and Noguera (2012) overcome this limitation and compute the *ratio* of value added to gross exports as a measure of the intensity of production sharing. Finally Koopman *et* al. (2010, 2014) provide a full decomposition of value added which includes returned domestic value added (domestic value added that comes back incorporated in foreign inputs produced with domestic inputs) and the indirect exports to third countries.

A variant of this indicator decomposes value added, similarly across countries and sectors, but according to final demand (Los *et* al., 2015). This tracks not just the value added traded in the production of exports, but also that used to satisfy domestic and international final demand. Both indicators (that based on exports and that based on final demand) involve similar calculation techniques but the former is solely concerned with exporting activities whereas the latter considers the origin of value added in GDP. The difference is important because domestic final demand and gross export vectors differ.

In this paper, we will mainly use the indicator based on gross exports. The choice is dictated by the focus on global value chains (this measure is also preferred by the OECD (2013). However, the results generated using the *ratio* between domestic and foreign value added, are then compared with the findings

[2] Indicators of participation in GVCs can also be computed using the WIOD (World Input Output Database). The two databases differ significantly in terms of country and time coverage: WIOD covers 40 countries and TiVA 63 countries (e.g. TiVA includes Southeast countries) and WIOD provides a complete time series from 1995 to 2011 while TiVa covers 1995, 2000, 2005 and on a yearly basis from 2008 to 2011. There are other small methodological differences between the two databases related to the use of the sources. However, the two databases provide comparable information. In our paper, we resort to TiVA mainly since it provides "ready to use" indicators of participation in GVCs.

obtained by using the final demand indicator that has the advantage of accounting for total value added in GDP.

The database employed in this paper includes also data on both tangible and intangible capital inputs as well as standard growth accounting variables such as output and labour input. Intangible capital is taken from the INTAN-invest database[3] as outlined in Corrado *et* al. (2012). Intangible assets are classified into three broad groups – computerised information, innovative property and economic competencies. Computerised information basically coincides with computer software and databases. Innovative property refers to the innovative activity built on a scientific base of knowledge as well as to innovation and new product/process R&D more broadly defined. Economic competencies include spending on strategic planning, worker training, redesigning or reconfiguring existing products in existing markets, investment to retain or gain market share and investment in brand names.The main source for output, labor and tangible capital is the EU KLEMS database[4] (see O'Mahony and Timmer, 2009, for details).

Data from TiVa are available only for selected years (1995, 2000, 2005 and from 2008 to 2011) while all the other information covers the period 1995-2011 on a yearly basis.The country coverage refers to 11 European countries: Austria, Belgium, Germany, Denmark, Spain, Finland, France, Italy, Netherlands, Sweden and UK.

5. - Descriptive Evidence: Intangible Capital and GVC Participation

In advanced countries, higher levels of intangible investment are associated with higher rates of productivity growth. Empirical evidence shows that many EU countries are experiencing a shift from tangible to intangible investment, particularly in areas where they have greatest comparative advantages. The driving factors of the relatively faster accumulation of intangible capital are related to the shift from industry to services, the rise of the digital economy, the changing global specialization in production, and general technological progress (OECD, 2015).

Our goal is to investigate to what extent the growing relevance of intangible capital affects the degree and the benefits of countries' participation to global value chains. Thus we start our analysis providing an overview of the diffusion of intangible capital accumulation and the level of participation to GVC across the EU countries.

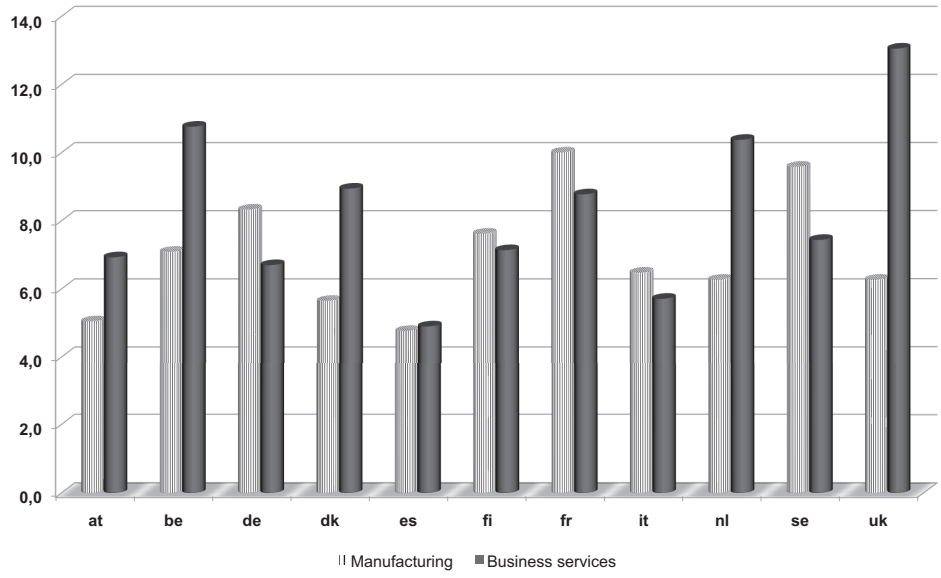
[3] *http://www.intan-invest.net.*

[4] *http://www.euklems.net.*

Graph 1 shows that intangibles account for a relatively higher share of value added in services (8.2%) than in manufacturing (7.0%) in six out of eleven countries. Services are significantly more intangible intensive than manufacturing in UK, Netherlands, Denmark and Belgium while in Austria and Spain the two sectors show relatively comparable shares.

GRAPH 1

INTANGIBLE INVESTMENT 1995-2010: AVERAGE VALUE ADDED SHARE



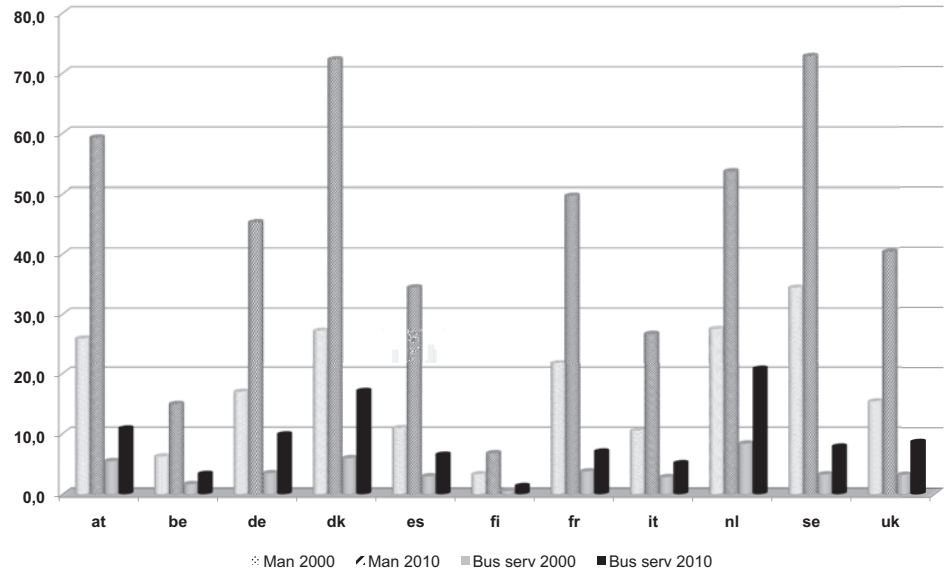
Source: INTAN INVEST (*www.intan-invest.net*).

Participation in global value chains (standardized by hours worked) is rather heterogeneous across countries with higher indexes for manufacturing compared to services (Graph 2). Nordic and Continental EU economies (with the exception of Belgium and Finland) show relatively higher degree of participation compared to the Mediterranean countries.

However, the index of participation is not informative about the position of a country along the supply chain. To identify if a country is specializing in activities upstream or downstream in the production network we need to look at its forward and backward linkages in GVC.

Graph 2

PARTICIPATION IN GLOBAL VALUE CHAINS

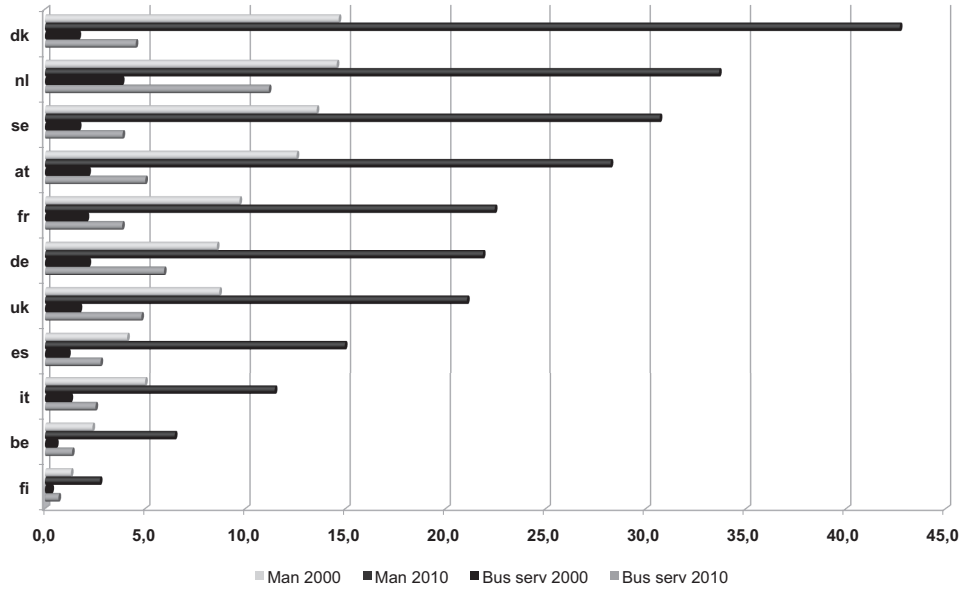


Source: TiVA Oecd, Database.

Graphs 3 and 4 provide evidence on the extent of forward and backward participation in the EU sample economies. In 2010, Denmark, Sweden and the Netherlands have higher forward than backward participation in manufacturing suggesting they lie relatively more upstream in the production network. Germany is instead more involved in downstream production as supported by a higher backward than forward participation index, while France has comparable values for both forward and backward participation.

GRAPH 3

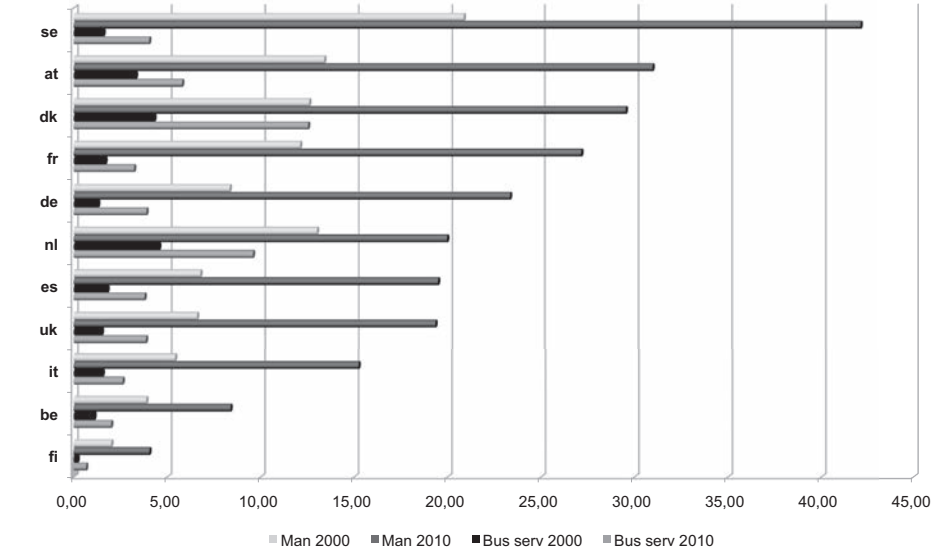
FORWARD PARTICIPATION TO GVC



Source: TiVA OECD, Database.

GRAPH 4

BACKWARD PARTICIPATION

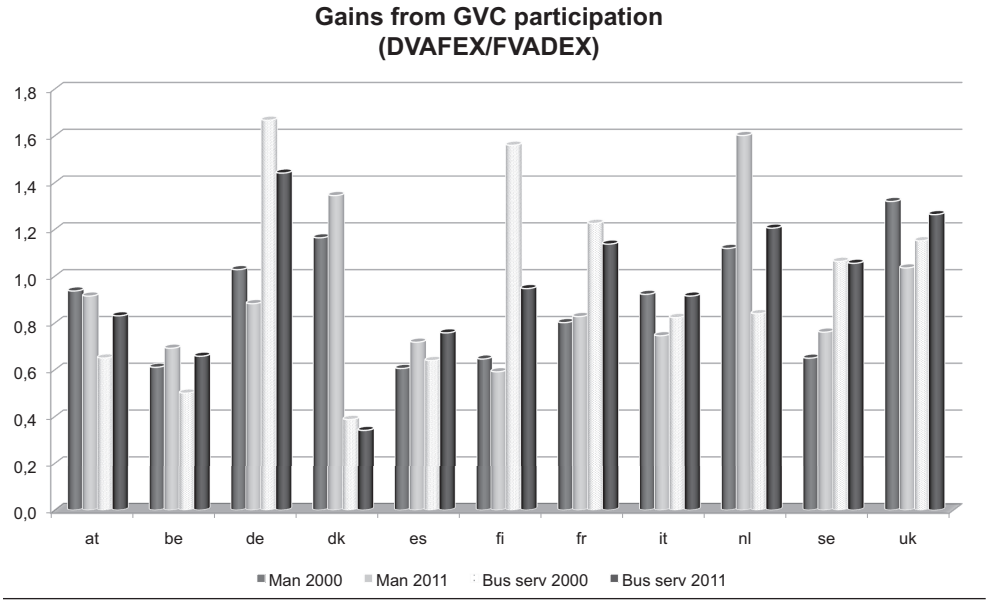


Source: TiVA OECD, Database.

Gains from participation refer to the capability of a country to appropriate a large share of value added. In 2011, UK and Netherlands have relatively higher gains both in manufacturing and services, Denmark higher in manufacturing and Germany in services (Graph 5).

Graph 5

GAINS FROM PARTICIPATION



Source: TiVA Oecd, Database.

Higher participation in QVC is not necessarily linked to higher gains. In our sample this is the case of Sweden and Austria showing very high participation but relatively low gains. The Netherlands instead has both high participation and high gains implying that it is creating and exporting more domestic value added than how much it is importing foreign value added. The Mediterranean countries have both low participation and gains from GVC.

6. - Intangible Capital and GVC

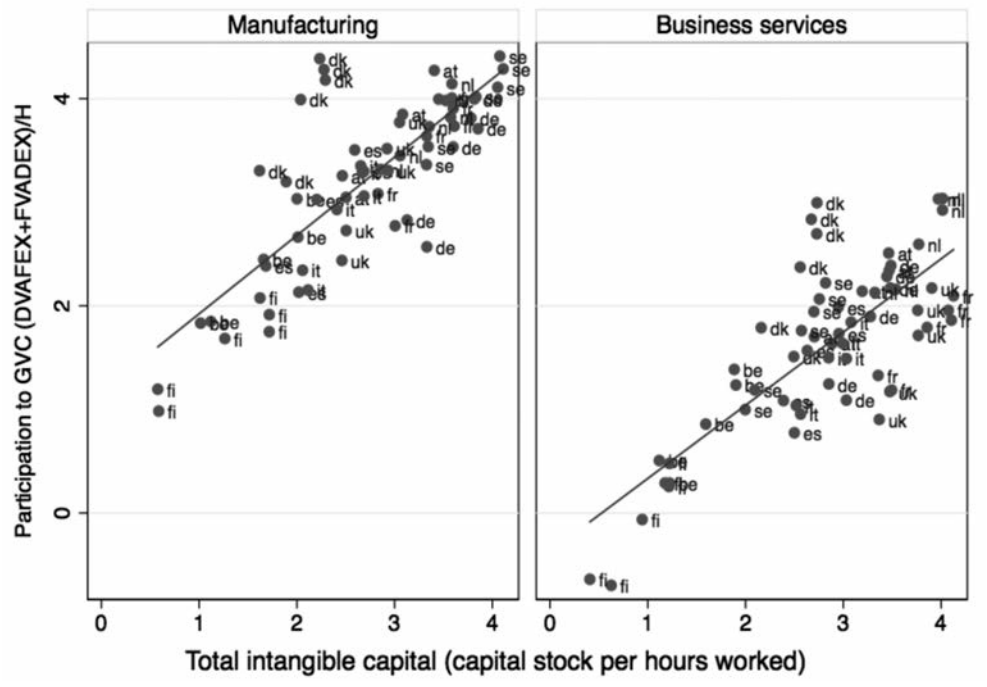
6.1 *Exploring the Correlation between Intangible Capital and GVC Participation and Benefits*

The main goal of our analysis is to investigate if and to what extent intangible capital accumulation is related to the degree and the benefits of country's participation in GVC. Thus this section provides an overview of the correlations between different measures of participation in GVC and intangible assets.

Graph 6 shows data on per hour worked total intangible capital against participation in GVC in manufacturing and services across the sample countries. Correlation is significantly positive in both sectors suggesting a deeper analysis is warranted.

GRAPH 6

PARTICIPATION TO GLOBAL VALUE CHAINS *VS* INTANGIBLE CAPITAL

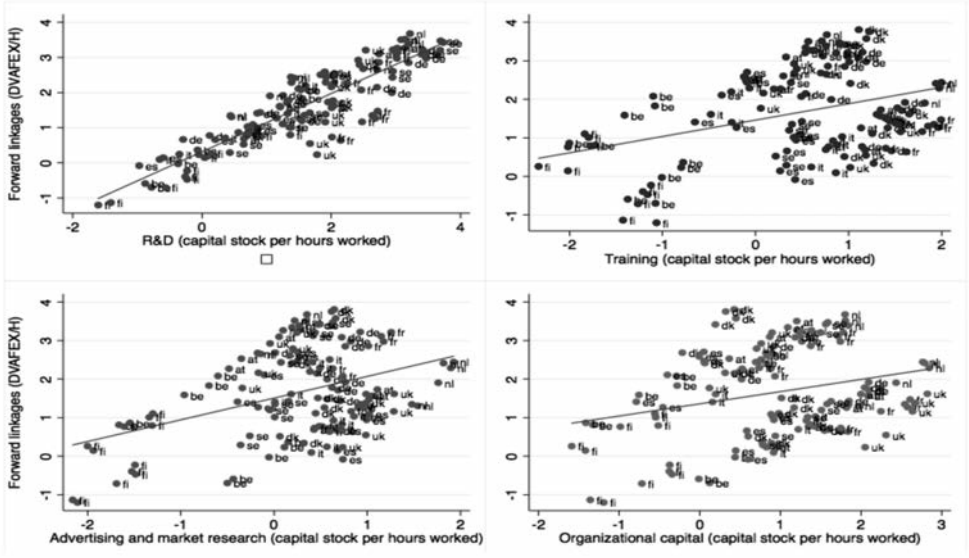


Source: Author's own elaboration from INTAN INVEST, EUKLEMS and TIVA, data.

Graphs 7 and 8 show forward and backward measures of GCV participation plotted against four different types of intangibles: R&D, Training, Advertising and Organizational capital. The linkages with R&D is rather strong for both indicators while for the remaining assets the correlation is relatively stronger with forward than with backward linkages.

Graph 7

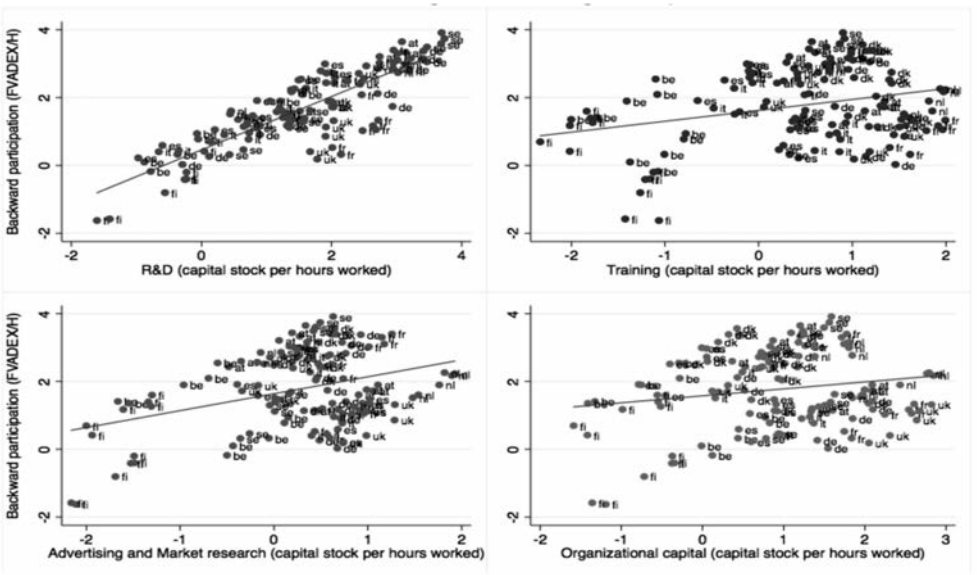
FORWARD PARTICIPATION TO GLOBAL VALUE CHAINS AND INTANGIBLE ASSETS



Source: Author's own elaboration from Intan Invest, Euklems and TiVA, data.

GRAPH 8

BACKWARD PARTICIPATION TO GLOBAL VALUE CHAINS AND INTANGIBLE ASSETS

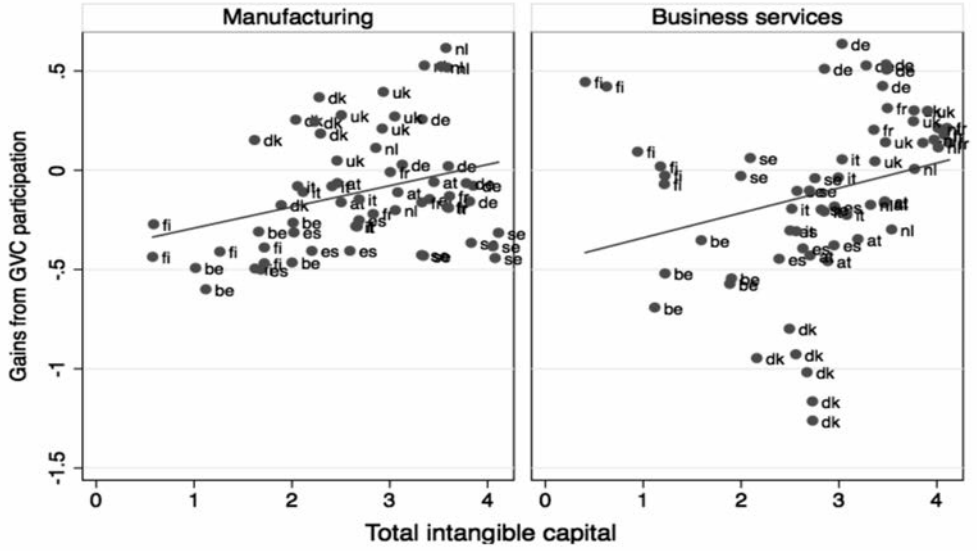


Source: Author's own elaboration from INTAN INVEST, EUKLEMS and TIVA, data.

Finally Graph 9 provides evidence of the correlation between gains from participation in GVC and per hour total intangible capital in manufacturing and services.

GRAPH 9

GAINS FROM PARTICIPATION TO GLOBAL VALUE CHAINS AND INTANGIBLE CAPITAL



Source: Author's own elaboration from INTAN INVEST, EUKLEMS and TIVA, data.

Gains from participation are positively correlated with intangible capital accumulation with services showing a more widespread distribution across countries.

6.2 *Empirical Strategy*

We start by exploring the relationship between the participation in GVC and intangible capital accumulation testing the relevance of intangible assets as drivers of forward and backward participation in GVC.

$$\ln Y_{i,c,t}^{GVCj} = \alpha_1 \ln K_{i,c,t}^{Intgs} + \alpha_2 \ln K_{i,c,t}^{ICT} + \alpha_3 \ln K_{i,c,t}^{Non\ ICT} + \alpha_4 \ln X_{i,c,t} + \delta_t + \gamma_i + \varepsilon_{c,i,t}$$

where:
c = country (11 EU member countries), i = industry (manufacturing and business services), and t time (1995, 2000, 2005, 2008-2011). Y^{GVC_j} represents different indicators for GVC participation (total, forward and backward) and gains from GVC measured as the *ratio* between forward and backward indicators. K^{Intg_s} is intangible capital with s = Total Intangible, R&D, Training, Design, Advertising and marketing, Organizational capital; K^{ICT} is ICT capital and $K^{Non\ ICT}$ is tangible

Non ICT capital stock; X are other controls (corporate income taxes, country size); δ_t and γ_i are time and industry dummies. All variables are in per hour term.

We use an export-based indicator to measure participation in GVC that can be split into backward and forward participation.

In particular, domestic value added embodied in foreign exports (DVAFEX) captures the domestic value added content of gross exports and includes the value added generated by the exporting industry during its production processes as well as any value added coming from upstream domestic suppliers that is embodied in the exports. This measure is likely to be higher for countries (and sectors) involved in upstream production, with output and exports of that country feeding into the production and exports of downstream producers (*i.e.* forward integration).

Foreign value added content of gross exports (FVADEX) captures the value of imported intermediate goods and services that are embodied in a domestic industry's exports. The value added can come from any foreign industry upstream in the production chain. It is used to measure the extent to which a country's exports are dependent on imported content, the so-called backward integration. It is therefore likely to be higher if a country (or sector) is involved in downstream production.

Finally the sum of the two indicators is a measure of overall participation in GCV. Therefore *HP*1 requires the coefficient of K^{int} to be positive and significant when the dependent variable is the sum of DVAFEX and FVADEX, while *HP*3 requires a different impact of investment in R&D, design, marketing and advertising on the two indicators (for R&D and design higher for DVAFEX and for marketing and advertising higher for FVADEX).

Domestic value added embodied in foreign final demand (DVAFFD) measures the contribution in terms of value added to the final demand of foreign countries including their consumption and gross fixed capital formation together with their exports.

Foreign value added embodied in domestic final demand (FVADFD) measures how much foreign countries contribute in terms of value added to the final demand of the domestic country.Therefore, the *ratio* between DVAFFD and FVADFD and the *ratio* between DVAFEX and FVADEX are used as indicators of the capability of a country to appropriate a large share of value added. Therefore HP3 requires K^{int} to positively affect these ratios.

7. - Econometric Results

We first estimate the determinants of participation in GVC (Table 1), then assess how different intangible assets affect forward and backward participation (Tables 2 and 3) and finally look at the relationship between intangible assets and gains for participation (Tables 4 and 5). In all estimations we report results for total intangible assets (column 1) and distinguishing between R&D and other intangible assets (columns 2, 3 and 4). Finally, we consider separately training (column 5), marketing and advertising (column 6), architectural design (column 7) and organizational capital (column 8).

Looking at Table 1, we find support for our first hypothesis: total intangible assets positively affect participation in global value chains. This confirms the important role played by this type of investment for advanced countries. Moreover, when looking separately at R&D and other intangible assets, they both show up with a positive and significant coefficients, with other assets playing a larger role with respect to R&D. Finally, all assets but architectural design contribute to explaining participation in GVCs and the larger impact is associated to investment in training.

The results also show that tangible capital and ICT positively contribute to participation in GVCs pointing to the complementary role of tangible capital, intangible capital and ICT for countries and industries to take part to the global production process. However, while tangible assets have a positive impact on GVC participation across all specifications, ICT loses significance in some specifications. This can be due to some collinearity between ICT capital and investment in some intangible assets. Finally as expected small countries and countries with a lower income corporate tax rate enjoy higher participation in GVCs.

TABLE 1

THE DETERMINANTS OF PARTICIPATION IN GLOBAL VALUE CHAINS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Participation to GVC							
VARIABLES								
lnK_Intg	0.169***							
	(0.050)							
lnK_Intg(ex-R&D)			0.346***	0.397***				
			(0.067)	(0.120)				
lnK_R&D		0.247***		0.143***				
		(0.035)		(0.047)				
lnK_Train					0.596***			
					(0.049)			
lnK_Adv-Mkt						0.306***		
						(0.069)		
lnK_Design							0.015	
							(0.063)	
lnK_Org Cap								0.250***
								(0.045)
lnK_ICT	0.316***	0.262***	0.173**	0.025	0.103	0.199**	0.495***	0.160**
	(0.080)	(0.058)	(0.084)	(0.091)	(0.065)	(0.091)	(0.077)	(0.081)
lnK_Tang	0.447***	0.406***	0.421***	0.355***	0.098**	0.412***	0.359***	0.539***
	(0.065)	(0.058)	(0.055)	(0.062)	(0.047)	(0.057)	(0.061)	(0.064)
Country Size	-0.148***	-0.124***	-0.223***	-0.230***	-0.283***	-0.197***	-0.103	-0.140***
	(0.049)	(0.046)	(0.052)	(0.051)	(0.036)	(0.058)	(0.070)	(0.051)
Corporate income tax rate	-0.028***	-0.019***	-0.028***	-0.014***	-0.010**	-0.031***	-0.028***	-0.030***
	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)
Observations	92	82	92	82	92	92	92	92
Number of ctrysec	18	16	18	16	18	18	18	18

Source: Author's own elaboration.
Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

When looking separately at forward and backward participation (Table 2 and 3), we find partial support for our third hypothesis. Most intangible assets appear to contribute positively to both forward and backward participation; however, the impact of R&D is larger for forward than for backward participation (coefficients are respectively 0.38 and 0.12) while that of marketing and advertising is larger for backward linkages (coefficients are respectively 0.14 and 0.40). This is consistent with R&D being more important in upstream production and marketing and advertising in downstream production. However, contrary to our hypothesis, in the case of architectural design the results show no significant impact on forward participation. Finally, training and organizational capital (for which we had no *a priori* hypotheses) appear to be more important for forward participation. In particular, while training positively affects both forward and backward participation, organizational capital has a negative effect on backward participation. This is an interesting result deserving more investigation.

As far as other assets are concerned, ICT appears to be more important for backward participation while tangible capital for forward participation. High corporate income taxes discourage both forward and backward participation and the size of the country is negatively association to both types of participation.

TABLE 2

THE DETERMINANTS OF FORWARD PARTICIPATION

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Forward participation							
VARIABLES								
lnH_D_totintg	0.301***							
	(0.060)							
lnH_D_intg_xrd_kstock			0.503***	0.540***				
			(0.083)	(0.116)				
lnH_D_rd_kstock_k		0.385***		0.251***				
		(0.040)		(0.051)				
lnH_D_train_kstock_k					0.787***			
					(0.048)			
lnH_D_adv_mkt_kstock_k						0.141*		
						(0.076)		
lnH_D_arch_des_kstock_k							-0.001	
							(0.051)	
lnH_D_orgcap_kstock_k								0.124**
								(0.057)
lnH_D_k_ict	0.160**	0.108*	0.005	-0.206**	-0.137***	0.277***	0.419***	-0.177**
	(0.074)	(0.063)	(0.089)	(0.093)	(0.051)	(0.092)	(0.051)	(0.076)
lnH_D_all_tang_kstock_k	0.553***	0.513***	0.505***	0.441***	0.213***	0.518***	0.479***	0.075
	(0.069)	(0.067)	(0.071)	(0.071)	(0.040)	(0.059)	(0.050)	(0.059)
ln_pop	-0.222***	-0.250***	-0.236***	-0.285***	-0.272***	-0.130*	-0.064	-0.248***
	(0.042)	(0.034)	(0.049)	(0.052)	(0.035)	(0.067)	(0.070)	(0.039)
Corporate income tax rate	-0.032***	-0.015**	-0.034***	-0.016**	-0.012**	-0.029***	-0.029***	-0.025***
	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.004)	(0.005)	(0.006)
Observations	92	82	92	82	92	92	92	92
Number of ctrysec	18	16	18	16	18	18	18	18

Source: Author's own elaboration.
Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 3

THE DETERMINANTS OF BACKWARD PARTICIPATION

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Backward participation							
VARIABLES								
lnH_D_totintg	0.144***							
	(0.046)							
lnH_D_intg_xrd_kstock			0.281***	0.277*				
			(0.088)	(0.152)				
lnH_D_rd_kstock_k		0.119***		0.036				
		(0.041)		(0.064)				
lnH_D_train_kstock_k					0.415***			
					(0.063)			
lnH_D_adv_mkt_kstock_k						0.404***		
						(0.074)		
lnH_D_arch_des_kstock_k							0.158**	
							(0.074)	
lnH_D_orgcap_kstock_k								-0.203***
								(0.050)
lnH_D_k_ict	0.385***	0.399***	0.299***	0.254**	0.255***	0.178*	0.413***	0.278***
	(0.084)	(0.070)	(0.100)	(0.110)	(0.088)	(0.099)	(0.087)	(0.077)
lnH_D_all_tang_kstock_k	0.325***	0.319***	0.256***	0.264***	0.084	0.265***	0.262***	-0.224***
	(0.069)	(0.066)	(0.068)	(0.073)	(0.063)	(0.065)	(0.070)	(0.059)
ln_pop	-0.158**	-0.158**	-0.187**	-0.234***	-0.335***	-0.225***	-0.162*	-0.293***
	(0.075)	(0.074)	(0.078)	(0.078)	(0.063)	(0.060)	(0.084)	(0.076)
Corporate income tax rate	-0.027***	-0.019***	-0.024***	-0.016***	-0.010	-0.026***	-0.027***	-0.028***
	(0.005)	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)	(0.006)
Observations	92	82	92	82	92	92	92	92
Number of ctrysec	18	16	18	16	18	18	18	18

Source: Author's own elaboration.
Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

While intangible assets appear to matter for European countries to take part in global value chains, we may ask whether they also contribute to the appropriation of a great share of value added created in a GVC. We expect that since value appropriation varies according to the ability of participants to supply sophisticated products or services, countries investing more in intangible assets have a comparative advantage in producing such products or services. Tables 4 and 5 report estimates of the gains from participation. In Table 4 these are measured as the *ratio* between domestic value added embodied in foreign exports and foreign value added embodied in domestic exports. The idea is that the higher is domestic value added to foreign value added, the higher is the domestic appropriation of value along the value chain. In Table 5, a similar indicator is built considering the *ratio* between domestic value added embodied in foreign final demand and foreign value added embodied in domestic final demand. This second indicator considers not only value added embodied in exports but also that embodied in consumption and investment giving a broader picture of overall value creation.

Looking at the results of gains from participation measured referring to exports (Table 4), we find that intangible assets positively affect value appropriation and the results are robust to introducing separately R&D and other intangible assets. However, not all intangible assets have the same importance: training and organizational capital have a large positive effect while marketing and advertising and architectural design do not appear to matter. The big role of organizational capital in affecting value appropriation in GVC confirms the importance of governance for extracting maximum rents also for advanced countries. More difficult to interpret is the negative impact of ICT on gains from participation in most specifications. Although this might depend on some degree of collinearity with intangible assets (in the specification where only architectural design is included ICT shows up positive and significant), it could also be linked to the higher importance of ICT for downstream with respect to upstream production. Finally, tangible capital, population and the corporate income tax rate do not appear to affect gains from participation.

When looking at value appropriation in terms of final demand, results are only partly confirmed. Intangible assets positively affect value appropriation, although with a lower coefficient. Moreover, when R&D and other intangible assets are introduced simultaneously in the regression, only R&D has a significant impact. Another important difference is that organizational capital is no longer significant. Finally, tangible capital and the corporate income tax rate negatively affect gains from participation and larger countries appear to appropriate a larger share of value added compared to smaller ones.

Table 4

THE DETERMINANTS OF THE DOMESTIC TO FOREIGN VALUE ADDED CONTENT OF EXPORTS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				(DVAFEX/FVAFEX)				
VARIABLES								
lnH_D_totintg	0.285***							
	(0.056)							
lnH_D_intg_xrd_kstock			0.450***	0.221*				
			(0.071)	(0.116)				
lnH_D_rd_kstock_k		0.152***		0.095**				
		(0.025)		(0.043)				
lnH_D_train_kstock_k					0.331***			
					(0.049)			
lnH_D_adv_mkt_kstock_k						-0.102		
						(0.080)		
lnH_D_arch_des_kstock_k							0.042	
							(0.064)	
lnH_D_orgcap_kstock_k								0.297***
								(0.038)
lnH_D_k_ict	-0.204***	-0.083**	-0.307***	-0.218***	-0.254***	0.152*	0.039	-0.254***
	(0.076)	(0.042)	(0.083)	(0.078)	(0.068)	(0.078)	(0.069)	(0.077)
lnH_D_all_tang_kstock_k	0.048	0.014	-0.035	-0.024	-0.021	0.031	0.011	0.076
	(0.059)	(0.046)	(0.056)	(0.051)	(0.050)	(0.055)	(0.057)	(0.061)
ln_pop	0.053	0.017	0.077	0.042	0.030	0.115*	0.091	0.048
	(0.057)	(0.059)	(0.060)	(0.065)	(0.055)	(0.063)	(0.065)	(0.051)
Corporate income tax rate	-0.001	-0.000	-0.000	0.002	0.007	-0.005	-0.005	0.003
	(0.007)	(0.005)	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Observations	92	82	92	82	92	92	92	92
Number of ctrysec	18	16	18	16	18	18	18	18

Source: Author's own elaboration.
Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

TABLE 5

THE DETERMINANTS OF THE DOMESTIC TO FOREIGN VALUE ADDED CONTENT OF FINAL DEMAND

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				(DVAFFD/FVADFD)				
VARIABLES								
lnH_D_totintg	0.044*							
	(0.026)							
lnH_D_intg_xrd_kstock			0.027	0.014				
			(0.035)	(0.063)				
lnH_D_rd_kstock_k		0.080***		0.077***				
		(0.023)		(0.026)				
lnH_D_train_kstock_k					0.056*			
					(0.030)			
lnH_D_adv_mkt_kstock_k						0.027		
						(0.038)		
lnH_D_arch_des_kstock_k							0.054*	
							(0.032)	
lnH_D_orgcap_kstock_k								0.033
								(0.021)
lnH_D_k_ict	0.046	-0.013	0.055	-0.022	0.012	0.061	0.042	0.051
	(0.042)	(0.046)	(0.045)	(0.060)	(0.049)	(0.045)	(0.042)	(0.043)
lnH_D_all_tang_kstock_k	-0.119**	-0.069	-0.123**	-0.071	-0.109**	-0.131**	-0.134***	-0.120**
	(0.051)	(0.058)	(0.052)	(0.060)	(0.046)	(0.052)	(0.051)	(0.052)
ln_pop	-0.062***	-0.079***	-0.062***	-0.079***	-0.072***	-0.054**	-0.056***	-0.064***
	(0.021)	(0.025)	(0.022)	(0.026)	(0.022)	(0.025)	(0.021)	(0.021)
Corporate income tax rate	-0.019***	-0.016***	-0.019***	-0.016***	-0.017***	-0.020***	-0.020***	-0.018***
	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	92	82	92	82	92	92	92	92
Number of ctrysec	18	16	18	16	18	18	18	18

Source: Author's own elaboration.
Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

8. - Conclusions

A recent stream of literature has emphasized the importance of intangible assets, including R&D but also organizational capital, training, marketing and advertising for firms' and countries' productivity growth. At the same time a growing field of research has highlighted how the globalisation of value chains has changed the traditional factors of international competitiveness with different benefits accruing to different firms and countries depending on the tasks performed within the value chain. This paper is a first attempt at bridging the two streams of literature by investigating whether and how intangible assets contribute to foster advanced countries' participation in global value chains. The main results of this analysis can be summarized as follows.

First, intangible capital as a whole is positively related to participation in global value chains in advanced countries. Moreover, non R&D intangibles play a larger role than R&D with training being the main driver of participation.

Secondly, intangibles contribute positively, but to a different extent, to both forward and backward participation: R&D is more relevant for forward linkages while marketing and advertising are more important for backward linkages. This evidence supports the assumption that R&D is a factor affecting upstream production while marketing and advertising have a role in downstream production.

Finally, intangibles positively affect value appropriation along the value chain (measured as the domestic value added embodied in foreign exports relative to the foreign value added embodied in domestic exports) and the results are robust to introducing separately R&D and other intangible assets. Training and organizational capital have a large positive effect on value appropriation while marketing and advertising and architectural design do not.

The descriptive evidence reported in the paper has also shown the heterogeneous behavior of European countries in terms of both intangible capital accumulation and participation in global value chains. In this respect the low figures for Mediterranean countries (Italy and Spain) suggest that these countries are in a vicious circle of low investment in high value added creating activities and low competitiveness in international markets.

Although the paper has not addressed this issue directly, the poor performance in productivity and growth of the Italian economy can be partly explained by the simultaneous low investment in intangible assets and low participation in GVCs. Therefore, higher levels of public investment in intangible assets and fiscal and innovation policies promoting private investment are highly needed to enhance competitiveness and growth.

Due to the short time series, this paper has not tested the possible two way relationship between investment in intangible assets and participation in GVC. This is left for future studies that could also address their joint impact on sectoral/national productivity.

BIBLIOGRAPHY

Baldwin R. (2011), «Trade and Industrialisation after Globalisation's 2nd Unbundling: How Building and Joining a Supply Chain Are Different and Why It Matters», *NBER Working Paper*, no. 17716.

Baldwin R. - Lopez-Gonzalez J. (2015), «Supply-Chain Trade: A Portrait of Global Patterns and Several Testable Hypotheses», *The World Economy,* vol. 38(11), pp. 1682-1721.

Baldwin R. - Yan B. (2014), «Global Value Chains and the Productivity of Canadian Manufacturing Firms», *Economic Analysis Research Paper Series*, no. 90, Ottawa, Statistics Canada.

Banga R. (2013), «Measuring Value in Global Value Chains», *Background Paper*, no. RVC-8, UNCTAD.

Chen K. - Rehmen S. - Seneviratne D. - Zhang S. (2015), «Reaping the Benefits from Global Value Chains», *IMF Working Paper*, 15/204.

Chun H. - Fukao K. - Hisa S. - Miyagawa T. (2012), «Measurement of Intangible Investments by Industry and Its Role in Productivity Improvement Utilizing Comparative Studies between Japan and Korea», *Discussion Papers*, no. 12037, Research Institute of Economy, Trade and Industry (RIETI).

Corrado C. - Haskel J. - Jona-Lasinio C. (2017), «Knowledge Spillovers, ICT and Productivity Growth», *Oxford Bulletin of Economics and Statistics*, 1468-0084, DOI 10.1111/obes.12171.

Corrado C. - Haskel J. - Jona-Lasinio C. - Iommi M. (2013), «Innovation and Intangible Investment in Europe, Japan and the United States», *Oxford Review of Economic Policy*, no. 29(2), pp. 261-286.

Corrado C. - Hulten C. - Sichel D. (2005), «Measuring Capital and Technology: An Expanded Framework», in Corrado C. - Haltiwanger J. - Sichel D. (eds), *Measuring Capital in the New Economy*, *National Bureau of Economic Research Studies in Income and Wealth*, Chicago, The University Chicago Press, 65, pp. 11-45.

-.-,-.-,-.- (2009), «Intangible Capital and U.S. Economic Growth», *Review of Income and Wealth*, no. 55(3), pp. 661-685.

De Backer K. - Miroudot S. (2013), «Mapping Global Value Chains», OECD, *Trade Policy Papers*, 159, pp. 1-46.

Dedrick J. - Kramer K.L. - Linden G. (2010), «Who Profits from Innovation in Global Value Chain? A Study of the iPod and Notebook PCs», *Industrial and Corporate Change,* vol. 19(1), pp. 81-116.

Everatt D. - Tsai T. - Chang B. (1999), «The Acer Group's China Manufacturing Decision», Richard Ivey School of Business, *Case Serie*s, #9A99M009*,* University of Western Ontario.

Gereffi G. - Humphrey J. - Sturgeon T. (2005), «The Governance of Global Value Chains», *Review of International Political Economy*, 12(1), pp. 78-104.

Hummels D. - Ishii J. -Yi Km (2001), «The Nature and Growth of Vertical Specialization in World Trade», *Journal of international Economics*, 54(1), pp. 75-96.

Hummels D. - Schaur G. (2012), «Time as a Trade Barrier», *NBER Working Paper*, no. 17758, Cambridge, Mass.

Jalava J. - Aulin-Ahmavaara P. - Alanen A. (2007), «Intangible Capital in the Finnish Business Sector», *ETLA Discussion Papers Series*, 2007.

Kaplinsky R. (2000), «Globalisation and Unequalisation: What Can Be Learned from Value Chain Analysis?», *Journal of Development Studies*, 37(2), pp. 117-146.

-.- (2013), «Global Value Chains: Where They Came From, Where They Are Going and Why This Is Important», *Innovations, Knowledge and Development, Working paper*, no. 68, 2013.

Koopman R. *et* al. (2010), «Give Credit where Credit Is Due: Tracing Value Added in Global Production Chains», *National Bureau of Economic Research*.

Koopman R. - Wang Z. - Wei S.J. (2014), «Tracing Value-Added and Double Counting in Gross Exports», *The American Economic Review*, 104(2), pp. 459-494.

Laursen K. - Meliciani V. (2010), «The Role of ICT Knowledge Flows for International Market Share Dynamics», *Research Policy*, 39(5), pp. 687-697.

Lopez Gonzalez J. - Meliciani V. - Savona M. (2015), *When Linder Meets Hirschman: Inter-Industry Linkages and Global Value Chains in Business Services*, SPRU-Science and Technology Policy Research, University of Sussex, 2015

Marcolin L. - Le Mouel M. - Squicciarini M. (2016), «Investment in Knowledge Based Capital and Backward Linkages in Global Value Chains», OECD - DSTI/EAS/IND/WPIA, 2, *Working Paper.*

Marrano M.G. - Haskel J. - Wallis (2009), «What Happened to the Knowledge Economy? ICT, Intangible Investment, and Britain's Productivity Record Revisited», *Review of Income and Wealth*, 55(3), pp. 686-716.

Miyagawa T. - Hisa S. (2013), «Estimates of Intangible Investment by Industry and Productivity Growth in Japan», *Japanese Economic Review*, 64(1), pp. 42-72.

Mudambi R. (2007), «Offshoring: Economic Geography and the Multinational Firm». *Journal of International Business Studies*, 38(1), p. 206.

-.- (2008), «Location, Control and Innovation in Knowledge-Intensive Industries», *Journal of economic Geography*, 8(5), pp. 699-725.

Nakamura L. (1999), «Intangibles: What Put the New in the New Economy?», *Business Review*, Federal Reserve Bank of Philadelphia, Philadelphia, Jul/Aug.

Nakamura L. *et* al. (2001), «What is the US Gross Investment in Intangibles?: (at Least) One Trillion Dollars a Year!», *Economic Research Division,* Federal Reserve Bank of Philadelphia.

OECD (2013*a*), «Knowledge-Based Capital and Upgrading in Global Value Chains», *Supporting Investment in Knowledge Capital, Growth and Innovation,* OECD Publishing.

-.- (2013*b*), *Interconnected Economies. Benefiting from Global Value Chains*, OECD Publishing.

Schmitz H. - Strambach S. (2009), «The Organisational Decomposition of Innovation and Global Distribution of Innovative Activities: Insights and Research Agenda», *International Journal of Technological Learning, Innovation and Development*, 2(4), pp. 231-249.

Shin N. - Kraemer K.L. - Dedrick J. (2009), «R&D, Value Chain Location and Firm Performance in the Global Electronics Industry», *Industry and Innovation*, 16(3), pp. 315-330.

-.-,-.-,-.- (2012), «Value Capture in the Global Electronics Industry: Empirical Evidence for the "Smiling Curve" Concept», *Industry and Innovation*, 19(2), pp. 89-107.

Timmer M. *et* al. (2014), «Slicing Up Global Value Chains», *The Journal of Economic Perspectives*, 28(2), pp. 99-118.

World Trade Organization (2014), *World Trade Report, The Rise of Global Value Chains*, Geneva.

Global Value Chains Participation as a Competitiveness Tool: A Micro-Founded Analysis across European Firms

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In this paper we assess the different patterns of participation in Global Value Chains (GVCs) and their implications for productivity by using the results of a benchmark survey run in 2015 on representative samples of 650 manufacturing firms active in five of the most dynamic regions of Europe – Lombardy, Baden-Württemberg, Bayern, Rhône-Alpes and Cataluña. Firms' characteristics fostering a "higher value added" positioning within GVCs are given specific attention. We find that each subsequent and more sophisticated step in the participation in GVCs requires different and additional firms' characteristics, with the highest involvement being associated to specific internal organization features.
[JEL Classification: F14; L20].

Keywords: international trade; global value chains; firm performance.

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1. - Introduction

Since the seminal paper of Frankel and Romer (1999), trade is widely recognized as an important driver of growth. A key feature of trade patterns in the last two decades is the emergence of Global Value Chains (GVCs), *i.e.* the breaking-up of production processes into ever-narrower discreet activities and tasks, combined with the dispersion of these activities and tasks across countries. The development of GVCs in fact has been one of the key factors behind the fast trade growth since the 1990s. Also, new evidence suggest that their expansion might have levelled off around the crisis, hence becoming one of the reasons behind the recently observed reduction in the elasticity of trade with respect to GDP (Al-Haschimi *et* al., 2015; Constantinescu *et* al., 2015).[1]

Still, understanding the evolving roots of trade performance and global involvement of countries is not an easy task due to data constraints. While aggregate data at the country-industry level is available (e.g. the WIOD database), hence allowing to map the evolution of GVCs as well as some indicators of countries' participation and positioning into them, systematic firm-level evidence on GVCs comparable across countries is scant.

This work tries to partly fill the gap by analyzing the drivers of firms' international activities and GVC participation at regional level across European countries. Specifically, we use the results of a benchmark survey run in 2015 (and asking questions on firms' status in 2013) on representative samples of 650 manufacturing firms active in five of the most dynamic regions of Europe – Lombardy, Baden-Württemberg, Bayern, Rhône-Alpes and Cataluña[2] – in order to assess different patterns of participation in GVCs in relations with firms' characteristics, with a special focus on Lombardy. Balance sheet information linked to the surveyed firms covering the years 2005 to 2013 also allows to correlate these

[1] GVC have contributed to fast trade growth also as a result of the so-called "double counting" in gross trade figures, with flows crossing borders multiple times (and therefore being accounted into the statistical systems of different nations) before being finally "absorbed" into final goods. See KOOPMAN R. *et* AL. (2014) for a discussion and a measurement of this phenomenon, that might account for up to 30% of global trade volumes.

[2] The analysis is based on the newly collected Assolombarda "benchmark" firm-level dataset on European firms, replicating at the regional level across Europe a subset of the first international survey of this kind conducted in Europe, namely the EFIGE project (*www.efige.org*). The Assolombarda survey, run for the first time in 2015, provides consistent cross-regional data on all the international activities of firms, combined with many other firm characteristics as well as with balance-sheet data. A new wave of the survey is currently ongoing.

characteristics to changes in firms' performance throughout the crisis. Specific attention is paid to those firms' characteristics that foster a "higher value added" positioning within GVCs.

We find the drivers of international performance to be largely independent of the specific region in which firms are located. Companies that internationalize their activities, successfully participating in GVCs, share similar features in all European regions. Size, productivity, innovation-related aspects and governance are positively related to firms' international exposure, and the same firms' characteristics support more complex internationalization strategies (in line with existing theories of firms' self-selection into international markets; see Altomonte and Békés, 2016 for a recent survey of this literature).

How to reconcile the finding that internationalization patterns are driven by similar firm characteristics with the evidence that, overall, regions (and countries) perform very differently in terms of their exports and global production strategies? Consider Lombardy: in our regressions exploring the drivers of GVCs' participation, we do not find any specific regional fixed effect, despite firms in Lombardy participate in relatively lower value-added activities with respect to the other European regions considered. It then follows that the characteristics that position firms into different parts of GVCs are consistent across regions, but that the distribution of these characteristics is heterogeneous. As in our survey we are comparing "the top" manufacturing regions of the EU, we conclude that "institutions" (broadly considered) matter in affecting external competitiveness of regions mainly through their effects on the equilibrium distribution of firms' size, productivity, innovative capacity, organization and management. Our findings thus support the view that external competitiveness is fostered by horizontal policies. Those entail improving the general business environment and removing obstacles that hinder long-term investments, innovation capabilities and firms' growth, rather than targeted intervention such as measures for export promotion.[3]

A second relevant policy implication stems from another of our results, and namely the fact that the distribution of firms' characteristics appears to be heterogeneous also within regions. Consider again Lombardy: we look at the difference in performance (turnover growth) between those firms able to increase

[3] Altomonte C. and Békés G. (2016) discuss how, because of granularity associated to heterogeneous firm-level distributions, country and sector average measurements, which are the parameters on which targeted policy actions are generally based, do a poor job in grasping the actual level of competitiveness both within countries (regions) and across them.

exports throughout the crisis (2008-2013) and domestic firms. The number of these "winning" firms is similar between Lombardy and Germany (actually slightly higher in Lombardy), while on average Lombardy's "export champions" experience a turnover growth of 2.8% every year, less than their German counterparts. However, within Lombardy domestic firms only grew by 1.6% on average in the same period. This 1.2% growth gap between domestic *vs.* exporting firms is the largest recorded across our European regions, pointing at an increasing polarization of the industrial structure in Lombardy between the "happy few" medium to large winners of the globalization race *vs.* many small losers.

The remaining of this work is organized as follows. In section 2 we briefly introduce the survey and describe the data. Section 3 presents some preliminary evidence on internationalisation and GVCs participation, together with data on firms' productivity, while section 4 is devoted to assess additional firms' characteristics that are associated to different patterns of GVC participation. Section 5 concludes.

2. - The Assolombarda Benchmark Survey

Assolombarda, the largest regional branch of the Italian Confederation of employers (Confindustria), has funded a specific project within its 2014-2016 Strategic Plan called "The performances of European Firms: a benchmark analysis". Its specific aim is twofold: overcoming the limited harmonized statistical information on European firms, as well as gathering insights on firms' strategies and re-organization processes that take place across Europe since the start of the crisis.[4]

The project complements with firm-level information the traditional country- and industry-level data on competitiveness, by generating a harmonised cross-country dataset from an extensive survey of manufacturing firms with more than 10 employees. The survey has been carried out in spring 2015. The focus is on five large European regions at the heart of the EU industry: Lombardy (Italy), Baden-Württemberg and Bayern (Germany), Cataluña (Spain) and Rhône-Alpes (France). The project used as a methodological benchmark the 2010 EU-funded cross-country survey "European firms in a global economy: Internal policies for

[4] The full report of the survey can be found at *http://www.assolombarda.it/centro-studi/le-performance-delle-imprese-europee-unanalisi-benchmark*. An English version of the Executive summary is available upon request.

external competitiveness" (EFIGE)[5]. Thanks to the new data collected, we have been able to update some of the information provided in the EFIGE dataset, as well as to derive a number of new indicators.

The data collection has been carried out by a professional Contractor, with the aim of gathering both qualitative and quantitative information at the firm level.[6] The questionnaire submitted to the firms covers seven different broad areas, for a total of around 100 variables:

- firm structure (company ownership, domestic and foreign control, management);
- workforce (skills, type of contracts, training);
- investments and related financing;
- innovation, patent activity and R&D (and related financing);
- export and internationalization processes;
- financial structure and bank-firm relationship;
- market structure and competition;
- bureaucracy and administrative context.

As the survey was run in early 2015, information is mostly collected as a cross-section for the last available budget (year 2013), although some questions cover the period 2011-2013 and/or the behaviour of firms in comparison to the pre-crisis period or during the crisis. Data have been integrated with balance sheet information drawn from the Amadeus database managed by Bureau van Dijk, retrieving ten years of usable balance sheet information for each surveyed firm, from 2005 to 2014. The aim is to further improve on the characterisation of firms included in the survey, in particular by enabling the calculation of firm-specific measures of productivity.

To identify the features that have allowed firms to successfully compete in the global environment, we devoted our attention to the five European regions that are driving EU manufacturing (Lombardy, Baden-Württemberg, Bayern, Cataluña, Rhône-Alpes). Although with some differences related to institutional factors, these regions are overall comparable from a structural point of view, as shown in Table 1. Together, these regions represent on average 16.7% of GDP and 15.4% of employment in each country.[7]

[5] The EFIGE dataset is now publicly available at *www.efige.org*.

[6] GFK, the fourth largest market research company in the world.

[7] GDP data refer to 2014; employment to 2015.

TABLE 1

STRUCTURAL PROFILE OF THE FIVE EU REGIONS

	Population at 01/01/2015		Surface		GDP 2014 (current prices)		Export 2015 (current prices)	
	number	% over tot. EU28	km²	% over tot. EU28	mln €	% over tot. EU28	mld €	% over tot. world
Baden-Württemberg	10,716,644	2.1	35,751	0.8	440,057	3.2	185	1.3
Bayern	12,691,568	2.5	70,550	1.6	524,064	3.8	179	1.2
Rhône-Alpes	6,510,561	1.3	43,698	1.0	207,243	1.5	56*	0.4*
Cataluña	7,396,991	1.5	32,090	0.7	197,004	1.4	64	0.4
Lombardy	10,002,615	2.0	23,864	0.5	348,615	2.5	111	0.7

Source: EUROSTAT, WTO, IMF, DESTATIS, IDESCAT, Direction générale des douanes et droits indirects data.
* Auvergne-Rhône Alpes.

Firm-level samples were designed in each region to be representative of the overall firm distribution in terms of both company size and sectors of activity. Specifically, in order to ensure the standard statistical representativeness of the collected data, the dataset was built to fulfil three criteria:

1. the availability of an adequately large sample of firms at the regional level, set around 100 firms for Baden-Württemberg, Bayern, Rhône-Alpes and Cataluña, and around 250 firms for Lombardy;[8]
2. a minimum response rate of 85-90% for 26 key questions previously agreed upon and an overall average of response rates not below 60% for the remaining part of the questionnaire;
3. a proper stratification of the sample in order to ensure representativeness of the collected data *ex-ante* and *ex-post* for each region. In particular, two dimensions have been used for the stratification of the sample: industries (4 macro-sector based on Eurostat-NACE Rev. 2 classification of 2 digit manufacturing industries by R&D intensities, see Table A1) and size (3 classes of 10-49; 50-249; more than 250 employees). Given their relevance in aggregate competitiveness dynamics, but a relative "thin" weight in a standard stratification of the population of firms (see Table A2), large firms have been oversampled.

The final Assolombarda Benchmark Survey (ABS) dataset is made up of 645 firms, distributed as reported in Table 2.

[8] The higher numbers in Lombardy reflect both the need to oversample large firms, so as to better account for them given the traditional smaller size of Italian firms, as well as the possibility of linking the survey data for Lombardy to the universe of "Medium-sized" Italian companies collected by Mediobanca in a regular yearly survey.

TABLE 2

THE DATASET BY REGION

Region	Number of firms
Baden-Württemberg	100
Bayern	100
Rhône-Alpes	101
Cataluña	103
Lombardy	241
Total	*645*

Source: Author's calculation from ASSOLOMBARDA, Benchmark Survey dataset.

A weighting scheme has been set up to retrieve the sample's representativeness starting from simple within-sample averages (see Appendix A2 and Table A3). All analysis herein reported are based on the weighted sample.

As mentioned in the previous section, the present survey has been constructed so as to guarantee comparability with EFIGE, thanks to an analogous stratification process and a very similar questionnaire on manufacturing firms with more than 10 employees. For this purpose, Table 3 presents the main descriptive statistics of the two datasets derived from balance-sheet information, related to 2013 and 2009, respectively. In order to compare the two datasets, the EFIGE data have been regionalized and re-weighted applying the same territorial weighting scheme as in the ABS data.

3. - The Internationalisation of Firms across EU Regions

One of the key issues when assessing competitiveness is international trade or, more in general, international openness. In that respect the Assolombarda Benchmark Survey contains a rich section on internationalisation. Firms were asked several questions on exports, imports, foreign direct investments (FDI) and international outsourcing (IO), which includes international production carried out under arm-length contracts by third foreign companies.

By using firm-level data it is possible to break a country's manufacturing exports down into two margins: the percentage of firms in manufacturing that export a fraction of their sales (the so-called "extensive margin") and, only for exporters, the share of the export value over total turnover (the so-called "intensive margin"). In Graph 1 and Graph 2 we report these two figures by region, distinguishing between total exports and extra-EU exports, and considering only the export of domestic produced goods. The extensive margin varies substantially

TABLE 3

DESCRIPTIVE STATISTICS: ABS *vs.* EFIGE

Assolombarda Benchmark Survey, 2013				
Region	Employees		Turnover	Labur productivity
	mean	median	(thousand €)	(thousand €)
Baden-Württemberg	66	26	8,419.0	61.9
Bayern	57	25	8,604.3	58.7
Rhône-Alpes	39	19	8,828.8	53.9
Cataluña	24	19	4,619.2	43.9
Lombardy	33	18	6,888.8	51.0
Total sample	43	20	7,081.2	50.6
EFIGE, 2009				
Region	Employees		Turnover	Labur productivity
	mean	median	(thousand €)	(thousand €)
Baden-Württemberg	63	28	9,344.7	60.2
Bayern	62	27	8,685.0	64.0
Rhône-Alpes	43	20	7,570.4	49.8
Cataluña	43	18	6,718.7	49.9
Lombardy	39	20	7,772.1	57.3
Total sample	51	23	8,045.7	55.8

Source: Author's calculation from ASSOLOMBARDA, Benchmark Survey and EFIGE dataset.

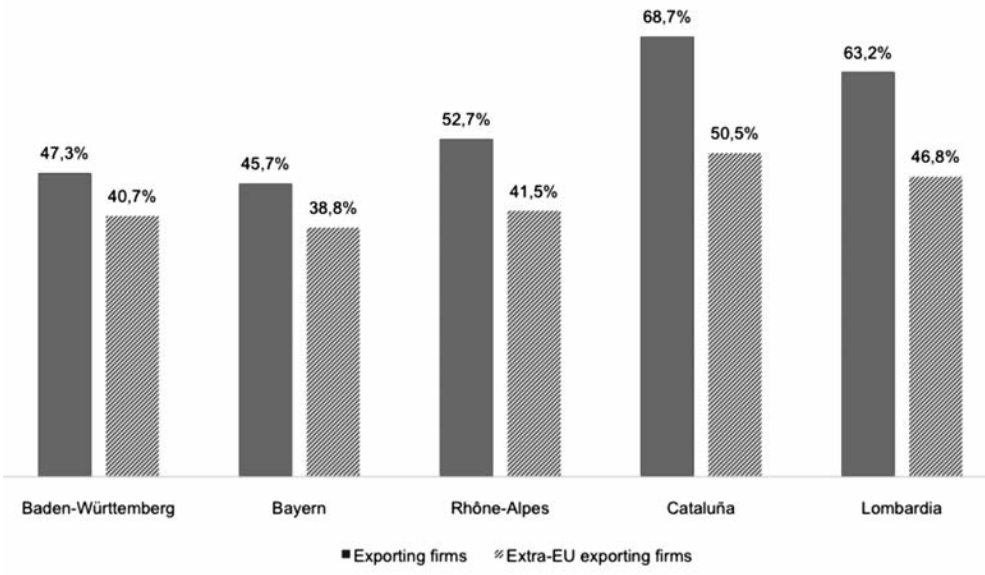
across regions and is larger in Cataluña and Lombardy (68.7% and 63.2%, respectively) than in Baden-Württemberg, Bayern and Rhône-Alpes (slightly less than 50%, on average), also if we consider extra-EU markets. This could be related to the higher industry fragmentation of Italy and Spain, countries where manufacturing firms with more than 10 employees represent less than 20% of the population, whereas in Germany firms with more than 10 employees account for around 40% of total manufacturing.

The intensive margins confirms the openness to trade of European manufacturing firms: on average, direct exporters sell abroad one third of their total turnover, and slightly more than 10% if we consider only extra-EU markets. An interesting case is Cataluña, that displays the highest percentage of exporting firms (68.7%) but a relatively low intensive margin (25.8%). Instead Lombardy stands out with respect to export turnover: almost 40% of total turnover is exported, a percentage that remains above average even if we consider only extra-EU markets (12.7%). However, in the latter case differences across regions are less pronounced. In fact, as it can be seen in Graph 2, the variance of the intensive

margin varies across the type of exports, with standard errors typically smaller for extra-EU flows, where likely more self-selection is present.

Graph 1

THE EXTENSIVE MARGIN OF EXPORTS
(% of firms/total, 2013)



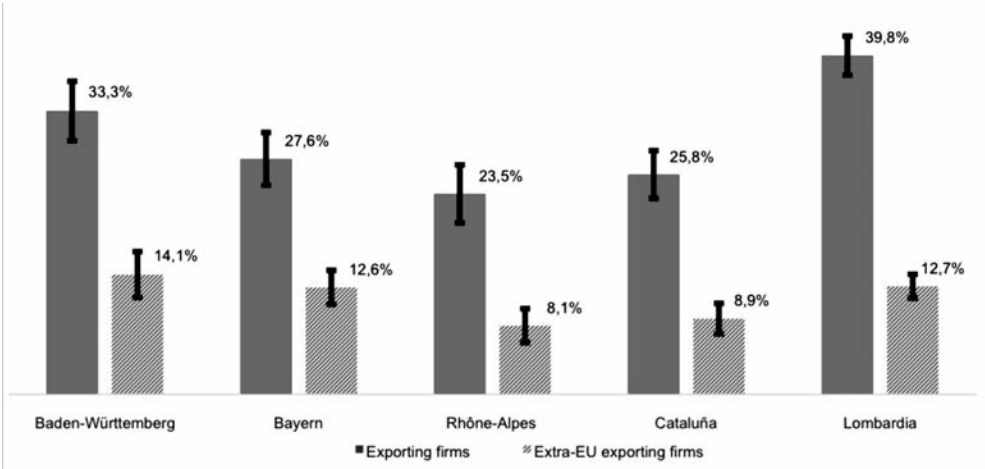
Source: Author's calculation from Assolombarda, Benchmark Survey dataset.

Having looked at export patterns, let us now consider other modes of internationalization that may help firms to either reduce production costs through access to cheaper inputs, or tapping foreign technologies. This can take place through different modalities, the simplest of which is importing foreign inputs and components for use in domestic production. The second modality is international outsourcing (IO), which implies setting up specific arms-length agreements with companies in foreign markets, for example for the production of finished goods under licensing, or the production of specific components. The third modality, which generally involves higher investment and fixed costs, is carrying out own production through foreign direct investments (FDI).

Regional patterns differ when we consider specific modalities of internationalisation beyond exports (Graph 3). Baden-Württemberg, Bayern and Lombardy have a lower share of firms producing abroad than the other two regions, driven by the fact that a lower share of firms use imported inputs. Let us consider Ger-

GRAPH 2

THE INTENSIVE MARGIN OF EXPORTS
(% of export turnover/total turnover of exporting firms, 2013)

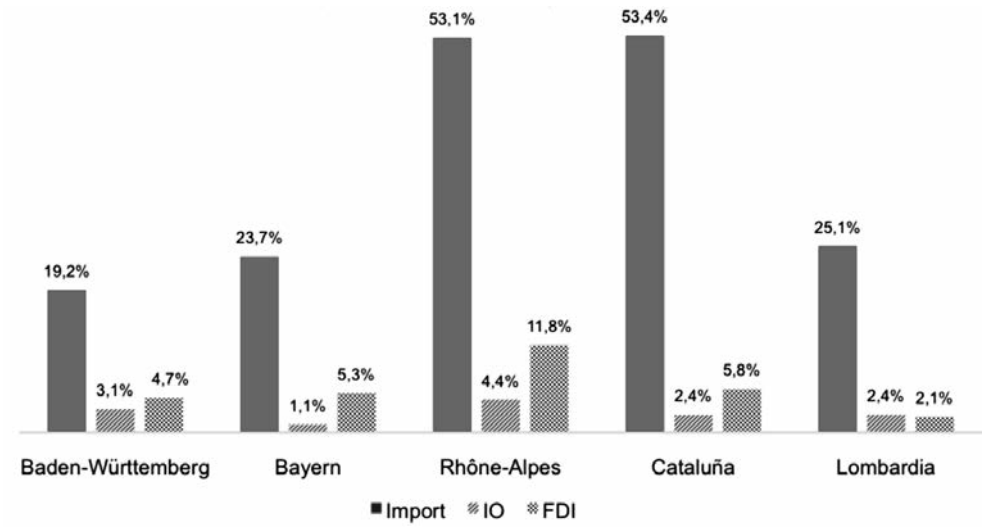


Source: Author's calculation from ASSOLOMBARDA, Benchmark Survey dataset.

many first: the result could be related to the fact that a large share of firms are vertically integrated (use fewer purchased inputs than elsewhere), or source more domestically. This finding is apparently at odds with the higher aggregate German share of imports of goods relative to GDP compared to other higher continental countries, but it can likely be driven by larger size of German firms. The picture in fact changes if we focus only on IO and FDI. Here German firms are more likely to pursue these strategies than firms in Lombardy. The latter region represents an interesting case: the smaller size of Lombard firms explains the very low percentages in IO and FDI. The region also displays a relatively low percentage of importing firms (25.1%).

Graph 3

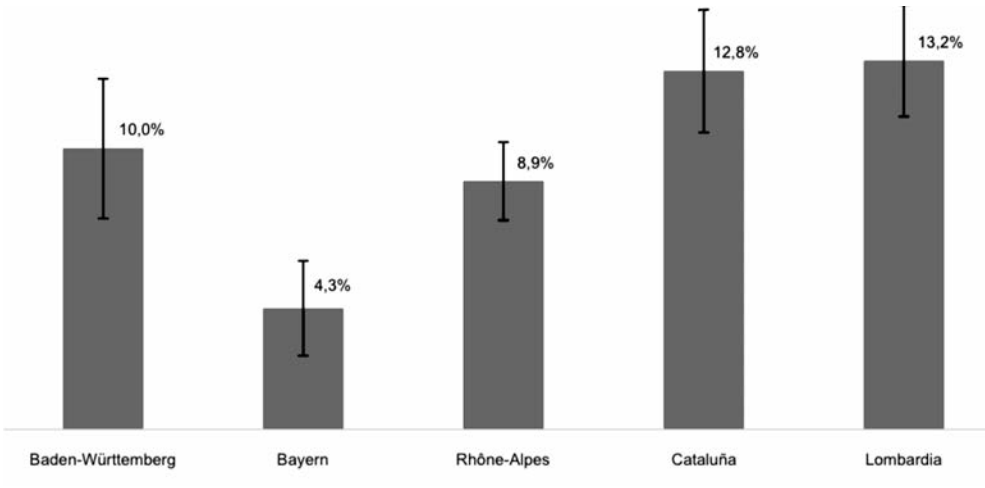
THE EXTENSIVE MARGIN OF GLOBAL PRODUCTION: IMPORT, IO AND FDI
(% of firms/total, 2013)



Source: Author's calculation from Assolombarda, Benchmark Survey dataset.

Graph 4

THE INTENSIVE MARGIN OF IMPORTS
(% of import/total turnover of importing firms, 2013)



Source: Author's calculation from Assolombarda, Benchmark Survey dataset.

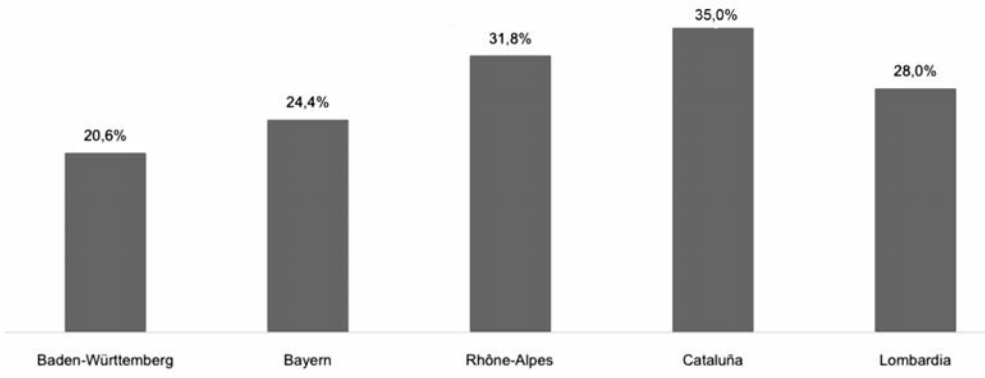
Still, even though the extensive margin of imports is larger than for IO and FDI, the ranking is reversed when we consider the intensive margins, *i.e.* the share of the value of imports over turnover, which is much lower than the share of turnover from FDI and IO on total firms' turnover (Graph 4). In fact, the intensive margin of IO is equal to 23.2% (with a standard error equal to ±6%), the one of FDI is equal to 26.8% (standard error ±3.5%), while the average intensive margin of imports equals 10.9% (standard error ±0.9%).

In other words, fewer firms seem to enter into FDI or IO, but then these modes imply a much larger share of (or shift to) foreign production for firms that undertake these internationalization modalities.

Another interesting feature of the data is the possibility to look at whether and to what extent internationalisation activities have changed across the crisis. To that extent, we consider "export champions", *i.e.*, those firms that during the last years experimented an increase in export turnover with respect to the pre-crisis period. In Lombardy, 28% of firms were able to increase their export turnover during the crisis, versus shares of about 20% and 25% registered in Baden-Württemberg and Bayern, respectively (Graph 5).

GRAPH 5

EXPORT TOP PERFORMERS
(% of firms increasing export turnover w.r. to the pre-crisis period)



Source: Author's calculation from ASSOLOMBARDA, Benchmark Survey dataset.

The benefit associated to this increase in export activity are marked: overall, "export champions" under-performed domestic firms in the years of sever international trade slowdown, but they experimented a y/y percentage change in total turnover higher than domestic firms in recovery periods. On average (see Table

4), the total turnover of "export champions" increased by 2.8% every year in Lombardy, a figure smaller than their German counterparts, growing between 4.1% and 5.6% on average. What is striking however is the difference within the region: domestic firms in Lombardy in fact grew by a mere 1.6% per year over the same period. Only Bayern presents a similar (but smaller) polarization in performance: +5.6% increase in total turnover for "export champions" *vs.* +4.6% for domestic firms.

Table 4

YEARLY % CHANGE IN TOTAL TURNOVER: DOMESTIC FIRMS *vs*. EXPORT TOP PERFORMERS

Firms that experimented an increase in export turnover						
	% var. 09/08	% var. 10/09	% var. 11/10	% var. 12/11	% var. 13/12	Average % var.
Baden-Württemberg	-12.9	6.5	17.6	3.0	6.1	4.1
Bayern	-8.5	11.1	11.1	4.0	10.3	5.6
Rhône-Alpes	-14.4	9.5	10.8	2.1	7.1	3.0
Cataluña	-15.4	7.0	4.1	-5.9	6.8	-0.7
Lombardy	-16.3	15.9	13.6	-3.5	4.4	2.8
Domestic firms						
	% var. 09/08	% var. 10/09	% var. 11/10	% var. 12/11	% var. 13/12	Average % var.
Baden-Württemberg	-2.0	4.2	8.9	5.1	4.4	4.1
Bayern	-0.5	6.3	11.3	3.0	2.8	4.6
Rhône-Alpes	-12.7	6.6	13.5	1.9	6.7	3.2
Cataluña	-17.7	2.2	5.3	-3.5	2.2	-2.3
Lombardy	-12.6	11.9	9.4	-1.2	0.6	1.6

Source: Author's calculation from Assolombarda, Benchmark Survey dataset.

3.1 *GVCs Participation*

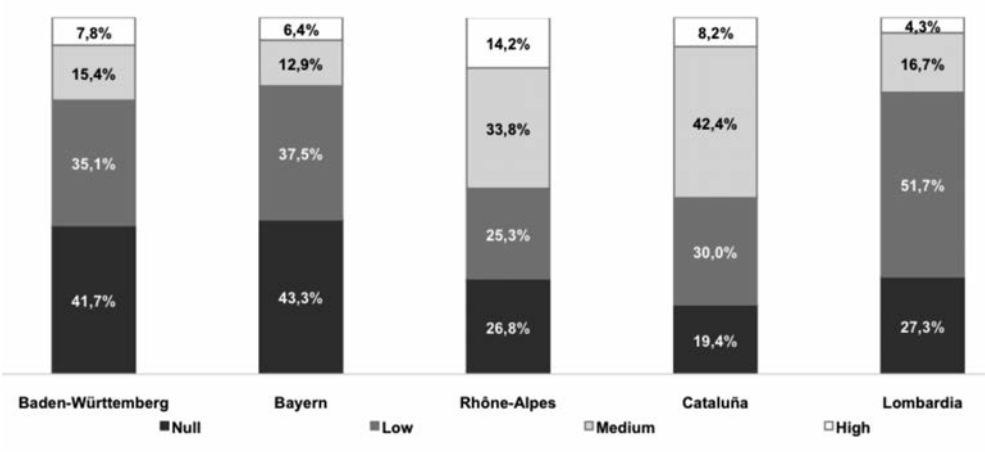
We measure the degree of participation of the surveyed firms into GVCs through the combination of the different undertaken international activities discussed in the previous section: a "Null" degree of GVC participation corresponds to domestic firms; "Low" to firms that either import or export only; "Medium" to firms that both import and export; "High" to firms that undertake IO or FDI.[9]

[9] For a comprehensive review of firms into GVCs, see Manufacturing Europe's future, Bruegel Blueprint, edited by Veugelers R. (2013) available at *http://www.bruegel.org/download/parent/795-manufacturing-europesfuture/file/1683-manufacturing-europes-future/*, and Amador J. and Di Mauro F. (2015), available at *http://www.voxeu.org/sites/default/files/GVCsebook.pdf.*

Descriptive evidence highlights some differences across regions, confirming the results discussed in the previous section (Graph 6). For instance, about 52% of Lombard firms are characterized by a low degree of participation in GVCs, meaning that the sole international activities performed are import or export alone, without other forms of international production. This figure is the largest in the sample. On the contrary, about 20% of Lombard firms presents a medium to high involvement into GVCs (a result analogous to the German ones) but this is driven by around 7-8% of German firms showing a high degree of participation in GVCs while only 4.3% of Lombard firms have a high participation in GVCs. With this respect, Rhône-Alpes is the top performing region, with 14.2% of firms having a high degree of GVC involvement – a result related to a more widespread presence of firms structured as international groups in that region compared to the others.

GRAPH 6

GLOBAL VALUE CHAINS PARTICIPATION
(% of firms/total, 2013)



Source: Author's calculation from ASSOLOMBARDA, Benchmark Survey dataset.

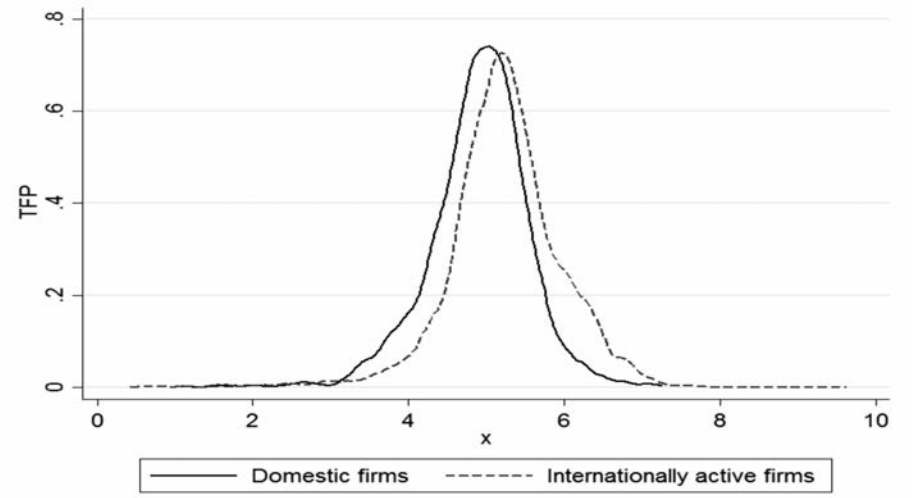
A standard way of showing selection into different internationalization activities is to draw the kernel density estimates of the productivity distribution for firms involved in each of these activities, and compare it with those of domestic firms, *i.e.* firms that are internationally inactive. Given the relationship between

technological change and competitiveness, we proxy the latter through total factor productivity (TFP) rather than simple labour productivity.[10]

Graph 7 highlights that, in general terms, a randomly drawn internationalized firm is likely to be more productive than a randomly drawn firm that is inactive internationally, consistent with the well-known evidence of self-selection of firms into internationalization (Melitz, 2003). Plotting Kernel densities of TFP for domestic firms, low, medium and high degree of participation in GVCs, respectively, we also find that, on average, the distribution of each level of GVCs participation is rightward-shifted with respect to the preceding step (Graph 8). That only more efficient firms invest in more complex internationalization strategies is already known from the literature (see for instance Antràs and Helpman, 2004, and Helpman *et* al., 2004), and provides an indirect validation of the quality of our data.

GRAPH 7

TFP AND INTERNATIONALIZATION: COMPARING INTERNATIONALLY ACTIVE AND NON-ACTIVE FIRMS
(% of firms/total sample, 2013)

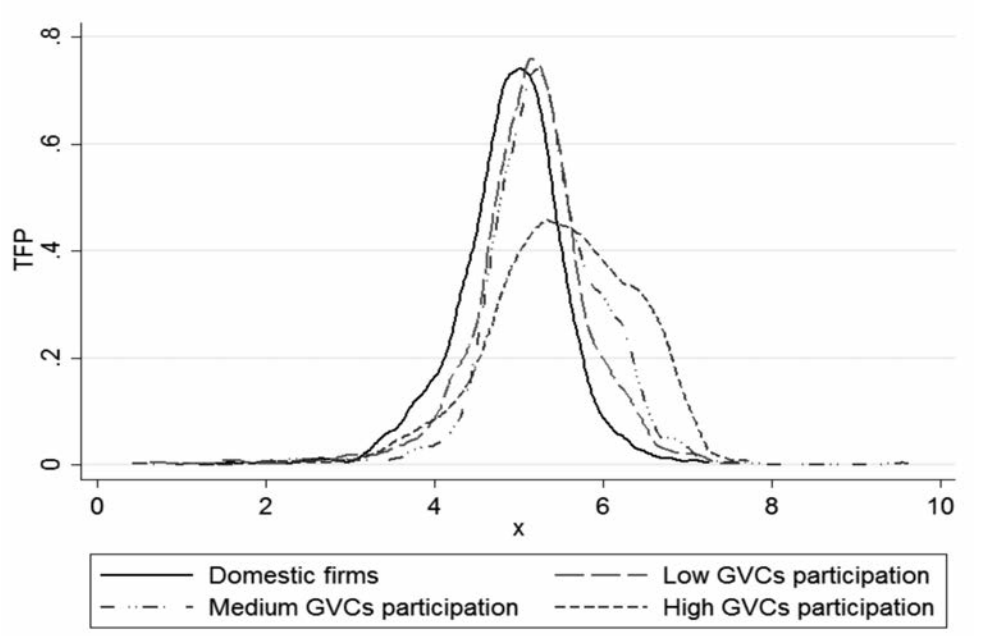


Source: Author's calculation from ASSOLOMBARDA, Benchmark Survey dataset.

[10] Following standard practice in the literature, output is proxied in the estimations by value-added, deflated using industry-specific price indices retrieved from Eurostat, the labour input is measured by the number of employees and capital through deflated total assets. See ALTOMONTE C. *et* AL .(2012) for a detailed description of the methodology behind TFP calculation, carried out as in the EFIGE data.

GRAPH 8

TFP AND GVCs: COMPARING SUBSEQUENT DEGREE OF GVCs PARTICIPATION AND NON-ACTIVE FIRMS
(% of firms/total sample, 2013)



Source: Author's calculation from ASSOLOMBARDA, Benchmark Survey dataset.

4. - The Determinants of GVCs Participation

In order to test the role of firms' characteristics on GVCs participation, we consider a two-step OLS model. We first assume that there are some variables that strongly affect the probability of observing a firm involved in GVCs, but that the same variables do not (entirely) explain the specific outcome under study, *i.e.*, the degree of participation in GVCs.

In technical terms, we first run a selection equation that features as dependent variable *Internationally active*, a dummy variable equal to 1 if the firm pursues any international activity, 0 otherwise. Following the idea that only productive firms can bear the fixed costs of internationalization, we consider as the main independent variable the log of *Productivity*. The second feature that we assume could influence the decision to become internationalized or not is a trait linked

to the ownership/management of the firm. Specifically, we take as second independent variable *Family managed*, a dummy variable equal to 1 if the board members of the firm are 100% related to a controlling family. Then, we consider as control variables fixed effects related to regions, industries (the macro-sector dummies based on Eurostat-NACE Rev. 2 classification of 2 digit manufacturing industries by R&D intensities used for the stratification of the sample) and size classes (10-49; 50-249; more than 250 employees).

The selection equation is the following:

$$(1a) \quad Int.\ active_t = \beta_0 + Prod._t \times \beta_1 + Fam.\ managed_t \times \beta_2 + I.regio_t \times \beta_3 + \\ + I.industry_t \times \beta_4 + I.size\ class_t \times \beta_5 + u_{1t}$$

Results by OLS estimation are reported in Table 5. Data confirm our hypothesis. The decision of being internationally active positively depends on productivity (the associated coefficient is equal to 0.0874 and significant at 1% confidence level) and negatively on family management (the associated coefficient is equal to -0.0947 and significant at 5% confidence level).

TABLE 5

DETERMINATS OF INTERNATIONALISATION

Variables	Internationally active
Productivity	0.097 ***
	(0.032)
Family managed	-0.096 **
	(0.043)
Region FE	YES
Industry FE	YES
Size class FE	YES
Constant	0.328
	(0.221)
Observations	482
R-squared	0.129

Source: Author's calculation from ASSOLOMBARDA, Benchmark Survey dataset.
Note: The table reports regression coefficients and associated robust standard errors (in parenthesis). The dependent variable is reported at the top of the column. The table reports the R^2. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

We then compute residuals from the selection equation and insert them as an additional control in the second step of our analysis, *i.e.* the model of GVCs participation. We run three different groups of OLS regressions that feature as de-

pendent variables the different steps of GVCs participation as defined in section 3, each subsequent step being more sophisticated than the former: *GVCs low*, *GVCs medium* and *GVCs high*. For each step of GVCs participation, we run three equations that feature as independent variables three key aspects that can shape firms' access to GVCs, added in sequence to the specification: innovation, digitalisation and management.

Within the "innovation group" we consider first of all *R&D*, a dummy variable equal to 1 if the firm was active in research and development in the period 2011-2013. To that, we add as an additional control *IPR*, a dummy variable equal to 1 if the firm has requested/obtained patents or other forms of protection of intellectual property (trademarks, industrial designs and copyright) in the period 2011-2013. In fact, what could make the difference in terms of competitiveness is into the ability to convert innovative inputs arising from research and development technological output with sound market value.[11]

In light of the growing importance of the new manufacturing paradigm that goes under the label of "Industry 4.0", we add to the innovation variables a measure of firms' digitalization. This is computed taking into account the number of IT instruments used in 2013, among which: internal information management systems (e.g., ERP); advanced management systems (e.g., CRM or Groupware); systems for automatic information sharing between customers and suppliers (e.g., visual marketplace). The variable *Digit* is a dummy equal to 1 if the firm has a medium-high level of digitalization, *i.e.* uses at least two out of the three instruments considered.[12]

Management refers to the way labour and activities are structured. As proxies of a more efficient internal organization, first we consider the variable *Bonus*, a dummy variable equal to 1 if firms reward managers/executives partly on the basis of their individual performance and achievement of individual targets. In fact, the presence of remuneration policies based on performance significantly influences turnover growth (positive and significant correlation of +1.5% in the unconditional regression) as well as the probability to achieve in the long run a level of turnover greater than the median value (correlation of +31%). A second proxy

[11] In a separate paper, we find that the protection of intellectual property significantly influences turnover growth (estimated impact: 2%) and productivity (estimated impact: 22%). This analysis as well as the other analysis cited but not reported are available upon request.

[12] We find that firms having this medium-high level of digitalization (an indicator that can be thought of as a proxy of firms' readiness for Industry 4.0) are 40% more productive and have 15% more probability of exporting.

for a more efficient organization is the degree of decentralization in strategic decisions. The associated variable is *Autonomy*, a dummy variable equal to 1 if management can take autonomous decisions in some strategic business area. Last, we turn out attention to the restructuration processes for firms' growth and development. In the survey we asked firms if in the period 2011-2013 they have carried out processes of relational or functional upgrading *i.e.* if they have introduced new sales and marketing practices, changes in the relationship with other firms (relational upgrading), improvements in labour organisation or new purchase practices (functional upgrading). The unconditional regressions show that relational upgrading processes influences turnover growth (correlation of +1.8%), whereas firms that carry on functional upgrading are 13% more productive. Hence, we consider in our model *Relational* and *Functional*, two dummy variables equal to 1 in the presence of relational and functional upgrading, respectively.

In each of the resulting nine equations we control for firms' equity. In fact, the importance of a sound capital structure emerges clearly looking at firms that have carried out R&D activities or those that have managed to increase the value of extra-EU exports compared to pre-crisis levels. In all the regions considered, firms having succeeded in such activities are characterized by an equity over total assets *ratio* higher than average. For instance, in the case of firms in Lombardy, those that undertake innovation activities or that are able to export outside the EU show an "equity premium" of around 5-7 percentage points. The continuous variable *Equity* represents the equity over total assets *ratio*, in percentage terms. As in the selection equation, we also control for regional, industry and size classes fixed effects.

The corresponding equations then take the following form:

$$\begin{aligned}(1b)\quad GVCs\ type_t = {} & \beta_0 + Digit_t \times \beta_1 + IPR_t \times \beta_2 + R\&D_t \times \beta_3 + Equity_t \times \beta_4 + \\ & + Bonus_t \times \beta_5 + Relational_t \times \beta_6 + Functional_t \times Authonomy_t \times \beta_8 + I.regio_t \times \beta_9 + \\ & + I.industry_t \times \beta_{10} + I.size\ class_t \times \beta_{11} + Resid_t \times \beta_{12} + u_{2t}\end{aligned}$$

where *type* can be either low, medium or high GVC participation. For each step of GVCs participation, results by OLS estimation are reported in Table 6, Table 7 and Table 8, respectively.

Equation *(1)* to *(3)* in Table 6 relate to low GVC participation. In all the three equations, the role of digitalisation and intellectual property rights plays a positive and statistically significant role in differentiating domestic firms from firms weakly involved in GVCs. The coefficient associated to *Digit* is equal to 0.075

and significant at 1% confidence level in equation *(1)* and also in *(2)*, when we add variables related to innovation; then it decreases to 0.072 in equation *(3)*, when we add additional controls on the internal organization of the firm, but still remains significant at 1% confidence level. The coefficient associated to *IPR* is equal to 0.042 in equation *(1)*, and significant at 5% confidence level; it decreases to 0.039 in equation *(2)* and *(3)*, and still significant at 10% confidence level. Interestingly R&D and management-related variables appear not to be significant, as if these aspects are less relevant in the capability of firms to switch from a domestic activity to a weakly participated GVC.

Indeed, these activities become relevant when we study the subsequent higher involvement into GVCs: in equation *(5)* and *(6)* in Table 7, pertaining to firms with an intermediate involvement into GVCs *vs.* domestic firms. There, the *R&D* variable appears positive and significant at 5% confidence level, with a coefficient equal to 0.148 in equation *(5)* and 0.136 in equation *(6)*. Once again, moving to the analysis of an even more sophisticated participation in GVCs, we find that innovation is not enough: the management variables seem to be the ones that enable the transition from a medium to a high GVCs participation that involves also IO and FDI. Specifically, what matters is the internal organization of the firms, as shown in equation *(9)* in Table 8: the key variables are *Bonus* and *Functional upgrading*, both positive (coefficient equal to 0.217 in both cases) and significant at 5% confidence level.

Table 6

DETERMINANTS OF LOW GVCs PARTICIPATION

Variables	GVCs low *(1)*	GVCs low *(2)*	GVCs low *(3)*
Digit	0.075 ***	0.075 ***	0.072 ***
	(0.016)	(0.017)	(0.016)
IPR	0.042 **	0.039 *	0.039 *
	(0.016)	(0.020)	(0.020)
R&D		0.003	-0.000
		(0.016)	(0.016)
Bonus			0.009
			(0.015)
Relational upgrading			0.009
			(0.013)
Functional upgrading			-0.002
			(0.013)
Authonomy			0.017
			(0.019)
Equity	0.011	0.011	0.013
	(0.023)	(0.023)	(0.023)
Region FE	YES	YES	YES
Industry FE	YES	YES	YES
Size class FE	YES	YES	YES
Resid	0.998 ***	0.997 ***	0.997 ***
	(0.012)	(0.012)	(0.012)
Constant	0.706 ***	0.705 ***	0.695 ***
	(0.033)	(0.034)	(0.035)
Observations	324	324	324
R-squared	0.975	0.975	0.975

Source: Author's calculation from Assolombarda, Benchmark Survey dataset.
Note: The table reports regression coefficients and associated robust standard errors (parenthesis). The dependent variables is reported at the top of the column. The table reports the R^2. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

TABLE 7

DETERMINANTS OF MEDIUM GVCs PARTICIPATION

Variables	GVCs medium *(4)*	GVCs medium *(5)*	GVCs medium *(6)*
Digit	0.043	0.028	0.033
	(0.081)	(0.080)	(0.082)
IPR	0.074	-0.037	-0.032
	(0.080)	(0.093)	(0.092)
R&D		0.148 **	0.136 **
		(0.069)	(0.069)
Bonus			0.031
			(0.062)
Relational upgrading			0.044
			(0.069)
Functional upgrading			-0.035
			(0.064)
Authonomy			-0.018
			(0.070)
Equity	0.050	0.044	0.036
	(0.104)	(0.102)	(0.102)
Region FE	YES	YES	YES
Industry FE	YES	YES	YES
Size class FE	YES	YES	YES
Resid	-0.153	-0.137	-0.088
	(0.352)	(0.346)	(0.343)
Constant	0.485 **	0.453 **	0.426 *
	(0.221)	(0.224)	(0.221)
Observations	327	327	327
R-squared	0.191	0.205	0.207

Source: Author's calculation from ASSOLOMBARDA, Benchmark Survey dataset.
Note: The table reports regression coefficients and associated robust standard errors (parenthesis). The dependent variables is reported at the top of the column. The table reports the R^2. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

Table 8

DETERMINANTS OF HIGH GVCs PARTICIPATION

Variables	GVCs high	GVCs high	GVCs high
	(7)	*(8)*	*(9)*
Digit	0.050	0.062	0.001
	(0.085)	(0.083)	(0.089)
IPR	0.002	0.052	0.033
	(0.095)	(0.111)	(0.108)
R&D		-0.070	-0.142
		(0.120)	(0.106)
Bonus			0.217 **
			(0.104)
Relational upgrading			0.042
			(0.085)
Functional upgrading			0.217 **
			(0.093)
Authonomy			0.018
			(0.098)
Equity	-0.109	-0.108	-0.152
	(0.172)	(0.171)	(0.130)
Region FE	YES	YES	YES
Industry FE	YES	YES	YES
Size class FE	YES	YES	YES
Resid	-0.322	-0.328	-0.137
	(0.640)	(0.636)	(0.568)
Constant	0.193	0.203	-0.0696
	(0.300)	(0.294)	(0.301)
Observations	158	158	158
R-squared	0.082	0.085	0.226

Source: Author's calculation from Assolombarda, Benchmark Survey dataset.
Note: The table reports regression coefficients and associated robust standard errors (parenthesis). The dependent variables is reported at the top of the column. The table reports the R^2. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

These results confirm that different internationalization patterns are related to different firm characteristics, but that the influence of these characteristics is similar across regions. How can these findings be reconciled with the evidence that regions perform very differently in terms of their exports and global production strategies? The main reason is that the characteristics that position firms into different parts of GVCs are consistent across regions, but the distribution of these characteristics is heterogeneous: firms in Lombardy tend to have on average a lower value-added GVC positioning with respect to the other European regions considered, but in Lombardy we do also find firms that have a relatively higher GVC positioning, with similar characteristics to their counterparts in, say Germany (we do not find

any specific "Lombardy" fixed effect in our regressions). The only difference is that the frequency of those firms' characteristics associated to higher GVC participation is relatively smaller in Lombardy compared to other regions.

Specifically, Lombardy is in line with German regions in terms of R&D (39.9% of firms claim their engagement in R&D activities in 2011-2013, around 40% the equivalent figure registered in the two German regions), and digitalization (approximately half of the firms in the respective subsamples use only standard software, and less than 20% of them have a medium-high level of digitalization). However, over the same period, only 7.6% of Lombard firms have used some tool for the protection of intellectual property (patents, trademarks, industrial design or copyright), 5.7% considering patents (the form of intellectual property protection most related to scientific-technological innovations). These shares respectively increase to 18.3% and 11.2% on average if we consider the whole sample.

Another factor that restricts Lombard firms in their international growth path is management. The prevailing model of governance in all the analysed regions entails an ownership structure based on individual entrepreneurs or families, a common feature of all continental European firms compared to the Anglo-Saxon ones. What differentiates corporate structures across regions, however, is not so much the source of ownership, but rather the source of management: in Lombardy, firms that count among their managers only members of the owner's family are about two-thirds of all the family businesses, compared with an average in other European regions slightly below 50%. This is particularly alarming, as a management that is 100% linked to the owning or controlling family might ultimately hinder growth. In our data, always taking into account differences in sector, region or size firms that are fully family-managed are 21.5% less productive than the average. Moreover, only 20% of Lombard firms feature remuneration policies based on individual performance, compared with percentage around 50% in Bayern and Rhône-Alpes, and equal to 60.1% in Baden-Württemberg.

6. - Conclusions

Thanks to a novel firm-level dataset on manufacturing firms operating across the main EU regions, in this work we have been able to provide some highlights on the characteristics of firms that are typically associated with different degrees of global involvement.

Consistently with the results of a vast literature, we find that internationalized firms are likely to be more productive than domestic ones, and the productivity gap is higher, the higher is the involvement in GVCs.

Second, we find that internationalization patterns and performance are associated to similar firms' characteristics, largely irrespective of the specific region in which firms are located. Our analysis confirm that size, productivity, innovation-related aspects and governance are positively related to a firm's degree of involvement in GVCs. Specifically, while digitalization, patenting and R&D play a key role in achieving a low-to-medium degree of GVCs participation, management aspects are the ones more closely associated to the transition to more sophisticated international strategies involving also IO and FDI.

Third, even if the characteristics that allow firms to achieve different levels of GVCs participation are analogous across regions, the same regions perform very differently in exports and global production strategies, because the distribution of these characteristics is heterogeneous across regions and within them.

Two policy implications can be derived. Across regions, heterogeneity depends on the equilibrium distribution of firms' size, productivity, innovation capacity, organization and management, which in turns are affected by national institutions. Targeted intervention such as measure for export promotion may have positive effects in the short term, but are not enough to achieve long-lasting competitiveness. Horizontal policies are the ones that can foster international competitiveness by improving the local business environment and removing obstacles that hinder long-term investments, innovation capacity and functional upgrading.

The second policy implication is related to within-region heterogeneity. We have shown that, on average, the sales performance of firms with access to international markets has diverged from domestic-only firms in the post-crisis context, confirming the idea that internationalization is a key driver of competitiveness. Still, this divergence is different across European regions, being the largest in Lombardy. The latter generates an increasing polarization between the "happy few", medium to large, very productive and internationally active firms *vs.* the many small losers of the globalization race. This is likely to create a political problem not only at the regional level, to the extent that these two groups of firms over time are likely to require different policy receipts, but also at the European level, as long as this effect is not homogeneous across regions, thus leading to potentially increasing regional disparities.

APPENDIX

A1. - The Stratification Process

TABLE A1

MANUFACTURING INDUSTRIES CLASSIFICATION BY R&D INTENSITY

Manufacturing industries	NACE	Description
High-technology	21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
	26	Manufacture of computer, electronic and optical products
Medium-high-technology	20	Manufacture of chemicals and chemical products
	27	Manufacture of electrical equipment
	28	Manufacture of machinery and equipment n.e.c.
	29	Manufacture of motor vehicles, trailers and semi-trailers
	30	Manufacture of other transport equipment
Medium-low-technology	19	Manufacture of coke and refined petroleum products
	22	Manufacture of rubber and plastic products
	23	Manufacture of other non-metallic mineral products
	24	Manufacture of basic metals
	25	Manufacture of fabricated metal products, except machinery and equipment
	33	Repair and installation of machinery and equipment
Low-technology	10	Manufacture of food products
	11	Manufacture of beverages
	12	Manufacture of tobacco products
	13	Manufacture of textiles
	14	Manufacture of wearing apparel
	15	Manufacture of leather and related products
	16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
	17	Manufacture of paper and paper products
	18	Printing and reproduction of recorded media
	31	Manufacture of furniture
	32	Other manufacturing

Source: EUROSTAT.

Table A2

EX-ANTE AND *EX-POST* SAMPLE DISTRIBUTION

Baden-Württemberg	10-49	50-249	> 250	Baden-Württemberg	10-49	50-249	> 250
HT	4	1	0.4	HT	2	2	1
MHT	25	11	4	MHT	21	11	9
MLT	24	7	1	MLT	21	7	3
LT	19	4	1	LT	17	4	2
Bayern	10-49	50-249	> 250	Bayern	10-49	50-249	> 250
HT	4	1	0.4	HT	2	2	1
MHT	20	9	3	MHT	17	9	8
MLT	26	7	1	MLT	22	7	4
LT	24	5	1	LT	21	5	2
Rhône-Alpes	10-49	50-249	> 250	Rhône-Alpes	10-49	50-249	> 250
HT	2	1	1	HT	2	2	2
MHT	12	5	2	MHT	10	5	6
MLT	36	8	2	MLT	31	7	4
LT	24	6	1	LT	22	6	3
Cataluña	10-49	50-249	> 250	Cataluña	10-49	50-249	> 250
HT	3	1	0.4	HT	2	2	1
MHT	17	4	1	MHT	16	4	2
MLT	26	4	1	MLT	25	4	2
LT	37	5	1	LT	35	5	2
Lombardy	10-49	50-249	> 250	Lombardy	10-49	50-249	> 250
HT	6	2	1	HT	5	2	3
MHT	54	11	2	MHT	52	11	6
MLT	85	11	1	MLT	83	10	3
LT	70	6	1	LT	65	7	3

Source: GfK-Eurisko calculations on Eurostat data.

A2. - The Weighting Scheme

Absolute weights have been constructed, splitting the sample into 72 cells by 2 digit NACE Rev. 2 manufacturing industries and the three size classes on which the stratification has been carried out (see Table A3, which considers as an example the case of Lombardy). First, from Eurostat Structural Business Statistics (year 2010), we have computed the composition of each region's economic activity by industry and firm's size class (*i.e.*, the population distribution). Second, we have repeated the same exercise considering the data effectively collected (*i.e.*, the sample distribution). Then, for each region, the absolute weight for firms in industry k and size class j is built as follows:

$$aw_{kj} = \frac{Pfirms_{kj} \,/\, Pfirms}{Sfirms_{kj} \,/\, Sfirms}\left(\frac{Pfirms}{Sfirms}\right) \tag{A1}$$

where $Pfirms_{kj}$ is the number of firms in industry k and size class j for the population in a given region; $Sfirms_{kj}$ is the number of firms in industry k and size class j in the sample; *Pfirms* and *Sfirms* are the total number of firms in the population and in the sample, respectively. By construction, firms belonging to the same sampling interval (*i.e.* to the same combination industry/size classes) share the same weight. The sum of weights over the firms is equal to the total number of firms in the sample by region.

Table A3

EX-POST SAMPLE DISTRIBUTION AND ABSOLUTE WEIGHTS: THE CASE OF LOMBARDY

	Population (Eurostat)				Sample (Survey)				Weights (population/sample)		
	10-49	50-249	>250	Totale	10-49	50-249	>250	Totale	10-49	50-249	>250
Basic pharmaceutical products and pharmaceutical preparations	0.00054	0.00056	0.00028	0.00138	0.00156	0.00156	0.00000	0.00313	0.34550	0.35721	0.00000
Computer, electronic and optical products	0.00583	0.00134	0.00023	0.00740	0.01094	0.00000	0.00313	0.01406	0.53331	0.00000	0.07320
Chemicals and chemical products	0.00597	0.00168	0.00031	0.00796	0.00625	0.00156	0.00156	0.00938	0.95452	1.07750	0.19618
Electrical equipment	0.01071	0.00190	0.00035	0.01296	0.01875	0.00469	0.00000	0.02344	0.57096	0.40601	0.00000
Machinery and equipment n.e.c.	0.03372	0.00622	0.00093	0.04087	0.06094	0.00781	0.00000	0.06875	0.55339	0.79641	0.00000
Motor vehicles, trailers and semi-trailers	0.00358	0.00111	0.00043	0.00512	0.00156	0.00000	0.00000	0.00156	2.29262	0.00000	0.00000
Other transport equipment	0.00286	0.00064	0.00020	0.00370	0.00156	0.00156	0.00156	0.00469	1.83292	0.40699	0.12883
Coke and refined petroleum products	0.00034	0.00000	0.00007	0.00041	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Rubber and plastic products	0.01512	0.00274	0.00032	0.01819	0.01875	0.00313	0.00000	0.02188	0.80666	0.87840	0.00000
Other non-metallic mineral products	0.01692	0.00205	0.00037	0.01933	0.00625	0.00000	0.00000	0.00625	2.70693	0.00000	0.00000
Basic metals	0.00551	0.00158	0.00031	0.00740	0.01875	0.00313	0.00313	0.02500	0.29377	0.50508	0.09955
Fabricated metal products, except machinery and equipment	0.05715	0.00592	0.00040	0.06347	0.08281	0.01406	0.00156	0.09844	0.69007	0.42131	0.25766
Repair and installation of machinery and equipment	0.01446	0.00111	0.00009	0.01566	0.00313	0.00000	0.00000	0.00313	4.62622	0.00000	0.00000
Food products	0.02734	0.00302	0.00047	0.03083	0.01250	0.00313	0.00000	0.01563	2.18721	0.96770	0.00000
Beverages	0.00233	0.00034	0.00008	0.00275	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Tobacco products	0.00000	0.00001	0.00001	0.00002	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Textiles	0.01215	0.00183	0.00024	0.01422	0.01875	0.00469	0.00156	0.02500	0.64782	0.39137	0.15518
Wearing apparel	0.02122	0.00157	0.00025	0.02304	0.00313	0.00000	0.00000	0.00313	6.79001	0.00000	0.00000
Leather and related products	0.01470	0.00131	0.00011	0.01612	0.00469	0.00000	0.00000	0.00469	3.13588	0.00000	0.00000

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continued TABLE A3

	Population (Eurostat)				Sample (Survey)				Weights (population/sample)		
	10-49	50-249	>250	Totale	10-49	50-249	>250	Totale	10-49	50-249	>250
Wood and of products of wood and cork, except furniture	0.01223	0.00000	0.00000	0.01224	0.01406	0.00156	0.00000	0.01563	0.86994	0.00293	0.00000
Paper and paper products	0.00560	0.00105	0.00012	0.00678	0.00469	0.00000	0.00000	0.00469	1.19560	0.00000	0.00000
Printing and reproduction of recorded media	0.00981	0.00074	0.00007	0.01062	0.01563	0.00313	0.00000	0.01875	0.62805	0.23570	0.00000
Furniture	0.01530	0.00186	0.00015	0.01731	0.00313	0.00000	0.00000	0.00313	4.89560	0.00000	0.00000
Other manufacturing	0.00793	0.00092	0.00011	0.00897	0.00156	0.00156	0.00000	0.00313	5.07713	0.58853	0.00000
Total	0.30133	0.03952	0.00591	0.34676	0.30938	0.05156	0.01250	0.37344			

Source: Author's calculation from EUROSTAT and ASSOLOMBARDA, Benchmark Survey dataset.

BIBLIOGRAPHY

Al-Haschimi A. - Skudelny F. - Vaccarino E. - Wörz J. (2015), «The Trade and Demand Nexus: Do Global Value Chains Matter?», European Central Bank, *Comp Net Discussion Paper*.

Altomonte C. - Aquilante T. - Ottaviano G.I.P. (2012), «The Triggers of Competitiveness: The EFIGE Cross-Country Report», Bruegel, *Blueprints Series*, 17(738), pp. 1-67.

Altomonte C. - Békés G. (2016), «Measuring Competitiveness in Europe: Resource, Allocation», *Granularity and Trade*, Bruegel, *Blueprint*, 24.

Amador J. - di Mauro F. (2015), «The Age of Global Value Chains: Maps and Policy Issues», *VoxEU eBook*, Centre for Economic Policy Research, available at *http://www.voxeu.org/sites/default/files/GVCsebook.pdf.*

Antras P. - Helpman E. (2004), «Global Sourcing», *Journal of Political Economy*, 112, issue 3, pp. 552-580.

Constantinescu C. - Mattoo A. - Ruta M. (2015), «The Global Trade Slowdown: Cyclical or Structural?», World Bank, *Policy Research, Working Paper*, WPS 7158.

Frankel J.A. - Romer D.H. (1999), «Does Trade Cause Growth?», *American Economic Review*, 89(3), pp. 379-399.

Helpman E. - Marc J. - Melitz M.J. - Yeaple S.R. (2004), «Export Versus FDI with Heterogeneous Firms», *American Economic Review*, 94(1), pp. 300-316.

Koopman R. - Wang Z. - Wei S.-J. (2014), «Tracing Value-Added and Double Counting in Gross Exports», *American Economic Review*, 104(2), pp. 459-494.

Mayer T. - Ottaviano G.I.P. (2007), «The Happy Few: The Internationalisation of European Firms», Bruegel, *Blueprint*, 3.

Melitz M. (2003), «The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry. Productivity», *Econometrica,* vol. 71, no. 6.

Syverson C. (2004), «Product Substitutability and Productivity Dispersion», *Review of Economics and Statistics*, vol. 86, no. 2, pp. 534-550.

Veugelers R. (2013), «Manufacturing Europe's Future», Bruegel, *Blueprint*, 21.

Import, Export and Multinationality. Evidence from Swedish Firms

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This paper studies the role of imported inputs in explaining firms' export behaviour. Unlike most of the existing literature we are also able to control for the participation of domestic firms to multinational networks. This allows us to test to what extent the recurrent evidence that importing foster exporting activity is instead a figment of the fact that importers are also part of multinational groups. Our evidence, based on Swedish manufacturing firms, suggests that imported inputs, rather than multinationality, are a key determinant of firms' export propensity and product scope. This result is particularly strong for SMEs, and it is driven by imported intermediates and (to a lesser extent) capital goods.
[JEL Classification: F14; F23; O52].

Keywords: importing; exporting; multinational enterprises; Sweden.

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1. - Introduction

Explaining firms' exporting behaviour has been at the forefront of research in applied international trade for the last two decades. The availability of large scale firm (and establishment) level data has allowed researchers to uncover interesting facts about exporters. Earlier studies have focused on explaining why some firms export, and highlighted a number of firm characteristics that make exporting more likely. Among others, firm size, innovation and productivity stood out as the key factors explaining the probability to export.[1] Subsequent works have highlighted that export does not occur in isolation, and firms are often involved in different modes of internationalisation. In particular, importing and exporting activities tend to occur in the same firms, which have been often labelled as two-way traders[2]. More recent studies have investigated the links between importing and exporting activities, showing that imported inputs can be an important determinant of future exporting activities[3]. Evidence in this direction have been provided for countries as diverse as France (Bas and Strauss-Kahn, 2013); Italy (Lo Turco and Maggioni, 2013); Slovenia (Damijan and Kostevc, 2015); and a sample of firms from 27 Central and Eastern European countries (Aristei *et* al., 2013).

The relationship between importing and exporting activities has been explained by the fact that importing allows firms to access a larger set of intermediate inputs, which enable them to increase efficiency, upgrade technologies and introduce product innovation (Broda and Weinstein, 2006; Goldberg *et* al., 2010; Colantone and Crinò, 2014; Halpern, Koren and Szeil, 2015; Lo Turco and Maggioni, 2015), and eventually export (Kugler and Verhoogen, 2009; Bustos, 2011).

Other studies have moved to assess the impact of importing not only on the probability or the volume of exports, but also on the geographic and product scope of exporting activities. The underlying idea of these studies is that by allowing to introduce new and improved products, imported intermediate inputs may boost the degree of innovation in export destinations and exported products. This is consistent with the idea that firms prepare to export, initially by improving products which are destined for the export market (Costantini and Melitz, 2007;

[1] See the reviews of empirical evidence offered, for example, in Wagner J. (2006) and Bernard *et* al. (2012).

[2] Among others, see Muuls M. and Pisu M. (2009) for Belgium; Castellani D., Serti F. and Tomasi C. (2010) for Italy; and Vogel A. and Wagner J. (2010) for Germany. Wagner J. (2012 and 2016) offer a comprehensive review of the literature.

[3] The evidence on the relationship between exporting and importing activities seems less compelling (Damjian J.P. and Kostevc Č., 2015; Aristei D., Castellani D. and Franco C., 2013).

Iacovone and Javorcik, 2012). In this line of investigation, there is evidence that importing inputs contributes to increase the scope in exported varieties (Bas and Strauss-Khan, 2013; Damijan *et* al., 2014).[4]

This paper contributes to this fast-growing literature by focussing on the role of imported inputs in explaining the probability of firms' entry into the export market, as well as the scope of their exported products. Unlike most of existing literature we are able to control for the participation of domestic firms to multinational networks. By becoming part of a multinational firm, either by acquisition of foreign or domestic MNE, or by establishing its own network of affiliates abroad, a firm gains access to a variety of sources of imported inputs. So this boils down the question of whether the importance of flows of imported inputs found in previous studies is instead a figment of the fact that importing firms are part of MNEs. If this were the case, multinationality, rather than importing, would be the key factor explaining export performances. By linking foreign transaction level data with business register information on whether companies are independent or rather they are part of a group (controlled by a non-MNE, a domestic MNE or a foreign MNE) we are able to provide a richer interpretation into the role of imported inputs for firms' export performance.

We rely on data from the population of Swedish manufacturing firms with more than 5 employees over the 2001-2012 period. Information from four different sources have been combined. First, transaction-level data on import and export flows at a very disaggregated level (CN8 and country of source/destination) have been used to measure the export and import status of the firms, as well as the number of imported and exported products at the level of the firm, as well as the number of source countries for imports and destination countries for export. Second, for each firm, administrative data on number of employees, value added and physical capital, have been used to compute measures of firm size, labour productivity and investments intensity. Third, each firm could be matched with the register of business groups in Sweden, providing indication of whether the firm is either independent or part of a group, and in this case, whether the group owns affiliates abroad, and whether the ultimate owner is a Swedish or non-Swedish based company. Fourth, we were able to link patents applications filed by inventors employed in our sample firms, thus allowing us to build a proxy for

[4] Varieties are usually defined as the products sold to (or sourced from) a specific market. The scope of export varieties can increase both by selling a new product to the same (or different) markets, and by selling the same products in different markets.

the patenting activity of the firms. Each piece of information is available yearly for the period 2001-2012.

The results of our empirical analysis show that, even after controlling for multinational status, imported inputs (especially intermediate inputs) represent a very important factor able to boost Swedish firms' export participation and export scope. More specifically we find that it is the actual number of imported inputs and the geographical reach of imports that matters, rather than the simple fact of being an importer. The number and geographical reach of imported inputs is especially effective in increasing the export participation of small and medium enterprises (SMEs). Moreover, importing more products increases the export scope of both SMEs and large firms.

The effect of multinationality is instead less clear cut. Being part of a MNE does not increase firms' export participation, and actually Swedish SMEs which are acquired by a foreign MNE are less likely to enter the export market. Multinationality instead is still a positive factor able to increase firms' export scope, but only for large firms.

The paper is organised as follows. Section 2 lays out the empirical strategy, Section 3 illustrate the sources of data and provide some descriptive statistics, Section 4 discusses the results. Section 5 concludes.

2. - The Empirical Strategy

Our empirical analysis seeks to identify the role of different determinants of the decision to export, as well as the decision to increase the firm portfolio of exported products (*i.e.* the export scope). Besides the usual determinants that are able to explain export participation, such as productivity, firm size and innovative activity, we are especially interested in the role of imported inputs and multinationality. In particular, we want to clearly distinguish the individual effect of each of these two last factors, as the two are intrinsically interrelated, but both are likely to have an important effect on the ability of firms to sell their products abroad.

2.1 *The Decision to Export*

We start by estimating a simple logit model to explain the decision to export of firms:

$$(1a) \qquad X_{it} = \alpha_0 + \alpha_1 M_{it-1} + \alpha_2 M^{p}_{it-1} + \alpha_3 M^{c}_{it-1} + \alpha'_4 \mathbf{D}_{it-1} + \beta' \mathbf{Z}_{it-1} + \lambda_t + u_{it}$$

$$(1b) \qquad X_{it} = \alpha_0 + \alpha_1 M_{it-1} + \alpha_2 M^{p}_{it-1} + \alpha_3 M^{c}_{it-1} + \alpha'_4 \boldsymbol{D}_{it-1} + \beta' Z_{it-1} + \eta_i + \lambda_t + u_{it}$$

Where X is dummy variable taking value equal to 1 if firm i was an exporter in year t. We lag all the explanatory variables by one year to decrease problems related with simultaneity bias. As explained above, we are interested in the contribution of imported inputs on the decision of firms to export. We explore three mechanisms through which imports might influence export participation: the simple fact of importing, the overall number of different imported products and the geographical reach of foreign suppliers from which firms source foreign inputs. Accordingly in equation *(1a)* and *(1b)* M is a dummy variable taking value equal to 1 if firm i was an importer in the year t-1, while $,M^{p}_{it-1}$ measures the total number of different products exported by firm i in year $t-1$ and M^{c}_{it-1} indicates the total number of countries from which firm i sourced its foreign inputs. The other variables of interest are included in the vector of dummy variables defining the ownership structure of each firm, $\boldsymbol{D}_{it-1}$. We have four dummy variables that take value 1 if a firm is part of a Swedish group, of a Swedish multinational enterprise, or is a Swedish affiliated to a foreign-owned multinational, respectively. The baseline category is defined by firms that are independent Swedish-owned firms.

The propensity to export is likely to depend also on other firm-specific factors that have to do with its innovative capabilities, as well as its size and relative efficiency. The vector $\boldsymbol{Z}$ includes such usual set of control variables that are associated with export performance, including innovation activities implemented by each firm, labour productivity, size and investment intensity. The indexes η_i and λ_t denote respectively firm and year fixed effects, while u_{it} indicates the usual idiosyncratic error term.

The inclusion of fixed effects in our specification allows to control for the time-invariant firm heterogeneity that might be correlated both with export participation and with our variables of interest. However, we are interested in estimating the model both with *(1b)* and without firm fixed effects *(1a)*. This will allow us to investigate both the extent of the cross-sectional correlation, as well as to provide a more causal interpretation. Indeed, the interpretation of the coefficients of our main variables of interest changes when we introduce firms fixed effects. In the pooled cross-section specification we are able to assess whether being an importer (*M*) is generally associated with a higher propensity to export, while in the fixed effect specification we can check whether starting to import

has an impact on the decision to export. At the same time the coefficients of the variables that measure the total number of products imported (M^{p}_{it-1}) and the total number of foreign markets from which firm source their imports (M^{c}_{it-1}) have different interpretations according to the inclusion or not of firms' fixed effects. Without fixed effects we will know whether there is a positive correlation between the breadth of import activities (both in terms of product scope and geographical reach) and exporting. In the specification with fixed effects instead we check whether a marginal increase of these two variables has any effect on the probability to start exporting. Finally, also for the multinational status the interpretation differs, while without fixed effects we will just understand whether Swedish or foreign MNEs are more likely to be exporting, with fixed effects we will control whether becoming a MNE (either by acquisition or by expansion) increases the probability to start exporting.

2.2 *The Export Scope*

We are also interested in understanding what drives the broadening of the portfolio of products exported by an individual firm. For this reason, we examine the determinants of the export scope of exporting firms. Our dependent variable is the number of different 8-digits products exported by each firm in a specific year. Since this is a count variable with high over dispersion, we adopt a negative binomial regression method with fixed effects, as this estimator is particularly well suited for over-dispersed dependent variables.[5] Following the previous specification of equation *(1)* we estimate the following negative binomial model:

$$(2) \quad E\left(X^{p}_{it}\cdot\right)_{it} = exp\begin{pmatrix}\alpha_0 + \alpha_1 M_{it-1} + \alpha_2 M^{p}_{it-1} + \alpha_3 M^{c}_{it-1} + \alpha'_4 \boldsymbol{D_{it-1}} + \beta' \boldsymbol{Z}_{it-1} \\ +\eta_i + \lambda_t + u_{it}\end{pmatrix}$$

As in the previous specification all the explanatory variables are lagged by one year to alleviate problems associated with simultaneity bias. We adopt the same set of independent variables of equation *(1)*, but in this case our main interest is in understanding whether imports and multinationality have a specific impact

[5] We prefer the negative binomial estimator to the Poisson estimator, since the latter suffers from excess zero problems and in our sample, which includes also firms who enter and exit from export, the number of zeros is non negligible. Moreover the Poisson estimator is less suited for variables with high over dispersion (Cameron A.C. and Trivedi P.K., 2005).

on the ability of firms to increase the number of different exported products. Since in this case we control for firm fixed effects η_i the model allows us to identify whether the increase of the number of different imported products or of the number of import source markets also has an effect on the number of different products exported. Also in this case the interpretation of the coefficients for the MNE indicates whether becoming a MNE increases or decreases the product scope of exported outputs.

3. - Data and Descriptive Statistics

We use data provided by Sweden Statistics (SCB), combining information on international trade activities of Swedish firms, as well as business and ownership structure and balance sheets data. Linking different data sources on the universe of Swedish firms allows us to introduce a major innovation with respect to existing studies, as it is hardly the case that researchers can have access to such a rich set of information for large samples of firms and over a long period of time.

More specifically, the trade data provides product detailed information at the 8-digit CN8 level, which allows to measure the total number of different products exported or imported by each firm and destination/source country yearly. As recently showed by Van Beveren *et* al. (2012) the CN8 classification suffers from problems of time-inconsistency because of the frequent waves of product reclassification along the years. A typical outcome of these changes in the classification of each product is that the same specific product might enter a new category from one year to another simply because of a new classification, or two products can be aggregated to a unique category: this can sometimes drastically change the product portfolio of exporters (and importers), by arbitrarily increasing or decreasing the number of products exported according to the CN8 classification. In order to account for this we follow the procedure suggested by Van Beveren *et* al. (2012), which allows to obtain harmonized CN8 classifications for any specific time period considered, in order to make sure that the increase/decrease of exported products is not an artifact of changing classifications.[6]

[6] The algorithm created by Van Beveren I. *et* al. (2012) is such that if in a specific year t the homogeneous category of products *x* is divided in two different categories *y* and *z*, it creates an artificial category *x** which includes all three products (*x*, *y* and *z*) for all the years of the sample. If instead in year *t* a product *j* is included inside the category of products *k*, the algorithm creates a new category *k** which always includes *j* and *k* products for all the period considered. A typical outcome of this procedure is the reduction of the overall number of product categories.

Data on ownership structure instead allow us to distinguish firms into independent firms, firms that are part of Swedish groups without foreign subsidiaries, Swedish Multinational Enterprises (Swedish firms with foreign subsidiaries) and Foreign Multinationals Enterprises (foreign companies with Swedish subsidiaries). We are also able to associate patent information for each firm through the use of a specific dataset created by Jung and Ejermo (2014) which informs us whether any of the employees of a firm was listed as an inventor in the patents applied for at the European Patent Office in any year of the time period considered.

Finally, linking data from the business register, allows us to include an additional set of controls, which include labour productivity (measured as the log of value added per employee), the (log of the) number of employees and (the log of) total investments in physical capital.

We restrict our analysis to manufacturing firms, in order to focus on firms that are actively engaged in the production of goods and value added, and not only in trading. We want also to exclude micro firms and self-employment cases, so we only include firms with a median of at least 5 employees in the years included in our sample. This leaves us with 14,042 firms and 118,096 observations for which we have information on trade activities, multinational status, innovation activities and balance sheet data. Considering that our data covers the period 2001-2012 (12 years) we have an average of almost 10,000 firms per year. According to Eurostat data in the period 2001-2012 in Sweden on average there were 12,000 active enterprises with more than 4 employees. This indicates that the firm data used in our analyses covers more than 80% of the corresponding population of Swedish manufacturing firms with more than 5 employees.

Table 1

VARIABLES DESCRIPTION

Variables	Description
Dependent variable	
X (dummy)	= 1 if the firm is an exporter at time t
X^p	sum of the different types of products (CN8 8-digits) exported in year t^*
Independent variables	
Importing and exporting activities	
M (dummy)	= 1 if the firm is an importer at time t
ln(M^p)	log of the sum of the different types of products imported in year t^*
ln(M^p_intermediates)	log of the sum of the different types of intermediate goods imported in year t^*
ln(M^p_consumption)	log of the sum of the different types of consumption goods imported in year t^*
ln(M^p_capital)	log of the sum of the different types of capital goods imported in year t^*
ln(M^c)	log of the sum of all the countries from which a firm imports its products in year t^*
Ownership type	
Independent firm (dummy)	= 1 for a firm not belonging to a group
Swedish group (dummy)	= 1 for a firm belonging to a Swedish group
Swedish MNE (dummy)	= 1 for a firm belonging to a Swedish group with foreign subsidiaries
foreign MNE (dummy)	= 1 for a firm belonging to a foreign group with Swedish subsidiaries
Firm-level controls	
Patents (dummy)	= 1 for a firm having at least one employee who patented in year t
ln(Productivity)	log of labor productivity (value added over number of employees)
ln(Employment)	log of the number of employees
ln(Investments)	log of the level of investments in machinery and equipment*

Source: authors' own calculation on the basis of micro-data provided by Swedish Statistics.
* to avoid the log of zero, we add 1 before taking the ln.

Table (2) shows some of the general features of the firms in our sample: we notice that slightly more than half of the observations include exporting firms, while the average number of different exported products is around 6. Roughly half of the observations involves firms which also import, showing that in the overall sample exporting is lightly more common that importing. The average number of typologies of imported products is 7.9, slightly higher than the number of different exported products. When we distinguish imported inputs on the basis of the Broad Economic Categories classification we find that intermediates are the most common type of imported products, with an average of 5.4 products, while the average for consumption and capital goods is only slightly higher than 1.

TABLE 2

DESCRIPTIVE STATISTICS

Variables	Mean	Sd	Min	Max
X	0.567	0.496	0	1
X^p	5.947	18.465	0	599
M	0.500	0.500	0	1
M^p	7.915	23.134	0	700
M^p_intermediates	5.472	16.080	0	479
M^p_consumption	1.202	5.051	0	194
M^p_capital	1.233	4.717	0	166
M^c	3.142	5.992	0	134
Independent firm	0.465	0.499	0	1
Swedish group	0.304	0.460	0	1
Swedish MNE	0.129	0.335	0	1
Foreign MNE	0.102	0.302	0	1
Patents(dummy)	0.024	0.153	0	1
ln(Productivity)	13.101	0.528	2.639	20.036
ln(Employment)	2.763	1.198	0	10.057
ln(Investments)	13.635	2.934	0	23.658
Observations	118,096			

Source: authors' own calculation on the basis of micro-data provided by Swedish Statistics.

Independent firms are the most common type of firms, accounting for 46% of the overall observations, followed by firms belonging to Swedish groups (30%). Respectively 13% and 10% of the observations refer to Swedish and Foreign MNE. In about 2% of the observations firms apply for a patent, suggesting that this is a relatively rare event when one considers the whole of manufacturing sectors.

4. - Econometric Analysis

Export participation

Table (3) presents the results of the estimation of equation *(1a)*, without firms' fixed effects. The estimator used is a logit, and in all the specifications we include 2-digit industry dummies to account for possible differences in the sectoral propensity to export. In column (1) we introduce the importer dummy (*M*) to control whether firms imported in time *t*-1, controlling also for multinational status, innovation activity, size, productivity and level of investments. The coefficient of import activity is positive and strongly significant, showing that there is a general positive correlation between being an exporter and being an importer. Also, the coefficients that describe the ownership structure of the firms are positive

and significant, showing that with respect to independent ones, firms belonging to a Swedish group, Swedish MNE and Foreign MNE are more likely to export, relatively to Swedish-owned independent firms. Concerning the other coefficients included in our specification, the positive sign associated with the patent dummy indicates that firms with formalized innovative activities are also more likely to export, in line with most of the results in the existing literature (Roper and Love, 2002; Cassiman and Golovko, 2011). Also export participation is positively associated with higher productivity (Wagner, 2007; Greenaway and Kneller, 2007) as well as firm size and levels of investments. In columns (2) and (3) we further distinguish the import activities by adding a measure of the number of different imported products (M^{p}_{it-1}) and then introducing also the number of countries from which imports are sourced (M^{c}_{it-1}). In column (2) we find that the number of different typologies of imported products is positive and significant and its inclusion substantially reduces the size of the import dummy coefficient, showing that, even conditional on size and productivity, the actual number of different imported products has more explanatory power than the simple fact of being an importer. Also, the number of countries from which a firm imports is associated with substantially higher probability to export, and this effect is even stronger in magnitude than the total number of different imported inputs.

In columns (4) and (5) we distinguish between small and medium enterprises[7] (SMEs) and large firms. The results show that most of our findings are driven by SMEs. For large firms, only the number of different imported inputs and the number of different geographical sources matter, while multinational status is not relevant, as well as many of the other control variables. This is to say that, among large firms, those that are part of multinational groups are not more likely to be exporters, while this seems to make a big difference for SMEs.

The results of Table (3) show that when we do not control for firms' fixed effects, both importing activities and multinational status positively influence the ability of firms to export. In particular, the total number of different imported inputs and the geographical reach of foreign suppliers increase the probability to

[7] We define small and medium enterprises as those firms that during the period considered have a median number of employees lower or equal to 50. While this classification differs from the usual categorizations used in the existing literature, it seems better suited for our specific dataset, which covers more than 10 years. Indeed in such a long period firms might substantially change their size and hence risk being classified sometimes as small, medium or large according to the specific year considered. Using the median number of employees over time allows us to attribute each firm to only one size category in our data.

export. These results however only hold for small and medium sized firms, while for large firms we find that only the total number of imported inputs and the number of different countries matter.

TABLE 3

PROBABILITY TO EXPORT – CROSS-SECTIONAL ESTIMATES

Variables	(1) *all firms*	(2) *all firms*	(3) *all firms*	(4) *SME's*	(5) *large firms*
M_{it-1} (dummy)	1.939***	0.604***	0.323***	0.386***	-0.327**
	(0.030)	(0.048)	(0.051)	(0.056)	0.160)
$\ln(M^p)_{it-1}$		0.969***	0.530***	0.504***	0.753***
		(0.037)	(0.051)	(0.054)	(0.124)
$\ln(M^c)_{it-1}$			0.819***	0.788***	1.082***
			(0.068)	(0.074)	(0.159)
Ownership type					
Reference: independ. firms					
Swedish group$_{it-1}$	0.201***	0.197***	0.194***	0.186***	-0.257
	(0.036)	(0.036)	(0.036)	(0.037)	(0.216)
Swedish MNE$_{it-1}$	0.676***	0.496***	0.456***	0.440***	0.359
	(0.061)	(0.064)	(0.065)	(0.071)	(0.241)
Foreign MNE$_{it-1}$	0.677***	0.294***	0.260***	0.233***	0.243
	(0.074)	(0.080)	(0.081)	(0.089)	(0.260)
Patents$_{it-1}$ (dummy)	1.026***	0.819***	0.772***	0.804***	0.596
	(0.144)	(0.154)	(0.158)	(0.175)	(0.374)
ln(Productivity)$_{it-1}$	0.224***	0.165***	0.150***	0.156***	0.067
	(0.027)	(0.028)	(0.028)	(0.029)	(0.105)
ln(Employment)$_{it-1}$	0.489***	0.378***	0.362***	0.461***	-0.150**
	(0.022)	(0.023)	(0.023)	(0.026)	(0.069)
ln(Investments)$_{it-1}$	0.086***	0.084***	0.083***	0.079***	0.128***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.019)
Constant	-5.448***	-4.323***	-4.063***	-4.300***	-1.419
	(0.417)	(0.420)	(0.419)	(0.441)	(1.568)
2-digit industry dummies	yes	yes	yes	yes	yes
year dummies	yes	yes	yes	yes	yes
Observations	118,096	118,096	118,096	100,159	17,723
Log-likelihood	-53838	-52136	-51902	-48933	-2601
Pseudo *R*-squared	0.334	0.355	0.358	0.295	0.479
Total number of firms	14,042	14,042	14,042	12,052	1,965

Source: authors' own calculation on the basis of micro-data provided by Swedish Statistics.
The dependent variable is the probability that a firm exports in time *t*. Logit estimators are implemented in all models. Firm-level clustered standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 4

PROBABILITY TO EXPORT – FIXED EFFECTS ESTIMATES

Variables	(1) *all firms*	(2) *all firms*	(3) *all firms*	(4) *SME's*	(5) *large firms*
M_{it-1} (dummy)	0.468***	-0.014	-0.144**	-0.169**	-0.072
	(0.035)	(0.054)	(0.063)	(0.067)	(0.217)
$\ln(M^p)_{it-1}$		0.479***	0.341***	0.342***	0.287
		(0.041)	(0.054)	(0.057)	(0.183)
$\ln(M^c)_{it-1}$			0.323***	0.356***	0.238
			(0.082)	(0.088)	(0.246)
Ownership type					
Reference: independ. firms					
Swedish group$_{it-1}$	0.038	0.038	0.038	0.036	-0.125
	(0.053)	(0.053)	(0.053)	(0.054)	(0.298)
Swedish MNE_{it-1}	-0.046	-0.084	-0.085	-0.045	-0.349
	(0.104)	(0.104)	(0.105)	(0.112)	(0.356)
Foreign MNE_{it-1}	-0.204	-0.286**	-0.270**	-0.342**	0.130
	(0.129)	(0.131)	(0.131)	(0.140)	(0.429)
Patents$_{it-1}$ (dummy)	0.223	0.188	0.179	0.187	0.257
	(0.193)	(0.195)	(0.196)	(0.215)	(0.490)
ln(Productivity)$_{it-1}$	0.273***	0.257***	0.255***	0.249***	0.215
	(0.034)	(0.034)	(0.034)	(0.035)	(0.140)
ln(Employment)$_{it-1}$	0.784***	0.722***	0.711***	0.725***	0.492***
	(0.033)	(0.033)	(0.034)	(0.035)	(0.129)
ln(Investments)$_{it-1}$	0.073***	0.071***	0.070***	0.063***	0.213***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.047)
firm fixed effects	yes	yes	yes	yes	yes
year dummies	yes	yes	yes	yes	yes
Observations	41,839	41,839	41,839	39,448	2,391
Log-likelihood	-15647	-15578	-15570	-14767	-779.8
Pseudo *R*-squared	0.0510	0.0552	0.0557	0.0520	0.144
Total number of firms	4,465	4,465	4,465	4,208	257

Source: authors' own calculation on the basis of micro-data provided by Swedish Statistics.
The dependent variable is the probability that a firm exports in time *t*. Logit estimators with fixed effects are implemented in all models. Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

In Table (4) we estimate equation *(1b)* with a logit estimator with fixed effects. When we include the firms' fixed effects in the estimation of equation *(1b)*, using a logit estimator, we restrict our sample to the firms that during the period considered changed their export status at least once. This means that we exclude both domestic firms that never exported and persistent exporters who exported in all the years of our data: this leaves us with 4,465 firms and 41,839 observations. The reduction of the number of firms affects especially large firms, since many of these firms are persistent exporters who always export.

In column (1) we find that the import dummy *M* is still positive and significant, showing that starting to import also has a positive effect on the decision to start exporting (in the following year). On the contrary, the coefficients associated with the ownership structure of the companies are no longer statistically different from zero. In other words, becoming part of a Swedish group or of a Swedish MNE or a foreign MNE does not increase the probability of a firm to start exporting. Interestingly, also patenting activity does not have any impact on the propensity of firms to start exporting, differently from the results of Table (4) and from most of the existing literature on the relationship between innovation and export. This can be partly due to the fact that innovation includes a broad set of activities, of which patents represent only a limited share. However, the results suggests that, when import activities are accounted for, the individual contribution of innovation to export decreases substantially. Combined with previous cross-sectional results this suggests that innovators are generally more likely to be exporters, but innovating at time *t*-1 does not necessarily have an impact on firms' export decision in the following period. Productivity, size and investments are instead still positively associated with the decision to enter foreign markets. In columns (2) and (3) we gradually introduce the other import-related variables: the results show that both the number of different imported products and the number of countries from which the products are imported have a positive impact on the decision to export and the magnitude of their effect is roughly the same. It is worth mentioning that the import dummy turns negative, suggesting that the positive effects of importing on the probability of exporting can be appreciated only above a certain threshold of involvement in importing activities. When we control more in depth for the effect of importing, we also notice that the negative coefficient of Foreign MNE becomes significantly different from zero, showing that when a company is acquired by a foreign MNE its chances of becoming an exporter actually decrease. This suggests that firms that are acquired by foreign MNEs will experience an increase in their importing activity, thanks to the easier access to the MNEs network, which will boost exporting. However the change in ownership per se, is likely to decrease the probability of exporting, or increase the probability of exit from the export market. This result per se is a bit puzzling, but it could signal that foreign MNEs do not buy Swedish firms with the goal to serve the international market. When they acquire a firm that was already exporting, there is a good likelihood that the foreign MNEs will enforce exit from the export market, maybe in an attempt to avoid cannibalization with other products exported by the MNE worldwide.

When we distinguish between SMEs and large firms we find that the positive impact of the two different measures of import scope and geographical reach only have an effect for SMEs, while for larger firms they do not have a significant effect. We also find that the negative effect of becoming a foreign MNE is only limited to SMEs. Another relevant difference between the two groups of firms is that increases in productivity do not seem to matter for the decision to start exporting among large firms.

Summing up when we control for firms' fixed effects we are able to understand whether a change in our variables of interest have an impact on the export status. When we do that, we find that the number of different imported products and the number of countries from which imports are key determinants of the decision of firms to start exporting, and this is true almost exclusively for SMEs. For these firms, access to imported inputs is crucial for export performance.

Export scope

In Table (5) we estimate equation *(2)* which focuses on the determinants of export scope, following the same specification of equation *(1)*. It should be noted that since we estimate the model with firm fixed effects we necessarily focus only on firms that had some within-firm variation in the number of exported products. Firms that never export, or keep exporting the same number of products throughout the whole period, are excluded from the estimating sample, due to lack of within-firm variation in the dependent variable.[8] On the basis of this further restriction we will perform the analysis on 9,644 firms and 88,586 observations. As for the estimation of the probability of exporting, we gradually introduce our import measures in columns (1) to (3). Similarly to our previously reported evidence, the number of different imported products is an important determinant for export performance, and it significantly contributes to increase the export product scope of firms, in line with earlier findings in the literature (Bas and Strauss-Kahn, 2014). Also the number of country sources still has a positive effect on the increase of the export scope. Differently from the probability to export (with fixed effects) we find a positive effect of becoming a Swedish group or a Swedish MNE, while this is not the case for foreign MNE. Therefore, while be-

[8] In our sample there are no exporters that export exactly the same number of products overtime. There are instead 366 cases in which we observe exporters only for one year (either because the firm runs out of business or because we simply lack information on some relevant variables for the remaining years), also in this few cases the firms are not included in the negative binomial estimations.

coming part of a Swedish group (and MNEs in particular) does not seem to affect the probability to enter the export market, it provides a boost in the number of exported products for established exporters. Also, in line with the results on export participation, we find that innovative activities proxied by the patent dummy are not significantly related to export scope, while the coefficient of productivity is positive and significant.

TABLE 5

EXPORT SCOPE

Variables	(1) *all firms*	(2) *all firms*	(3) *all firms*	(4) *SME's*	(5) *large firms*
$M_{it\text{-}1}$ (dummy)	0.211***	-0.000	-0.033***	-0.003	-0.169***
	(0.010)	(0.012)	(0.012)	(0.014)	(0.037)
$\ln(M^p)_{it\text{-}1}$		0.186***	0.149***	0.132***	0.197***
		(0.005)	(0.007)	(0.009)	(0.011)
$\ln(M^c)_{it\text{-}1}$			0.081***	0.054***	0.135***
			(0.009)	(0.012)	(0.015)
Ownership type					
Reference: independ. firms					
Swedish group$_{it\text{-}1}$	0.031***	0.032***	0.031***	0.007	0.108***
	(0.011)	(0.011)	(0.011)	(0.012)	(0.027)
Swedish $MNE_{it\text{-}1}$	0.050***	0.036***	0.032**	0.020	0.122***
	(0.013)	(0.013)	(0.013)	(0.016)	(0.025)
Foreign $MNE_{it\text{-}1}$	0.013	-0.017	-0.019	-0.031	0.082***
	(0.014)	(0.014)	(0.014)	(0.020)	(0.025)
Patents$_{it\text{-}1}$ (dummy)	0.019*	0.003	0.003	0.013	0.007
	(0.010)	(0.010)	(0.010)	(0.021)	(0.011)
ln(Productivity)$_{it\text{-}1}$	0.083***	0.070***	0.067***	0.082***	0.043***
	(0.006)	(0.006)	(0.006)	(0.008)	(0.009)
ln(Employment)$_{it\text{-}1}$	0.248***	0.187***	0.179***	0.314***	0.091***
	(0.006)	(0.006)	(0.006)	(0.009)	(0.009)
ln(Investments)$_{it\text{-}1}$	0.025***	0.023***	0.023***	0.018***	0.029***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Constant	-0.423***	-0.174**	-0.134	-0.451***	0.088
	(0.088)	(0.085)	(0.085)	(0.113)	(0.146)
firm fixed effects	yes	yes	yes	yes	yes
year dummies	yes	yes	yes	yes	yes
Observations	88,586	88,586	88,586	71,257	17,329
Log-likelihood	-149492	-148878	-148838	-104477	-44058
Number of firms	9,644	9,644	9,644	7,798	1,846

Source: authors' own calculation on the basis of micro-data provided by Swedish Statistics.
The dependent variable is the number of different products exported by a firm in time *t*. Negative binomial estimators with fixed effects are implemented in all models. Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

When we distinguish between SMEs and large firms we find no substantial differences in the impact of the total number of imported products and the number of country sources: both matter for the increase of export scope. Instead we find that large Swedish firms that either become multinational by establishing subsidiaries abroad, or being acquired by foreign MNE exhibit an increase in the export scope. On the contrary, for SMEs becoming part of a Swedish group or any type of MNE does not have a substantial effect on their export scope.

4.1 *Robustness Check: Importing Intermediates, Capital Goods or Final Goods*

So far we have only distinguished the impact of imports by differentiating between importing per se, the import scope of firms, and the total number of country sources. However, a further important distinction concerns the type of imported products. The impact of importing activities might differ according to whether firms import intermediate goods, capital goods or final goods, since each of these goods impacts differently on the production function of the importers. For these reasons in Table (6) we calculate the number of different imported inputs that pertain to the category of respectively intermediate goods, capital goods and final goods, according to the Classification by Broad Economic Categories (Rev. 4).

We report the results obtained using all the three specifications used so far. In columns (1) to (3) we show that the probability to export (without including firms' fixed effects) is positively correlated with intermediate inputs and capital goods with a rather similar magnitude. On the contrary final goods do not show any significant correlation with the probability of being an exporter. When we distinguish between SMEs and large firms we find that capital goods are only important for the former. The same results hold also when we include firms' fixed effects in columns from (4) to (6): the only difference is that now the coefficient of intermediate goods is twice the size of the capital goods.

In columns (7) to (9) we analyze the impact of the different types of imports on the export scope. Also in this case we find that intermediate goods always display the larger coefficient, the main difference being the fact that for large firms also importing consumer goods benefits their ability to increase their export scope.

TABLE 6

IMPORTS BY BROAD ECONOMIC CATEGORY

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Probability to export (cross section)			*Probability to export (fixed effects)*			*Export scope (fixed effects)*		
VARIABLES	*all firms*	*SME's*	*large firms*	*all firms*	*SME's*	*large firms*	*all firms*	*SME's*	*large firms*
M_{it-1}(dummy)	0.464***	0.515***	-0.113	-0.069	-0.094	-0.009	0.020	0.041***	-0.098***
	(0.051)	(0.056)	(0.162)	(0.063)	(0.067)	(0.220)	(0.012)	(0.013)	(0.037)
$\ln(M^p\_\text{intermediates})_{it-1}$	0.427***	0.395***	0.652***	0.321***	0.300***	0.533***	0.116***	0.108***	0.153***
	(0.043)	(0.046)	(0.110)	(0.046)	(0.048)	(0.162)	(0.006)	(0.008)	(0.011)
$\ln(M^p\_\text{consumption})_{it-1}$	-0.001	-0.013	0.226**	-0.050	-0.030	-0.141	0.031***	0.010	0.056***
	(0.044)	(0.048)	(0.115)	(0.055)	(0.059)	(0.156)	(0.005)	(0.008)	(0.008)
$\ln(M^p\_\text{capital})_{it-1}$	0.440***	0.486***	0.083	0.159***	0.169***	0.062	0.040***	0.067***	0.013*
	(0.048)	(0.052)	(0.113)	(0.053)	(0.056)	(0.164)	(0.005)	(0.007)	(0.008)
$\ln(M^c)_{it-1}$	0.830***	0.801***	1.095***	0.335***	0.379***	0.069	0.082***	0.050***	0.141***
	(0.068)	(0.075)	(0.154)	(0.080)	(0.086)	(0.239)	(0.009)	(0.011)	(0.015)
Ownership type (reference: independ. firms)									
Swedish group_{it-1}	0.193***	0.185***	-0.277	0.038	0.036	-0.131	0.032***	0.006	0.110***
	(0.036)	(0.037)	(0.214)	(0.053)	(0.054)	(0.299)	(0.011)	(0.012)	(0.027)
Swedish MNE_{it-1}	0.445***	0.427***	0.363	-0.086	-0.048	-0.332	0.032**	0.019	0.121***
	(0.065)	(0.071)	(0.240)	(0.105)	(0.112)	(0.357)	(0.013)	(0.016)	(0.025)
Foreign MNE_{it-1}	0.250***	0.223**	0.241	-0.269**	-0.338**	0.084	-0.021	-0.038*	0.081***
	(0.081)	(0.089)	(0.260)	(0.131)	(0.140)	(0.430)	(0.014)	(0.020)	(0.025)
Patents_{it-1} (dummy)	0.745***	0.787***	0.578	0.169	0.180	0.255	0.000	0.012	0.006
	(0.161)	(0.177)	(0.368)	(0.196)	(0.215)	(0.498)	(0.010)	(0.021)	(0.011)
$\ln(\text{Productivity})_{it-1}$	0.150***	0.157***	0.073	0.254***	0.248***	0.224	0.066***	0.081***	0.042***
	(0.028)	(0.029)	(0.105)	(0.034)	(0.035)	(0.143)	(0.006)	(0.008)	(0.009)
$\ln(\text{Employment})_{it-1}$	0.357***	0.458***	-0.148**	0.710***	0.724***	0.490***	0.176***	0.310***	0.089***
	(0.023)	(0.026)	(0.069)	(0.034)	(0.035)	(0.129)	(0.006)	(0.009)	(0.009)
$\ln(\text{Investments})_{it-1}$	0.082***	0.078***	0.127***	0.071***	0.063***	0.208***	0.023***	0.018***	0.029***
	(0.007)	(0.007)	(0.019)	(0.008)	(0.008)	(0.047)	(0.002)	(0.002)	(0.003)

./.

continued Table 6

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Probability to export (cross section)			*Probability to export (fixed effects)*			*Export scope (fixed effects)*		
VARIABLES	*all firms*	*SME's*	*large firms*	*all firms*	*SME's*	*large firms*	*all firms*	*SME's*	*large firms*
Constant	-4.052***	-4.303***	-1.497	-	-	-	-0.101	-0.430***	0.136
	(0.418)	(0.441)	(1.553)	-	-	-	(0.085)	(0.112)	(0.146)
year dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	118,096	100,159	17,723	41,839	39,448	2,391	88,586	71,257	17,329
Log-likelihood	-51792	-48822	-2593	-15559	-14760	-774.5	-148800	-104436	-44042
Pseudo *R*-squared	0.359	0.297	0.481	0.0564	0.0525	0.150			
Total number of firms	14042	12052	1965	4,465	4,208	257	9,644	7,798	1,846

Source: authors' own calculation on the basis of micro-data provided by Swedish Statistics.
The dependent variable in columns (1) to (6) is the probability that a firm exports in time *t*. The dependent variable in columns (7) to (9) is the number of different products exported by a firm in time *t*. In columns (1) to (6) logit estimators are implemented. In column (7) to (9) negative binomial estimators are implemented. In columns (1) to (3) 2-digit sector dummies are included. In columns (4) to (9) fixed effects at the firm level are included. Standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5. - Concluding Remarks

This paper contributes to a fast-growing literature focussing on the role of imported inputs in explaining firm's export behaviour. Unlike most of existing literature we are able to control for the participation of domestic firms to multinational networks. Indeed, firms that become part of a MNE gain access to a variety of sources of imported inputs, so the effect of imported inputs and of multinationality may be confounded in previous studies. By linking foreign transaction level data with business register information on whether companies are independent or rather they are part of a group, controlled by a non-MNE, a domestic MNE or a foreign MNE, we are able to provide a richer interpretation into the role of imported inputs for firms' export behaviour.

We rely on data from the population of Swedish manufacturing firms with more than 5 employees over the 2001-2012 period. The results of our empirical analysis show that, even after controlling for multinational status, imported inputs represent a very important factor able to boost Swedish firms' export participation and export scope. More specifically we find that it is the actual number of imported inputs and the geographical reach of imports that matters, rather than the simple fact of being an importer. The number and geographical reach of imported inputs is especially effective in increasing the export participation of small and medium enterprises (SMEs). Moreover, importing more products increases the export scope of both SMEs and large firms. When we break down import by category, we find that the larger effect is associated with import of intermediates and capital goods, while import of final goods usually does not affect export behavior significantly. The effect of multinationality is instead less clear cut. Being part of a MNE does not increase firms' export participation, and actually Swedish SMEs which are acquired by a foreign MNE are less likely to enter (or more likely to exit) the export market. Instead multinationality is still a positive factor able to increase firms' export scope, but only for large firms.

These findings show that since the early 2000's and up until 2012 the access to imported inputs has boosted the competitiveness of Swedish firms, especially small and medium-sized firms, helping them both to enter foreign markets and to expand their portfolio of exported products. Especially for small and medium-sized firms the access to imported inputs (in particular intermediate inputs) has been much more effective than the acquisition by Swedish or foreign multinationals – a very frequent phenomenon in these years (see Bandick, Görg and Karpaty, 2014) – or the establishment of their own international network. Only

for large firms the establishment of an international network of subsidiaries (either Swedish or foreign-owned) has substantially contributed to their export performances, but mainly in terms of increased export scope.

The result of the paper have also clear implications for policy. In particular, they stress that allowing domestic firms an easy access to imported inputs can be as important as supporting their exporting activities. In this perspective, for example, a currency devaluation, while making exported goods cheaper, will also make imports more expensive, thus undermining one of the potential sources of export performance. At the same time, a word of caution is necessary, since the higher reliance on foreign inputs might also have some downsides for the Swedish economy: it is possible that companies that start to import are also likely to substitute domestic suppliers with foreign ones. From a policy point of view, it should also be important to identify which are the firms and sectors that are most affected by this phenomenon and suggest possible mechanisms to boost their competitiveness.

BIBLIOGRAPHY

Aristei D. - Castellani D. - Franco C. (2013), «Firms' Exporting and Importing Activities: Is there a Two-Way Relationship?», *Review of World Economics*, 149(1), pp. 55-84.

Bandick R. - Görg H. - Karpaty P. (2014), «Foreign Acquisitions, Domestic Multinationals, and R&D», *Scandinavian Journal of Economics,* 116(4), pp. 1091-1115.

Bas M. - Strauss-Kahn V. (2014), «Does Importing More Inputs Raise Exports? Firm-Level Evidence from France», *Review of World Economics*, 150(2), pp. 241-275.

Bernard A.B. - Jensen J.B. - Redding S.J. - Schott P.K. (2012), «The Empirics of Firm Heterogeneity and International Trade», *Annual Review of Economics*, 4(1), pp. 283-313.

Broda C. - Weinstein D.E. (2006), «Globalization and the Gains From Variety», *The Quarterly Journal of Economics*, 121(2), pp. 541-585.

Bustos P. (2011), «Trade Liberalization, Exports, and Technology Upgrading: Evidence on the Impact of Mercosur on Argentinian Firms», *The American Economic Review*, 101(1), pp. 304-340.

Cameron A.C. - Trivedi P.K. (2005), *Applied Microeconometrics Using STATA*, New York, STATA Press.

Cassiman B. - Golovko E. (2011), «Innovation and Internationalization Through Exports», *Journal of International Business Studies*, 42(1), pp. 56-75.

Castellani D. - Serti F. - Tomasi C. (2010), «Firms in International Trade: Importers' and Exporters' Heterogeneity in Italian Manufacturing Industry», *The World Economy*, 33(3), pp. 424-457.

Castellani D. - Zanfei A. (2007), «Multinational Companies and Productivity Spillovers: Is there a Specification Error?», *Applied Economics Letters*, 14(14), pp. 1047-1051.

Colantone I. - Crinò R. (2014), «New Imported Inputs, New Domestic Products», *Journal of International Economics*, 92, pp. 147-165.

Costantini J. - Melitz M. (2008), «The Dynamics of Firm-Level Adjustment to Trade Liberalization», *The Organization of Firms in a Global Economy*, 4, pp. 107-141.

Damijan J.P. - Konings J. - Polanec S. (2014), «Import Churning and Export Performance of Multi-Product Firms», *The World Economy*, 37(11), pp. 1483-1506.

Damijan J.P. - Kostevc Č. (2015), «Learning from Trade Through Innovation», *Oxford Bulletin of Economics and Statistics*, 77(3), pp. 408-436.

Goldberg P.K. - Khandelwal A.K. - Pavcnik N. - Topalova P. (2010), «Imported Intermediate Inputs and Domestic Product Growth: Evidence from India», *The Quarterly Journal of Economics*, 125(4), pp. 1727-1767.

Greenaway D. - Kneller R. (2007), «Firm Heterogeneity, Exporting and Foreign Direct Investment», *Economic Journal*, 117(517), pp. 134-161.

Halpern L. - Koren M. - Szeidl A. (2015), «Imported Inputs and Productivity», *The American Economic Review*, 105(12), pp. 3660-3703.

Harding T. - Javorcik B.S. (2012), «Foreign Direct Investment and Export Upgrading», *Review of Economics and Statistics*, 94(4), pp. 964-980.

Iacovone L. - Javorcik B. (2010), «Multi-Product Exporters: Product Churning, Uncertainty and Export Discoveries», *The Economic Journal*, 120(544), pp. 481-499.

-.-,-.- (2012), *Getting Ready: Preparation for Exporting*, mimeo.

Javorcik B.A. - Lo Turco A. - Maggioni D. (2015), *New and Improved: FDI and the Building Blocs of Complexity*, mimeo.

Jung T. - Ejermo O. (2014), «Demographic Patterns and Trends in Patenting: Gender, Age, and Education of Inventors», *Technological Forecasting and Social Change*, 86, pp. 110-124.

Kugler M. - Verhoogen E. (2009), «Plants and Imported Inputs: New Facts and an Interpretation», *The American Economic Review*, 99(2), pp. 501-507.

Lo Turco A. - Maggioni D. (2013), «On the Role of Imports in Enhancing Manufacturing Exports», *The World Economy*, 36(1), pp. 93-120.

-.-,-.- (2015), «Imports, Exports and the Firm Product Scope: Evidence from Turkey», *The World Economy*, 38(6), pp. 984-1005.

Lööf H. - Andersson M. (2010), «Imports, Productivity and Origin Markets: The Role of Knowledge-Intensive Economies», *The World Economy*, 33(3), pp. 458-481.

Muûls M. - Pisu M. (2009), «Imports and Exports at the Level of the Firm: Evidence from Belgium», *The World Economy*, 32(5), pp. 692-734.

Roper S. - Love J.H. (2002), «Innovation and Export Performance: Evidence from the UK and German Manufacturing Plants», *Research Policy*, 31(7), pp. 1087-1102.

Swenson D.L. - Chen H. (2014), «Multinational Exposure and the Quality of new Chinese Exports», *Oxford Bulletin of Economics and Statistics*, 76(1), pp. 41-66.

Van Beveren I. - Bernard A.B. - Vandenbussche H. (2012), «Concording EU Trade and Production Data over Time», *NBER Working Paper Series,* no. 18604.

Vogel A. - Wagner J. (2010), «Higher Productivity in Importing German Manufacturing Firms: Self-Selection, Learning from Importing, or Both?», *Review of World Economics*, 145(4), pp. 641-665.

Wagner J. (2007), «Exports and Productivity: A Survey of the Evidence from Firm-Level Data», *The World Economy*, 30(1), pp. 60-82.

-.- (2012), «International Trade and Firm Performance: A Survey of Empirical Studies Since 2006», *Review of World Economics*, 148(2), pp. 235-267.

-.- (2016), «A Survey of Empirical Studies Using Transaction Level Data on Exports and Imports», *Review of World Economics*, pp. 1-11.

II - THE ITALIAN CASE

Italian Firms in Global Value Chains: Updating our Knowledge

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The main goal of this paper is to evaluate participation and positioning of Italian manufacturing firms in Global Value Chains (GVCs) in the period 2009-2014. Findings indicate that: i) *participation in GVC is positively associated with firms' labour productivity;* ii) *Italian firms strongly participate in GVCs but frequently with the least advanced modes of internationalization (*i.e. *as pure exporters);* iii) *the vast majority of Italian firms are positioned in GVCs as suppliers rather than as final firms, thus operating in the less lucrative, intermediate stages of chains. The whole picture looks bleaker for firms located in Southern Italy.*
[JEL Classification: D22; D23; F23; L23].

Keywords: global value chains; firms' internationalization; Italian industry; labour productivity; suppliers.

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1. - Introduction

The global integration of markets and the vertical fragmentation of industries have advanced notably since the 1990s, with powerful repercussions on the international division of labour within firms and on firms' behaviour and performance in both advanced and developing countries. The growth of global value chains has been one of the key features of this process (Grossman, Rossi-Hansberg, 2006; Miroudot, Ragoussis, 2009; Oecd, 2012; Amador, di Mauro, 2015).

The term "global value chain" (GVC) denotes the entire complex of operations and transactions within and between firms through which raw materials are transformed into intermediate products and then into final goods. For industrial products, the transformation carried out along GVCs involves many stages, ranging from design, manufacturing and assembly to marketing and distribution; these activities are frequently dispersed over a good number of different firms, regions and countries, so as to exploit the comparative advantages of efficiency in each jurisdiction (Baldwin, Venables, 2013; Costinot *et* al., 2013). Accordingly, the expansion of GVCs in these years has driven a worldwide interconnection of industries and a remarkable growth in world trade, especially trade in intermediate goods and services.[1]

Owing in part to the lack of good quality data at firm level, the impact of participation in GVCs on firms' productivity is still under-researched. It has been investigated by relatively few papers, which in most cases have found a positive effect of GVCs on labour productivity and total factor productivity (for example, Veugelers *et* al., 2013; Baldwin, Yan, 2014; Amador, Cabral, 2015; OECD, 2015). There are in fact diverse channels through which participation in a GVC as exporters, importers or two-way traders and/or through foreign direct investments (FDI) can bring economic benefits. Exporting implies a number of potential advantages, in that access to larger foreign markets may allow a firm to exploit scale economies, to acquire new technologies abroad and learn by exporting, or expose it to stimulating international competition (De Loecker, 2007). Moreover, other benefits may accrue to firms that are active in GVCs through imports of foreign inputs: cost saving, technology transfer, higher input quality, and possible complementarities with domestic inputs (Agostino *et* al., 2016). Third, two-way trading may have the additional advantage of exploiting sunk cost complemen-

[1] The Oecd (2007) calculates that in 2003 about 54% of the world's manufactured imports were intermediate goods; according to De Backer K., Miroudot S. (2014), over 70% of service imports are intermediate services.

tarity and other positive interactions between export and import activities (Kasahara, Lapham, 2013). Lastly, especially for small firms and suppliers (*i.e.* firms selling to other firms), relationships with large buyers and/or assemblers may be extremely fruitful in prompting them to upgrade their technical, relational and managerial capabilities (Humphrey, Schmitz, 2002; Gereffi *et* al., 2005; Agostino *et* al., 2015).

1.1 *The Case of Italy*

Italy, the second largest European manufacturing economy after Germany (industry accounts for 15.8% of GDP in Italy and 22.5% in Germany), has a number of peculiar industrial features that are especially relevant in the GVC context. One key characteristic is pronounced fragmentation: 82.7% of Italian manufacturing firms, occupying almost 25% of the total manufacturing workforce, have fewer than 10 employees, while medium-to-large manufacturing firms with 250 or more employees are rare: 0.3% of the total, employing around 23% of the manufacturing workforce. Division of labour among firms is far-reaching (the well-known Marshallian industrial district model) and, before the surge of market globalization, it was territorially bounded. Italy's comparative advantage has continued to be mainly in the traditional industries (the "Made in Italy" sectors), such as textiles, wearing apparel, leather products, furniture and footwear, all industries that are deeply involved in the international dispersion of production[2].

The "great recession" was particularly severe in Italy, with an 8.5% contraction in GDP between 2008 and 2015. Consumption and investment plunged, and only foreign demand showed a somewhat positive trend, thanks to the "happy few" (Mayer, Ottaviano, 2007), *i.e.* a handful of companies (6.4% of all manufacturing firms) that account for 75% of exports (Mazzeo, 2016). Compared to other firms, these exporters feature larger size, higher productivity and wages, and more highly skilled workers.

Other important characteristics are Italy's lesser ability to attract foreign investment and the geographical divide. Indeed, the historical gap between the comparatively underdeveloped South, (including the regions Abruzzo, Molise, Campania, Basilicata, Apulia, Calabria, Sicily and Sardinia) and the more prosperous regions of the Centre-North is persistent (since the turn of the century

[2] As shown by Dell'Agostino L., Nenci S. (2016), the Italian trade specialization does not change much when calculated taking into account trade in value added, rather than simply observing gross export data.

per capita income in the South has been stuck at around 56% of that in the Centre-North); it reflects the differences in labour productivity and total factor productivity between firms located in the two regions (Giannola *et* al., 2016).

Because of these structural features, globalisation has been a severe shock for Italian firms. Nevertheless, as various papers have observed (Veugelers, 2013; Amador *et* al., 2015; Cappariello, Felettigh, 2015), Italy's participation in GVCs is now more or less on a par with that of Germany and France, as gauged both by the share of foreign value added embodied in Italian exports and by the share of national value added embodied in partners' exports.

Empirical studies at firm level in Italy (Giunta *et* al., 2012; Agostino *et* al., 2015; Brancati *et* al., 2015; Formai, Vergara Caffarelli, 2015; Giovannetti *et* al., 2015) have produced three interesting findings: *i*) beside participation, firms' positioning along the GVC is relevant as well, as it is shown, for example, by the fact that the great recession had more serious repercussions for suppliers[3] than for final product manufacturers, probably because of a "bullwhip effect" connected to the adjustment of inventories within GVCs (Bekes *et* al., 2011; Altomonte *et* al., 2012). Moreover, firms' position in GVCs appears to explain part of the performance gap between Italian and German firms during the recession (Accetturo, Giunta, 2016); *ii*) there is considerable heterogeneity of Italian firms involved in the GVCs; as the GVCs amplify the modes of firms' internationalisation, that results in large productivity differentials; *iii*) Italian firms' participation in GVCs is quite common, but participation per se does not guarantee good performance, which depends heavily on such firm-specific characteristics as the propensity to innovate, R&D investment, human capital, workers' training. Agostino *et* al. (2015) show that on average supplier firms are less productive than final firms; however, as the ability of supplier firms increases, their productivity shortfall diminishes, and in fact for those that succeed in both exporting and innovating, there is no statistically significant difference in productivity between suppliers and final firms.

1.2 *Aim and Outline of the Paper*

The main purpose of this paper is to update our knowledge concerning Italian firms' participation in GVCs. We evaluate the impact of participation in and po-

[3] Supplier firms (those that sell to other firms rather than the final market) have undergone a much more severe reduction in sales. And given their small size, the majority of Italian firms in fact operate as suppliers.

sitioning along GVCs on labour productivity in Italian manufacturing firms in the period following the "great recession", *i.e.* from 2009 to 2014.

We begin with an empirical investigation of a sample of more than 14,000 European industrial enterprises. We then focus on Italy, the core of our analysis, to highlight two main aspects. The first concerns the specific behaviour and performance of supplier firms, which produce for outsourcers and are therefore complementary to the international allocation of production within global networks (Giunta *et* al., 2012). This is one of only a few papers on the role of GVCs in determining labour productivity that explicitly consider this type of firm. Yet supplier firms constitute the bulk of the industrial structure in a number of countries, and Italy, as observed, is a case in point. Supplier firms are often described as suffering a productivity discount (Razzolini, Vannoni, 2011), although some researchers have noted the heterogeneous behaviour and performance of supplier firms (Accetturo *et* al., 2011; Agostino *et* al., 2015).

The second issue is the North-South divide in Italy, *i.e.* the performance gap between firms that are and are not part of GVCs, located in Southern and in Northern-Central Italy. The empirical evidence on this issue is scanty indeed. Both Giunta *et* al., (2012) and SVIMEZ (2016) report the low and relatively unqualified GVC participation of Southern firms; Cherubini, Los (2016) find that from 1995 to 2006 employment in GVC-participating firms increased in all regions of Italy, but much less in the South than in the rest of the country. Moreover, the GVCs in which Southern firms participate appear to be relatively slow-growing. Accetturo *et* al., (2016), analysing the impact of institutional quality on GVCs, document that firms located in regions with inefficient judicial systems (as is often the case in Southern Italy) are less likely to supply intermediate goods abroad.

Our source of data is 2010 EU-EFIGE dataset, gathering survey and balance-sheet information on industrial firms with 10 or more employees in seven European countries: Austria, France, Germany, Hungary, Italy, Spain and the United Kingdom, all of them showing a considerable involvement in GVCs.[4] Thanks to new balance-sheet data on the sample firms for 2011-2014, we make a novel con-

[4] The participation index (Koopman R. *et* al., 2011) is expressed as a percentage of gross exports and indicates the share of foreign inputs in exports (backward participation) and domestically produced inputs used in third countries' exports (forward participation). Among our seven countries, Hungary shows the highest backward participation (40% of gross exports), followed by Austria (around 30%), Germany (around 25%), France (20%), Spain (20%), and Italy (20%), while the United Kingdom exhibits the lowest backward participation index (around 15%).

tribution by analysing the post-crisis performance of the industrial firms covered by EFIGE's 2007-2009 survey.

The period under observation is of special interest in view of the severe shock produced by the financial crisis of 2008, which resulted in what some observers termed a "world trade collapse" (Baldwin, 2009). According to some recent works (Yi, 2009; Bems *et* al., 2010; Alessandria *et* al., 2011; Altomonte *et* al., 2012), GVCs played a leading role in transmitting the shocks in the wake of the crisis. Moreover, the following years registered a slowdown in world trade growth to about 3% a year in 2012-2015, compared with 7% in the pre-crisis decades from 1987 to 2007. It remains to be established whether this deceleration was driven by: *a)* compositional effects, such as a geographical shift in economic activity, from the advanced to the emerging economies, or possibly a shift towards less trade-intensive activities (Al Haschimi *et* al., 2016; Bussier *et* al., 2013; Constatinescu *et* al., 2016); *b)* structural effects relating to the "possibility that the structural transformation associated with the increasing geographical fragmentation of production is now nearly finished" (Ferrantino, Taglioni, 2014); *c)* the Chinese transition towards a more consumption-based economy; or *d)* protectionist measures inducing firms to rely mainly upon regional markets for sourcing and sales.

The remainder of the article is organised as follows. Section 2 assesses the degree of participation of European and Italian firms in GVCs, distinguishing among different modes of participation according to the number and kind of international activities undertaken. Section 3 treats our main theme, estimating the effect of GVCs on labour productivity. After presenting the econometric model and commenting on the general results, we conduct specific analyses on Italy, with particular reference to the North-South gap and to supplier firms. Section 4 summarizes the conclusions and outlines some policy implications.

2. - Participation in and Position Along GVCs

This section offers a preliminary evaluation of the involvement and positioning of Italian manufacturing firms in GVCs, in comparison with firms in other European countries. We also distinguish between firms operating in the Centre-North and the South of Italy (the so-called "Mezzogiorno").

To take account of the variety of modes of internationalisation associated with the operation of GVCs, we examine several possible modes of participation and their combinations: exports only, intermediate goods imports only, both exports

and imports (two-way trade), and international production. In particular, like Veugelers *et* al. (2013), we define "single", "dual" and "triple" modes of GVC participation. Single participation embraces pure importers of components/services, or pure exporters, or pure international producers (through FDI or international outsourcing). Dual mode comprises firms involved in any two of the foregoing modes (imports and exports, or imports plus international production, or exports and international production). Triple mode means the firms engaged in all three modes (imports, exports and international production). Finally, "zero" participation (the control group in our econometric analyses) encompasses firms that engage in no international activity: neither imports nor exports nor international production.[5] We classify firms in the various categories on the basis of qualitative information on the status of importer, exporter and international producer, as reported by the EFIGE survey.

2.1 *The International Comparison*

Table 1 shows the distribution of firms by country[6] (in the case of Italy, also with separate rows for Centre-North and South) and mode of participation in GVCs, distinguishing also among the different types of single, dual and triple participation. Germany has the largest share of firms not participating in any GVC (28.6%), followed closely by Spain. Conversely, Italy's involvement in GVCs is the strongest, practically on a par with France and "Others". On the other hand, Italian firms more frequently take part in GVCs with the least advanced participation mode (single), and in particular as pure exporters. More generally, in all countries the dual mode is the most common; in the majority of cases these firms are two-way traders. In this respect, Italy, France and Spain are

[5] This definition may overestimate firms' participation in GVCs. The EFIGE dataset cannot distinguish between exports of intermediate and final goods; likewise, we cannot establish whether an international producer is actually participating in a GVC (as when the firm produces intermediate goods that are subsequently exported for further processing) or, instead, has a totally self-contained foreign plant (all stages in production are performed within the plant), and the output is sold on local markets. Fortunately, this potential bias is limited because in our dataset it might concern 21% of the total sample at most (20.41% consisting of exporters and 0.24% of FDI-only firms, see Table 1).

[6] Only France, Germany, Italy and Spain are treated individually, while Britain, Austria and Hungary are grouped together as "Others". This is because on the one hand the productive structure of the UK, based on financial and knowledge-intensive business services, is quite different from that of France, Germany, Italy and Spain; and on the other, Hungary and Austria are much smaller economies, so that comparisons may not be particularly significant.

similar, while Germany has a somewhat smaller share of two-way traders (around 32%) and a higher percentage of firms that combine international production with importing or exporting (around 2.2%). The triple mode, the most complex, involves relatively few firms (6% in Italy, around 8% in Germany and France).

TABLE 1

MULTIPLE MODE INTERNATIONALIZATION BY COUNTRY

	Zero	Single			Dual			Triple	Total
		Imp	Exp	Prod	Exp-Imp	Imp-Prod	Exp-Prod		
FRANCE	21.36%	14.87%	12.24%	0.13%	41.94%	1.04%	0.20%	8.21%	**100%**
GERMANY	28.59%	5.96%	23.48%	0.20%	31.52%	0.48%	1.74%	8.04%	**100%**
ITALY	20.72%	5.10%	26.71%	0.23%	40.15%	0.10%	0.93%	6.06%	**100%**
CENTER-NORTH	*18.64%*	*4.78%*	*26.94%*	*0.15%*	*41.83%*	*0.08%*	*0.96%*	*6.62%*	***100%***
SOUTH	*34.07%*	*7.11%*	*25.25%*	*0.74%*	*29.41%*	*0.25%*	*0.74%*	*2.45%*	***100%***
SPAIN	27.19%	9.00%	19.77%	0.14%	39.94%	0.25%	0.35%	3.35%	**100%**
OTHERS	21.31%	8.64%	19.78%	0.47%	41.03%	0.87%	1.80%	6.10%	**100%**
TOTAL	**23.78%**	**8.71%**	**20.41%**	**0.24%**	**38.93%**	**0.55%**	**1.01%**	**6.38%**	**100%**

Authors' calculations on EFIGE data. SINGLE embraces pure importers of components/services, or pure exporters or pure international producers (through FDI or international outsourcing). DUAL comprises firms involved in any two of the foregoing modes (imports and exports, or imports plus international production, or exports and international production). TRIPLE means the firms engaged in all three modes (imports, exports and international production). OTHERS includes: Austria, Hungary and UK. IMP, EXP and PROD stand for importers, exporters and international producers, respectively. Total observations for Italy: 3,020.

As noted above, a firm's positioning along its GVC has significant impact. Indeed, being a supplier or a final firm may have important implications in itself and with regard to participation in and rewards from GVC. Tables 2*a* and 2*b* distinguish between "supplier firms", *i.e.* firms selling exclusively to other firms, and "final firms" *i.e.*, producers serving end markets. Table 2*a* shows that in Italy and France the majority of firms, internationalised or not, are suppliers (65% and 71% respectively), whereas in the other countries the incidence of suppliers is much lower, most notably in Germany (around 40%).

What is more, supplier and final market firms appear to differ very significantly in degree of involvement and mode of participation in GVCs. In all our sample countries (except Germany), and most especially in Italy, suppliers are more frequently confined to single national markets than final firms, and their participation modes are simpler. For example, dual and triple modes are much less common among suppliers than final firms in Italy and Spain, however in Germany no such a difference is found. In particular, this reflects the differing pres-

ence of two-way traders between final and supplier firms. Remarkably, while in Italy and Spain two-way traders account respectively for 38% and 36% of all suppliers (against 45% and 43% for final firms), in Germany the opposite holds: the share of suppliers consisting of two-way traders is higher.

Even when focusing on internationalised firms (Table 2*b*), suppliers – in single, dual, or triple mode – make up a substantial majority (around 63%) of GVC participants in Italy, but only 41% in Germany. In the latter country, more than 35% of internationalised firms are final firms participating with dual or triple modes, whereas in Italy the value is 24%. Conversely, suppliers integrated in GVCs with single mode are 27% in Italy against less than 18% in Germany. This is evidence that German and Italian firms perform different tasks, presumably associated with different rewards along the chain.

TABLE 2A

MULTIPLE MODE INTERNATIONALIZATION BY FIRMS' POSITIONING IN GVC

	Zero	Single			Dual			Triple	**Total**
		Imp	Exp	Prod	Exp-Imp	Imp-Prod	Exp-Prod		
Final Firms									
FRANCE	6.12%	4.14%	3.13%	0.03%	12.05%	0.20%	0.07%	2.83%	**28.57%**
GERMANY	18.26%	3.41%	13.49%	0.03%	18.19%	0.27%	1.06%	5.59%	**60.31%**
ITALY	5.73%	1.59%	8.61%	0.13%	15.79%	0.07%	0.40%	2.98%	**35.30%**
CENTER-NORTH	4.21%	1.23%	7.32%	0.07%	14.24%	0.03%	0.36%	2.72%	***30.17%***
SOUTH	1.52%	0.36%	1.29%	0.07%	1.56%	0.03%	0.03%	0.26%	***5.13%***
SPAIN	14.19%	4.80%	11.72%	0.07%	24.68%	0.14%	0.25%	2.12%	**57.98%**
OTHERS	10.48%	4.71%	10.78%	0.37%	23.56%	0.60%	1.40%	4.11%	**56.01%**
Supplier Firms									
	Zero	Single			Dual			Triple	**Total**
		Imp	Exp	Prod	Exp-Imp	Imp-Prod	Exp-Prod		
FRANCE	15.21%	10.73%	9.12%	0.10%	29.91%	0.84%	0.13%	5.38%	**71.43%**
GERMANY	10.32%	2.56%	9.98%	0.17%	13.32%	0.20%	0.68%	2.45%	**39.69%**
ITALY	14.97%	3.51%	18.11%	0.10%	24.37%	0.03%	0.53%	3.08%	**64.70%**
CENTER-NORTH	11.89%	2.91%	15.99%	0.07%	21.95%	0.03%	0.46%	3.01%	***56.32%***
SOUTH	3.08%	0.60%	2.12%	0.03%	2.42%	0.00%	0.07%	0.07%	***8.38%***
SPAIN	12.99%	4.20%	8.05%	0.07%	15.25%	0.11%	0.11%	1.24%	**42.02%**
OTHERS	10.81%	3.94%	8.98%	0.10%	17.49%	0.27%	0.40%	2.00%	**43.99%**

Authors' calculations on EFIGE data. SINGLE embraces pure importers of components/services or pure exporters or pure international producers (through FDI or international outsourcing). DUAL comprises firms involved in any two of the foregoing modes (imports and exports, or imports plus international production, or exports and international production). TRIPLE means the firms engaged in all three modes (imports, exports and international production). OTHERS includes: Austria, Hungary and UK. IMP, EXP and PROD stand for importers, exporters and international producers, respectively. Total observations for Italy: 3,020.

TABLE 2B

MULTIPLE MODE INTERNATIONALIZATION BY FIRMS' POSITIONING IN GVC
(excluding ZERO)

	Final Firms				Supplier Firms				Total
	Single	Dual	Triple	*Total*	Single	Dual	Triple	*Total*	
FRANCE	9.28%	15.65%	3.59%	***28.53%***	25.36%	39.26%	6.84%	***71.47%***	**100%**
GERMANY	23.71%	27.34%	7.82%	***58.87%***	17.80%	19.90%	3.44%	***41.13%***	**100%**
ITALY	13.03%	20.50%	3.76%	***37.29%***	27.39%	31.44%	3.88%	***62.71%***	**100%**
CENTER-NORTH	10.86%	18.46%	3.42%	***32.73%***	23.92%	28.31%	3.80%	***56.03%***	***89%***
SOUTH	2.17%	2.05%	0.33%	***4.55%***	3.47%	3.13%	0.08%	***6.68%***	***11%***
SPAIN	22.79%	34.43%	2.91%	***60.14%***	16.93%	21.24%	1.70%	***39.86%***	**100%**
OTHERS	20.14%	32.49%	5.22%	***57.85%***	16.54%	23.07%	2.54%	***42.15%***	**100%**

Authors' calculations on EFIGE data. SINGLE embraces pure importers of components/services or pure exporters or pure international producers (through FDI or international outsourcing). DUAL comprises firms involved in any two of the foregoing modes (imports and exports. or imports plus international production, or exports and international production). TRIPLE means the firms engaged in all three modes (imports, exports and international production). OTHERS includes: Austria, Hungary and UK. Total observations for Italy: 3,020.

2.2 *Focussing on Italy*

In accordance with previous literature (Bernard, Jensen, 1999; Melitz, 2003; Helpman *et* al., 2004), our data show a great heterogeneity among Italian industrial firms, in particular between suppliers and final firms. Table 3 (Panel A) displays some structural differences regarding labour productivity, participation in GVC, and some other variables[7] such as: SIZE, the percentage of small and medium-sized firms (under 250 employees); AGE, the percentage of firms more than 20 years old in 2008; GROUP and FOREGROUP, the percentage of firms belonging to a group and a foreign group, respectively; FORECOMP, the percentage of firms whose main competitors are located abroad; INNO and R&D, the percentage of firms carrying out product/process innovation or research activities respectively, and TRAIN, the percentage of employees involved in formal training programs. The comparison between final and suppliers highlights that the latter are on average less productive, smaller (precisely, the share of SMEs is higher), less integrated in business groups, more frequently closed to international trade and less inclined to undertaking R&D, innovation and workers' training.

[7] Two different measures of labour productivity are used, computed respectively as the *ratio* of total turnover (*PRODt*) and value added (*PRODv*) over the number of employees. The same set of variables is used in regressions of Section 3.

Table 3

ITALIAN FINAL AND SUPPLIER FIRMS. PRODUCTIVITY AND STRUCTURAL CHARACTERISTICS

Panel A	Zero	Single	Dual	Triple	Gvc #	Size	Age	Group	Fore-group	Fore-comp	R&D	Inno	Train
Final Firms	16.23%	29.27%	46.06%	8.44%	83.77%	89.77%	6.60%	21.67%	5.53%	9.47%	59.19%	27.67%	28.05%
Supplier Firms	23.13%	33.57%	38.54%	4.76%	76.87%	90.99%	6.50%	15.15%	3.22%	10.75%	52.71%	25.90%	22.52%

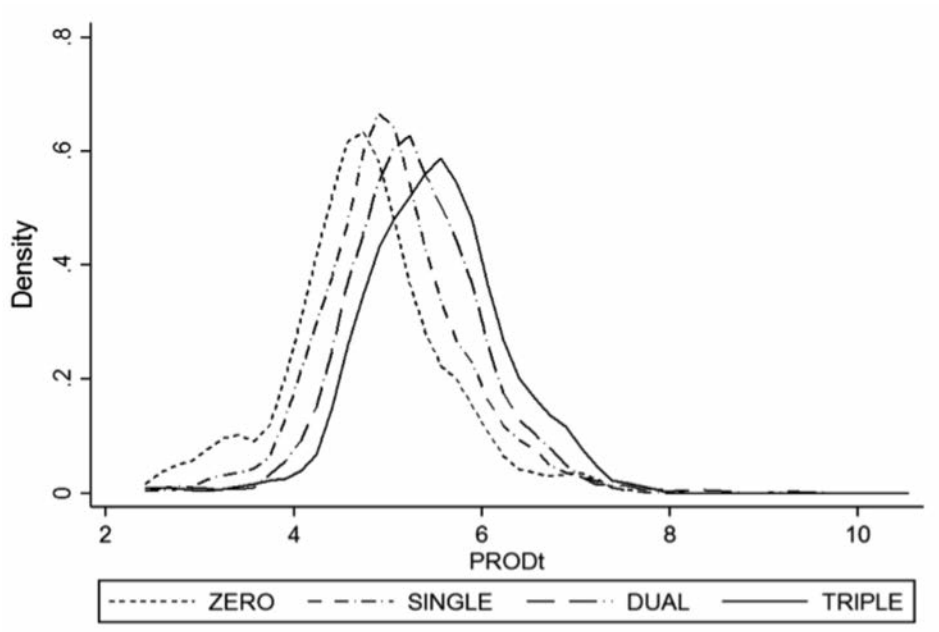
Panel B	**Final Firms**					**Supplier Firms**				
	Zero	Single	Dual	Triple	Total	Zero	Single	Dual	Triple	Total
PRODt[(a)]										
Average	219.6	225.5	318.3	325.8	**275.0**	150.4	192.3	243.1	311.1	**207.7**
Median	127.9	152.3	206.1	255.0	**181.3**	109.4	139.6	177.6	238.8	**151.4**
Observations	164	302	466	76	**1,008**	422	613	707	82	**1,824**
PRODv [(b)]										
Average	52.7	53.9	62.1	69.5	**58.7**	45.32	51.38	60.16	62.46	**53.88**
Median	46.4	46.5	54.7	60.8	**51.1**	41.44	46.76	53.88	56.61	**48.42**
Observations	163	297	460	74	**994**	415	602	700	80	**1,797**

Authors' calculations on Efige. All variables come from EU-Efige/Bruegel-UniCredit dataset. SINGLE embraces pure importers of components/services or pure exporters or pure international producers (through FDI or international outsourcing). DUAL comprises firms involved in any two of the foregoing modes (imports and exports, or imports plus international production, or exports and international production). TRIPLE means the firms engaged in all three modes (imports, exports and international production). #GVC is a dummy coded 1 if a firm is single, or dual, or triple mode. For the description of the others variables see Table 5. [(a)] Turnover on employees (average 2009-2014) [(b)] Added value on employees (average 2009-2014). Average and median values are in thousands of euro.

Concerning participation in GVC, Italian suppliers are more frequently integrated with single mode; less frequently with dual; in a very few cases with triple mode. Table 3 Panel B indicates that the more complex the participation mode in GVC, the more productive the firm. The hierarchy among the modes of participation in GVC is confirmed by Graphs 1 and 2, where Kernel density for each mode is depicted[8]. For both *PRODt* and *PRODv* measures of labour productivity, the curve relative to each category is located to the right of curves representing density of less complex participation modes.

GRAPH 1

PRODUCTIVITY AND MULTIPLE MODE INTERNATIONALISERS: *PRODt*



Source: Authors' elaboration on EFIGE data.

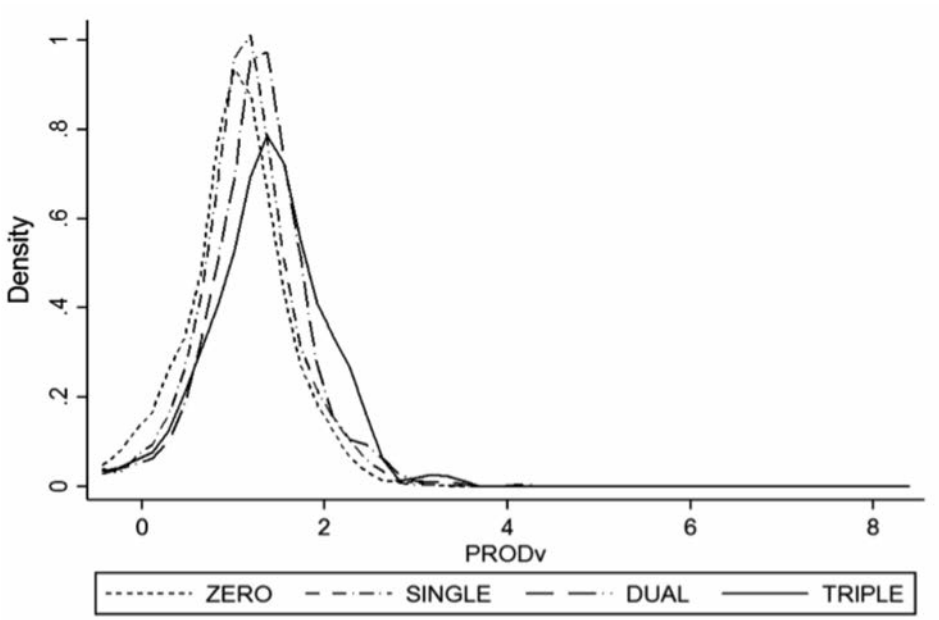
Moreover, the productivity gap between the two categories of firms (suppliers and final firms) varies with the mode of participation. Differences in average labour productivity rapidly shrink when moving from non-internationalized firms to simple and then to more complex modes[9]. In other words, data of Table 3

[8] The kernel density shows the probability of picking a firm with any given productivity level randomly drawing from triple, dual, single, or zero.

[9] This result is thoroughly consistent with the main findings of AGOSTINO M. *et* AL. (2015).

Graph 2

PRODUCTIVITY AND MULTIPLE MODE INTERNATIONALISERS: *PRODv*



Source: Authors' elaboration on Efige data.

show that the gain of joining a chain, and participating with more complex modes of integration, is larger for suppliers than final firms.

By Italian national standards, the condition of Southern industry is even worse. As shown in Table 1, the most striking difference lies in international opening: more than a third of all manufacturing firms in Southern Italy are closed to any sort of international trade. Considering only firms involved in GVCs (Table 2*b*), more than half of those in the South are characterised by the single mode, much higher than in Central-Northern Italy (39%) and the rest of Europe (35% in France, 39% in Spain, 41% in Germany, and 37% in the other countries). For the subset of suppliers, the numbers are worse: 37% of Southern firms are not involved in GVCs at all (Table 2*a*) and 52% of those involved participate only with the single mode (Table 2*b*).

Another point of interest is the share of internationalised final firms engaged in imports and that of pure export suppliers. From Table 2*a*, it can be calculated that in Southern Italy the percentage of final importer firms over the total number of internationalised firms is much lower than in Central-Northern Italy and in

all the other sample countries. Conversely, pure exporter suppliers account for a relatively very high share of all suppliers in GVC[10]. That is, Italy – and even more so Southern Italy – is characterised by a relatively smaller presence of final importers (pivotal firms that are usually large buyers and/or assemblers in the downstream stages), combined with a large presence of exporting suppliers (usually active in upstream and midstream stages). In sum, Southern firms are the least integrated into GVCs, and when they do participate they tend to be poorly positioned, thus preventing them from fully exploiting the opportunities of global market penetration.[11]

By looking at the industry disaggregation, Table 4 offers other significant insights into Italian involvement in GVCs. First, it confirms the overall high industry involvement in GVCs, with the partial exceptions of the rubber and plastic and food and tobacco sectors (with 26.5% and 23.5%, respectively, of non-participating firms). Second, it shows that the percentage of not internationalised firms is much higher for suppliers than for final firms in all sectors (except food). Third, the relatively modest GVC presence of final firms (35% on average compared with 65% for suppliers) in all sectors (except for Food and Tobacco) again spotlights a peculiar feature of Italian industry, namely the relative lack of large players occupying more secure and profitable positions and governing the chain.

[10] Final importers are the sum of final pure importers, two-way traders, importers producing abroad and triple mode firms (for Southern Italy 0.36% + 1.56% + 0.03% + 0.26%). Dividing by the total number of internationalised final firms (5.13% – 1.52%), it yields a share of 61% of importers over all internationalised final firms. This share amounts to 70% in Central-Northern Italy, 85% in France, 73% in Spain, 65% in Germany, and 72% in the other countries. The percentage of suppliers which are pure exporter can be calculated for Southern Italy as the *ratio* of suppliers only exporting (2.12%) to total internationalised suppliers (8.38% – 3.08%), which yields 40% against 36% in Central-Northern Italy, 16% in France, 28% in Spain, 34% in Germany, and 27% in the other countries.

[11] Consistent with these indications, SVIMEZ (2016) shows that Southern firms in GVCs tend to import relatively more standardised than customised intermediate goods and export relatively more to developing than to advanced countries.

TABLE 4

MULTIPLE MODE INTERNATIONALIZATION BY SECTOR (NACE 1.1): ITALY

	Final Firms					Supplier Firms					
Sector	Zero	Single	Dual	Triple	***Total***	Zero	Single	Dual	Triple	***Total***	**Total**
Food and Tobacco	13.45%	24.79%	22.69%	1.68%	***62.61%***	10.08%	13.87%	13.03%	0.42%	***37.39%***	**100%**
Textile	2.63%	5.97%	14.08%	7.40%	***30.07%***	14.32%	21.24%	28.16%	6.21%	***69.93%***	**100%**
Wood, paper, printing, furniture	4.42%	9.68%	10.95%	2.32%	***27.37%***	15.79%	27.79%	27.16%	1.89%	***72.63%***	**100%**
Chemical and pharmaceuticals	1.85%	8.33%	29.63%	2.78%	***42.59%***	5.56%	10.19%	36.11%	5.56%	***57.41%***	**100%**
Rubber and plastic	11.01%	8.63%	17.56%	0.60%	***37.80%***	15.48%	20.24%	23.81%	2.68%	***62.20%***	**100%**
Metal, machinery and equipment	4.03%	10.49%	14.42%	2.34%	***31.27%***	17.51%	24.63%	24.16%	2.43%	***68.73%***	**100%**
Electrical and optical equipment	6.62%	8.82%	22.43%	2.57%	***40.44%***	12.50%	18.01%	24.63%	4.41%	***59.56%***	**100%**
Transport equipment	5.00%	8.75%	16.25%	7.50%	***37.50%***	11.25%	11.25%	35.00%	5.00%	***62.50%***	**100%**
Total	**5.61%**	**10.38%**	**16.15%**	**2.97%**	**35.11%**	**14.92%**	**21.83%**	**25.03%**	**3.10%**	**64.89%**	**100%**

Authors' calculations on EFIGE data. SINGLE embraces pure importers of components/services or pure exporters or pure international producers (through FDI or international outsourcing). DUAL comprises firms involved in any two of the foregoing modes (imports and exports, or imports plus international production, or exports and international production). TRIPLE means the firms engaged in all three modes (imports, exports and international production).Total observations for Italy: 2,996.

Summing up, our descriptive analysis (Tables 1-4) documents the strong involvement of Italian industry in GVCs but also points out to some factors of weakness. Italy's participation is characterised by a very large share of supplier firms, that often operate in the less lucrative, intermediate stages of GVCs. Also, Italian firms, and particularly suppliers, participate in GVCs with the least advanced participation mode (single), frequently as pure exporters. Conversely, by comparison with the main European competitors, only a few Italian firms (around 6%) display the most advanced (triple) mode.

3. - The Empirical Inquiry

Here we set out the evidence of the importance of GVC participation in determining firms' productivity. In this econometric exercise, the dependent variable is labour productivity (measured either as value added or as total sales turnover per employee) and the vector of explanatory variables includes a number of controls and indicators of participation.

3.1 *Data and Estimation Methods*

We use micro-data from the EU-EFIGE Bruegel-UniCredit dataset, provided by the Belgian non-profit international association Bruegel. The dataset contains both survey and balance-sheet data on 14,759 firms with at least 10 employees operating in seven European countries: Austria, France, Germany, Hungary, Italy, Spain and the United Kingdom.[12] Although many of the qualitative and quantitative data from the EFIGE survey (conducted in 2010) refer to the triennium 2007-2009, almost all our explanatory variables are available for 2008 only. As a consequence, we cannot resort to dynamic panel data methods to account for unobserved heterogeneity between firms or possible simultaneity bias (that is, firms might select different types of GVC involvement depending on their level of productivity). The estimations therefore necessarily rely only on OLS methodology, so a strict causal interpretation of our results is precluded. On the other hand, thanks to the availability of balance-sheet data updated to 2014, we can observe and factor in the productivity performance of European manufacturing firms in the aftermath of the crisis by taking as the dependent variable average productivity in the years 2010-2014.

[12] For more details on the EFIGE dataset, see *http://bruegel.org/2012/10/the-eu-efigebruegel-unicredit/dataset/*

Our estimated equation is specified as follows:

$$(1)\quad PROD_i = \alpha + \beta_1 SINGLE_i + \beta_2 DUAL_i + \beta_3 TRIPLE_i + \beta_4 SUPPL_i + \phi \boldsymbol{X}_i + \sum_k \gamma_k IND_k + \sum_c \lambda_c C_c + \varepsilon_i$$

where the dependent variable is the log of average labour productivity for 2009-2014, computed as the *ratio* of either total turnover (*PRODt*) or value added (*PRODv*) to the number of employees. On the right hand side, SINGLE, DUAL, TRIPLE and SUPPL are our key regressors. The first three are dummies identifying the non-overlapping categories of GVC involvement defined above (ZERO being the control group). As in Section 2, our benchmark estimations classify firms in their respective categories on the basis of qualitative information on the status of importer, exporter and international producer as reported by the EFIGE survey. As a robustness check, we alternatively assign firms to each of our four participation modes according to the criterion of Veugelers *et* al. (2013), *i.e.* classifying «firms as internationally active only if their trade turnover (either turnover from imports of intermediate goods and services for domestic production, exports of domestic production or international production activities) is above the twenty-fifth percentile in their sector, or if their share of international activity (import, export or international production) over total turnover is above the twenty-fifth percentile» (Veugelers *et* al., 2013, p. 110). The SUPPL (suppliers) regressor designates firms whose entire turnover (100%) stems from produced-to-order goods. The control vector $\boldsymbol{X}$ contains a set of variables frequently used in the literature and previously discussed (Section 2): SIZE, AGE, GROUP, FOREGROUP, FORECOMP, INNO, R&D, and TRAIN. Finally, we also consider SIZE, as additional regressors industry dummies IND_k, controlling for unobserved heterogeneity at the industry level, and *Cc* are country specific effects, accounting for country unobservable heterogeneity. Table 5 provides a description of dependent and explanatory variables, together with some summary statistics, while Table 6 reports the correlation matrix.

TABLE 5

DESCRIPTION OF THE VARIABLES USED IN THE ESTIMATIONS AND THEIR MAIN SUMMARY STATISTICS

Variable	Description	Mean	Std. Dev.	Min	Max	Obs
PRODt	Turnover on employees (thousand Euros average 2009-2014)	4.866	0.791	2.515	10.437	9,507
PRODv	Added value on employees (thousand Euros average 2009-2014)	3.782	0.617	-0.362	8.327	9,826
ZERO	Dummy=1 if a firm is classified as inactive abroad in the EFIGE dataset (in 2008)	0.238	0.426	0	1	14,759
SINGLE	Dummy = 1 if a firm is pure importer of components/services or pure exporters or pure international producer (through FDI or international outsourcing), in 2008.	0.294	0.455	0	1	14,759
DUAL	Dummy = 1 if a firm is involved in two modes of international activity (import, export and international production), in 2008.	0.405	0.491	0	1	14,759
TRIPLE	Dummy = 1 if a firm is involved in all modes of international activity (import, export and international production), in 2008.	0.064	0.244	0	1	14,759
GVC	Dummy = 1 if a firm is single, or dual, or triple mode	0.762	0.426	0	1	14,759
SUPPL	Dummy = 1 (= 0) if share of total sales consisting in produced-to-order goods is 100% (0%)	0.525	0.499	0	1	14,755
SIZE	Dummy = 1 if a firm is small or medium-sized (under 250 employees)	0.712	0.453	0	1	14,759
AGE	Dummy = 1 if a firm is older than 20 years (in 2008)	0.577	0.494	0	1	14,759
GROUP	Dummy = 1 if firm belongs to a group (in 2008)	0.221	0.415	0	1	14,759
FOREGROUP	Dummy = 1 if firm belongs to a foreign group (in 2008)	0.088	0.284	0	1	14,759
FORECOMP	Dummy = 1 if the firm's main competitors are located abroad (in 2008)	0.141	0.348	0	1	14,751
R&D	Share of firm's turnover invested in R&D. average for 2007-2009.	0.511	0.500	0	1	14,755
INNO	Dummy = 1 if a firm carried out (in the three years 2007-2009) product or process innovation	0.282	0.450	0	1	14,759
TRAIN	Percentage of employees involved in formal training programs in 2008	44.35	49.68	0	100	14,759

Source: Authors' calculations on EGIFE data.
All variables come from EU-EGIFE/Bruegel-UNICREDIT dataset.

Table 6

CORRELATION MATRIX

	Zero	Single	Dual	Triple	Gvc	Supp	Size	Age	Group	Foregroup	Forecomp	R&D	Inno	Train
ZERO	1													
SINGLE	-0.360	1												
DUAL	-0.461	-0.532	1											
TRIPLE	-0.146	-0.168	-0.215	1										
GVC	-1.000	0.360	0.461	0.146	1									
SUPPL	0.018	0.026	-0.019	-0.041	-0.018	1								
SIZE	-0.020	0.027	0.026	-0.069	0.020	0.066	1							
AGE	-0.084	-0.020	0.059	0.064	0.084	-0.038	-0.004	1						
GROUP	-0.148	-0.093	0.134	0.162	0.148	-0.013	-0.032	0.013	1					
FOREGROUP	-0.145	-0.081	0.139	0.123	0.145	-0.028	-0.042	0.010	0.584	1				
FORECOMP	-0.140	-0.078	0.136	0.116	0.140	-0.008	-0.029	0.017	0.143	0.166	1			
R&D	-0.286	-0.062	0.231	0.151	0.286	-0.055	-0.028	0.059	0.136	0.080	0.139	1		
INNO	-0.163	-0.057	0.154	0.080	0.163	-0.046	-0.035	0.019	0.091	0.074	0.070	0.343	1	
TRAIN	-0.039	-0.033	0.039	0.051	0.039	-0.055	-0.031	0.006	0.121	0.106	0.037	0.137	0.120	1

Source: Authors' calculations on Efige data.
For the description of the variables see Table 5.

Equation *(1)* is estimated considering first all EFIGE countries (Austria, France, Germany, Hungary, Italy, Spain and Britain) and then Italy alone. To deepen our analysis, we re-estimate model (1) on the whole sample by replacing SINGLE, DUAL and TRIPLE with a simple GVC dummy that takes value 1 if a firm is internationally active (*i.e.* if any among SINGLE, DUAL and TRIPLE takes value 1). This allows us to include as an additional regressor the interaction term GVC*SUPPL (INTE1), which makes it possible to evaluate the productivity effect of being a GVC supplier. When the sample is restricted to Italian data, INTE2 is the interaction term between GVC and SOUTH, the latter being a dichotomous variable coded 1 for firms located in Southern Italy.

3.2 *Results*

Table 7 reports estimates for all our sample countries. Columns 1 and 2 show the results from estimating equation *(1)*, alternatively computing average labour productivity (our dependent variable) as either total turnover (*PRODt*) or value added (*PRODv*) per employee.

A preliminary look at the control variables shows that most have the expected sign and for the most part are statistically significant at the 1% level. Partial exceptions are SIZE and INNO, which in some cases are not significant.

Turning to our variables of interest, the coefficients of SINGLE, DUAL and TRIPLE are always positive and highly significant. It is worth noticing that the coefficient of TRIPLE is higher than that of DUAL, which in turn is higher than SINGLE. A possible implication is that the beneficial effect of GVC participation is enhanced when the firm is integrated into a GVC with a more complex mode of internationalisation. The tests reported at the bottom of Table 7 indicate that the increase in the magnitude of the impact is statistically significant: firms marked by all three modes of international integration have the highest level of labour productivity in our sample, followed by firms involved in two modes and then by those involved in just one. Moreover, in the first two columns of Table 7, the SUPPL parameter is negative and significant, corroborating the hypothesis of a productivity gap between suppliers and final firms.

In columns 3 and 4, we replace our three mode variables with a single GVC dummy, coded 1if a firm is SINGLE, or DUAL, or TRIPLE mode and 0 otherwise. The coefficient is positive and significant, and its magnitude is consistent with the range of the SINGLE, DUAL, TRIPLE parameters reported in columns 1 and 2.

Table 7

ESTIMATION RESULTS: ALL EFIGE COUNTRIES

	DEPENDENT VARIABLE:					
	PRODt 1	*PRODv 2*	*PRODt 3*	*PRODv 4*	*PRODt 5*	*PRODv 6*
SINGLE	0.243***	0.105***				
	0.000	*0.000*				
DUAL	0.383***	0.155***				
	0.000	*0.000*				
TRIPLE	0.543***	0.196***				
	0.000	*0.000*				
GVC			0.322***	0.133***	0.395***	0.156***
			0.000	*0.000*	*0.000*	*0.000*
SUPPL	-0.047***	-0.022*	-0.053***	-0.024**	0.044	0.008
	0.002	*0.057*	*0.000*	*0.039*	*0.149*	*0.751*
INTE1 (GVC*SUPPL)					-0.123***	-0.039
					0.000	*0.133*
SIZE	-0.065*	-0.030	-0.105***	-0.041	-0.103***	-0.041
	0.050	*0.238*	*0.001*	*0.101*	*0.001*	*0.105*
AGE	0.045***	0.046***	0.052***	0.049***	0.052***	0.049***
	0.002	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
GROUP	0.213***	0.067***	0.231***	0.073***	0.230***	0.073***
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
FOREGROUP	0.295***	0.195***	0.306***	0.199***	0.307***	0.200***
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
FORECOMP	0.012	0.051***	0.027	0.057***	0.027	0.057***
	0.580	*0.002*	*0.199*	*0.001*	*0.206*	*0.001*
R&D	0.023	0.040***	0.046***	0.048***	0.046***	0.048***
	0.136	*0.001*	*0.004*	*0.000*	*0.003*	*0.000*
INNO	0.001	0.007	0.008	0.009	0.006	0.009
	0.972	*0.603*	*0.642*	*0.471*	*0.699*	*0.487*
TRAIN	0.073***	0.059***	0.077***	0.060***	0.077***	0.060***
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Observations	9,192	9,555	9,192	9,555	9,192	9,555
Model test	177.9	142.97	185.3	152.59	177.9	146.33
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
test (SINGLE, DUAL)	70.62	14.29				
	0.000	*0.000*				
test (DUAL, TRIPLE)	23.84	2.81				
	0.000	*0.094*				
test (SUPPL, INTE1)					13.05	3.24
					0.000	*0.039*
test (GVC, INTE1)					170.56	48.22
					0.000	*0.000*

Source: Authors' calculations on Egife data.

For the description of the variables see Table 5. In columns 1 (2), 3 (4) and 5 (6) the dependent variable is the average labour productivity, in log, computed on turnover (added value) in the years 2009-2014. Superscripts ***, ** and * denote statistical significance at the 1, 5 and 10 percent level, respectively. The *p*-values of the tests are given in italics. The standard errors (not reported) are robust to heteroskedasticity and autocorrelation. Constant and country and sector dummies (NACE 1.1) always included but not reported.

In the last two columns of Table 7, we add the interaction term INTE1 between the dummies GVC and SUPPL. The coefficient of this variable is negative and individually significant in column 5. Although SUPPL loses significance, INTE1 is jointly significant with each of its constituent terms (GVC and SUPPL) in both columns, as is shown by the *F*-tests (the last rows). This allows us to evaluate the impact of participation in GVCs for suppliers alone (summing the coefficients of GVC and INTE): it is positive and significant, although lower than for final firms.

Table 8 reports the results of the regression for Italian manufacturing firms.

In the first four columns we replicate the analysis performed for the whole sample. The results are notably similar, confirming that in the Italian case too firms' involvement in GVCs is correlated with higher productivity, and that, as the mode of internationalisation becomes more complex, the productivity gain increases. Again, suppliers lag behind, and in most cases controls are statistically significant.

To evaluate possible geographical peculiarities, we include the additional dummy SOUTH, taking value 1 for firms located in Southern Italy. Its coefficient always has the expected negative sign (but is highly significant only for *PRODt* specifications). In columns 5 and 6, the dummies SOUTH and GVC are interacted in the term INTE2. Although not significant alone, INTE2 is positive and jointly significant with each of its constituent terms (SOUTH and GVC) in both columns, as indicated by the F-tests in the last rows. This result indicates that the productivity gap afflicting Southern firms is sharply attenuated when the firm is part of a GVC. Moreover, the impact of GVC participation turns out to be greater for firms in the South than for those operating in the Centre or North.

Tables 9 and 10 show that our results are robust to replication in which firms are assigned to the various internationalisation modes by the method of Veugelers *et* al., (2013). Indeed, for both the entire sample and the Italian subsample the results are substantially identical to those of Tables 7 and 8.

Table 8

ESTIMATION RESULTS: ITALY

	DEPENDENT VARIABLE:					
	PRODt 1	*PRODv 2*	*PRODt 3*	*PRODv 4*	*PRODt 5*	*PRODv 6*
SINGLE	0.261***	0.090***				
	0.000	*0.003*				
DUAL	0.476***	0.168***				
	0.000	*0.000*				
TRIPLE	0.707***	0.233***				
	0.000	*0.000*				
GVC			0.378***	0.132***	0.321***	0.067
			0.000	*0.000*	*0.000*	*0.194*
SOUTH	-0.061**	-0.004	-0.078***	-0.010	-0.143*	-0.085
	0.031	*0.853*	*0.006*	*0.672*	*0.053*	*0.123*
INTE2 (GVC*SOUTH)					0.080	0.092
					0.316	*0.125*
SUPPL	-0.197***	-0.158***	-0.217***	-0.165***	-0.219***	-0.166***
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
SIZE	0.008	-0.107*	-0.065	-0.130**	-0.067	-0.133**
	0.903	*0.078*	*0.318*	*0.027*	*0.298*	*0.024*
AGE	0.081***	0.064***	0.088***	0.067***	0.088***	0.066***
	0.003	*0.003*	*0.001*	*0.002*	*0.001*	*0.003*
GROUP	0.144***	0.023	0.174***	0.033	0.174***	0.033
	0.001	*0.568*	*0.000*	*0.412*	*0.000*	*0.411*
FOREGROUP	0.189***	0.226***	0.215***	0.235***	0.216***	0.236***
	0.009	*0.000*	*0.003*	*0.000*	*0.003*	*0.000*
FORECOMP	-0.121***	-0.023	-0.099**	-0.015	-0.099**	-0.015
	0.009	*0.552*	*0.034*	*0.699*	*0.034*	*0.702*
R&D	0.035	0.068***	0.066**	0.079***	0.066**	0.079***
	0.226	*0.004*	*0.025*	*0.001*	*0.025*	*0.001*
INNO	0.020	0.049*	0.027	0.051**	0.027	0.051**
	0.514	*0.056*	*0.387*	*0.047*	*0.379*	*0.044*
TRAIN	0.080***	0.040	0.092***	0.044*	0.091***	0.043*
	0.009	*0.107*	*0.003*	*0.075*	*0.003*	*0.084*
Observations	2,810	2,769	2,810	2,769	2,810	2,769
Model test	37.66	20.06	37.63	20.71	35.83	19.92
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
test (SINGLE, DUAL)	49.31	10.36				
	0.000	*0.001*				
test (DUAL, TRIPLE)	13.75	1.39				
	0.000	*0.238*				
test (SOUTH, INTE2)					13.33	10.46
					0.000	*0.000*
test (GVC, INTE2)					57.52	13.00
					0.000	*0.000*

Source: Authors' calculations on Egife data.

For the description of the variables see Table 5. In columns 1 (2), 3 (4) and 5 (6) the dependent variable is the average labour productivity, in log, computed on turnover (added value) in the years 2009-2014. Superscripts ***, ** and * denote statistical significance at the 1, 5 and 10 percent level, respectively. The *p*-values of the tests are given in italics. The standard errors (not reported) are robust to heteroskedasticity and autocorrelation. Constant and sector dummies (NACE 1.1) always included but not reported.

TABLE 9

ROBUSTENESS CHECK: ALL EFIGE COUNTRIES

	DEPENDENT VARIABLE:					
	PRODt 1	*PRODv 2*	*PRODt 3*	*PRODv 4*	*PRODt 5*	*PRODv 6*
SINGLE	0.243***	0.083***				
	0.000	*0.000*				
DUAL	0.414***	0.140***				
	0.000	*0.000*				
TRIPLE	0.473***	0.148***				
	0.000	*0.000*				
GVC			0.303***	0.102***	0.348***	0.131***
			0.000	*0.000*	*0.000*	*0.000*
SUPPL	-0.056***	-0.019	-0.060***	-0.020	0.007	0.024
	0.001	*0.161*	*0.001*	*0.139*	*0.843*	*0.428*
INTE1 (GVC*SUPPL)					-0.080**	-0.053
					0.047	*0.118*
SIZE	-0.045	-0.027	-0.075**	-0.035	-0.074**	-0.035
	0.183	*0.297*	*0.022*	*0.177*	*0.023*	*0.182*
AGE	0.011	0.042***	0.015	0.044***	0.015	0.044***
	0.510	*0.002*	*0.395*	*0.001*	*0.399*	*0.001*
GROUP	0.191***	0.059***	0.211***	0.065***	0.212***	0.065***
	0.000	*0.003*	*0.000*	*0.001*	*0.000*	*0.001*
FOREGROUP	0.275***	0.179***	0.294***	0.183***	0.294***	0.184***
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
FORECOMP	0.021	0.062***	0.042*	0.069***	0.041*	0.068***
	0.350	*0.001*	*0.066*	*0.000*	*0.069*	*0.000*
R&D	-0.018	0.027*	0.000	0.033**	0.001	0.033**
	0.316	*0.062*	*0.995*	*0.025*	*0.967*	*0.023*
INNO	-0.016	0.007	-0.009	0.010	-0.010	0.010
	0.366	*0.604*	*0.615*	*0.481*	*0.602*	*0.485*
TRAIN	0.055***	0.056***	0.060***	0.057***	0.059***	0.057***
	0.001	*0.000*	*0.000*	*0.000*	*0.001*	*0.000*
Observations	6,366	6,741	6,366	6,741	6,366	6,741
Model test	117.0	90.1	121.3	96.8	116.3	92.9
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
test (SINGLE, DUAL)	72.56	13.60				
	0.000	*0.000*				
test (DUAL, TRIPLE)	1.93	0.06				
	0.165	*0.805*				
test (SUPPL, INTE1)					7.28	2.18
					0.001	*0.113*
test (GVC, INTE1)					111.16	18.60
					0.000	*0.000*

Source: Authors' calculations on EGIFE data.

For the description of the variables see Table 5. In columns 1 (2), 3 (4) and 5 (6) the dependent variable is the average labour productivity, in log, computed on turnover (added value) in the years 2009-2014. Superscripts ***, ** and * denote statistical significance at the 1, 5 and 10 percent level, respectively. The *p*-values of the tests are given in italics. The standard errors (not reported) are robust to heteroskedasticity and autocorrelation. Constant and country and sector dummies (NACE 1.1) always included but not reported.

Table 10

ROBUSTNESS CHECK: ITALY

	DEPENDENT VARIABLE:					
	PRODt 1	*PRODv 2*	*PRODt 3*	*PRODv 4*	*PRODt 5*	*PRODv 6*
SINGLE	0.281***	0.114***				
	0.000	*0.001*				
DUAL	0.499***	0.163***				
	0.000	*0.000*				
TRIPLE	0.600***	0.261***				
	0.000	*0.000*				
GVC			0.360	0.134	0.280***	0.073***
			0.000	*0.000*	*0.000*	*0.010*
SOUTH	-0.212***	-0.103**	-0.229***	-0.108**	-0.230***	-0.130**
	0.000	*0.041*	*0.000*	*0.032*	*0.000*	*0.015*
INTE2 (GVC*SOUTH)					0.048	0.089
					0.664	*0.468*
SUPPL	-0.052*	0.016	-0.063**	0.012	-0.051*	0.015
	0.092	*0.546*	*0.044*	*0.657*	*0.098*	*0.569*
SIZE	0.020	-0.099	-0.055	-0.128**	0.013	-0.110*
	0.772	*0.121*	*0.396*	*0.039*	*0.840*	*0.080*
AGE	0.050	0.063**	0.049	0.063**	0.063**	0.068**
	0.109	*0.018*	*0.118*	*0.016*	*0.046*	*0.010*
GROUP	0.137***	0.006	0.169***	0.019	0.157***	0.017
	0.005	*0.894*	*0.001*	*0.693*	*0.001*	*0.714*
FOREGROUP	0.148*	0.209***	0.145*	0.207***	0.160**	0.211***
	0.053	*0.002*	*0.056*	*0.002*	*0.035*	*0.001*
FORECOMP	-0.076*	0.023	-0.065	0.024	-0.066	0.026
	0.099	*0.557*	*0.167*	*0.543*	*0.154*	*0.498*
R&D	-0.013	0.053*	0.005	0.059**	-0.001	0.059**
	0.691	*0.057*	*0.889*	*0.036*	*0.982*	*0.037*
INNO	-0.018	0.027	-0.007	0.029	-0.016	0.027
	0.589	*0.350*	*0.831*	*0.320*	*0.640*	*0.353*
TRAIN	0.072**	0.043	0.079**	0.046	0.079**	0.047
	0.032	*0.135*	*0.019*	*0.106*	*0.020*	*0.101*
Observations	2,035	2,007	2,035	2,007	2,035	2,007
Model test	22.9	13.1	22.3	13.4	20.2	12.7
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
test (SINGLE, DUAL)	36.57	2.59				
	0.000	*0.108*				
test (DUAL, TRIPLE)	1.80	2.10				
	0.181	*0.148*				
test (SOUTH, INTE2)					8.12	3.04
					0.000	*0.048*
test (GVC, INTE2)					35.91	4.09
					0.000	*0.017*

Source: Authors' calculations on Egife data.

For the description of the variables see Table 5. In columns 1 (2), 3 (4) and 5 (6) the dependent variable is the average labour productivity, in log, computed on turnover (added value) in the years 2009-2014. Superscripts ***, ** and * denote statistical significance at the 1, 5 and 10 percent level, respectively. The *p*-values of the tests are given in italics. The standard errors (not reported) are robust to heteroskedasticity and autocorrelation. Constant and sector dummies (NACE 1.1) always included but not reported.

4. - Summary and Concluding Remarks

The global fragmentation of production and the expansion of GVCs have significantly changed both the nature of national comparative advantages ("It's not wine for cloth anymore", Grossman, Rossi-Hansberg, 2006) and the competitiveness of firms, which participate in the new international division of labour with different tasks (and different rewards). The "new normal" in the organization of production fully involves firms from developing and developed countries alike. The phenomenon is remarkable: the interconnectedness of economies has far-reaching consequences and carries major policy implications. Nevertheless, the serious lack of good statistical data at firm level has precluded comprehensive empirical studies. The result is that this remains an under-researched area, investigated only recently and by a relatively small number of studies.

In line with recent developments, we contribute to this strand of the literature by investigating the impact of Italian manufacturing firms' participation in and positioning along GVCs on their labour productivity in the period that followed the great recession, *i.e.* 2009-2014. Given the structural features of Italian industry, globalisation has been a major shock for Italian firms. Nevertheless, as various papers have observed, Italy's participation in GVCs is currently comparable to that of Germany and France, as gauged both by the share of foreign value added embodied in Italian exports and by the share of national value added embodied in partners' exports.

We have conducted an empirical inquiry using the EU-EFIGE dataset of 2010. Thanks to the availability of new balance-sheet data (for the years 2011-2014) for our sample firms, we can update existing knowledge in the empirical literature by analyzing the post-crisis performance of Italian firms involved in GVCs.

To take account of the diversity of modes associated with GVCs, we examine various modes of firms' participation in GVCs, corresponding to simpler or more complex international activities: exports only, intermediate goods imports only, exporting and importing both, and international production.

Our approach is new in two major respects that have tended to be neglected by empirical studies. First, on the assumption that a firm's positioning along the GVC is a relevant factor, we distinguish supplier firms, *i.e.* firms that sell 100% of their output to other firms, from firms that serve the end market. Supplier firms, the "dark" side of the international division of labour, usually depicted as suffering from a productivity discount (Razzolini, Vannoni, 2011), make up the bulk of the industrial structure in a number of countries – most notably Italy.

Second, we focus on the micro features of the Italian North-South divide, which emerges in the contrast between the performance of firms that are and are not inserted in GVCs located in the South and the Centre-North. The empirical evidence on this point is definitely scanty. Further inquiry is essential, given that the South has a third of Italy's population and a per capita income scarcely half that of the Center-North.

Our findings imply three main new conclusions. First, the participation of Italian firms in GVCs is the highest among the European countries we consider. However, this is good news only in part, inasmuch as: *i*) Italian firms more frequently take part with the least advanced mode (single), and in particular as pure exporters; *ii*) Italy's internationalised firms are overwhelmingly positioned as pure suppliers, unlike Germany's the majority of which are final firms. The low incidence of final firms highlights a salient feature of Italian industry generally, namely the lack of large key players – usually assemblers or buyers located in the downstream portion of the GVCs – that hold more secure and lucrative positions and govern the chain.

Second, turning to the international participation and positioning of Southern Italian firms, matters appear still worse. A third of them are not engaged in any kind of international activity and so depend solely upon domestic demand. Southern firms are accordingly the least well integrated into GVCs, and where they do participate they tend to be sub optimally positioned, preventing them from fully exploiting the opportunities of global market penetration. This finding is a matter of serious concern, in that GVC participation would appear to be a new and novel parameter characterising the historical North-South divide.

Third, our econometric investigation confirms the prevalent thesis of the literature, namely that GVC participation is associated with higher productivity. Furthermore, we find that productivity gains are ordered: the more advanced the firm's mode of GVC participation, the greater the productivity premium. This result is robust to different specifications of the model and is confirmed for Southern firms as well. The literature's prediction concerning GVC positioning also stands confirmed. Suppliers do suffer from a productivity gap compared with final market firms, but when participating in a GVC (typically, by producing for firms that operate abroad), they obtain a productivity premium comparable to that gained by final firms. This suggests a cumulative learning process associated with GVC participation.

Summing up, there can be no doubt that GVCs do offer significant opportunities to get a toehold in larger markets and engage in exchange with more ad-

vanced firms, including the multinationals, which often coordinate the chains. Yet the capacity to take advantage of this opportunity would appear to be limited for Italian industry in general and practically non-existent for many Southern manufacturers. At the two ends of the GVC spectrum, Italy has too many firms in the simple participation mode and too few in complex modes.

As the OECD has observed (OECD, 2007), the globalisation of value chains confronts economies with new challenges as well as opportunities and raises major policy challenges for the OECD countries. This is particularly true of Italy, whose external competitiveness seems to depend on the strong performance of a "happy few" suppliers and final firms (Mayer, Ottaviano, 2007), too few to trigger powerful productivity growth at aggregate level. In order to expand the extensive margins of the firms that can face the global markets, at least two complementary sets of policies are required. For SMEs, uncertainty and information asymmetries in export and import markets are serious obstacles, especially in relation to the complex modes of internationalisation. Hence, public policy needs to facilitate the flow of specific export-import information and foster the diffusion of knowledge about foreign markets. This should be complemented by financial and fiscal incentives for SMEs to cooperate – for example, through formalized networks of firms – which would help create the critical mass required to bear the sunk costs of penetrating foreign markets. In addition, both to facilitate SMEs' links to GVCs and to increase the number of major assembler and buyer firms operating in Italy, policies to attract foreign direct investment would be fruitful in the light of the role played by large firms and multinationals within GVCs. What is required if such measures are to have an adequate impact on the economic system is no secret, and the want of it has long been felt: an institutional arrangement guaranteeing sufficient resources and a medium-period timeframe; simple, certain rules for firms; and stable institutional interlocutors. Finally, good quality micro data are badly needed to support specific policy design and to permit the assessment of policies' effectiveness.

BIBLIOGRAPHY

Accetturo A. - Giunta A. (2016), «Value Chains and the Great Recession: Evidence from Italian and German Firms», Banca d'Italia, Questioni di Economia e Finanza, *Occasional Papers*, no. 304, Rome.

Accetturo A. - Giunta A. - Rossi S. (2012), «Being in a Global Value Chain: Hell or Heaven?», *VoxEu,* December 15.

Accetturo A. - Linarello A. - Petrella A. (2016), «Legal Enforcement and Global Value Chains: Micro-Evidence from Italian Manufacturing», in Banca d'Italia, *Global Value Chains: New Evidence and Implications,* Seminari e Convegni, no. 21, pp. 269-289.

Agostino M. - Giunta A. - Nugent J.B. - Scalera D. - Trivieri F. (2015), «The Importance of Being a Capable Supplier: Italian Industrial Firms in Global Value Chains», *International Small Business Journal*, vol. 33, no. 7, pp. 708-730.

Agostino M. - Giunta A. - Scalera D. - Trivieri F. (2016), «Imports, Productivity and Global Value Chains: A European Firm-Level Analysis», manuscript, downloadable from *http://www.etsg.org/ETSG2016/Papers/102.pdf*

Alessandria G. - Kaboski J.P. - Midrigan V. (2011), «US Trade and Inventory Dynamics», *American Economic Review*, vol. 101, no. 3, May, pp. 303-307.

Al-Haschimi A. - Gächter M. - Lodge D. - Steingress W. (2016), «The Great Normalisation of Global Trade», *VoxEu.org*, October 14.

Altomonte C. - Di Mauro F. - Ottaviano G. - Rungi A. - Vicard V. (2012), «Global Value Chains during the Great Trade Collapse. A Bullwhip Effect», European Central Bank, *Working Paper*, no. 1412.

Amador J. - Cabral S. (2015), «Global Value Chains, Labour Markets and Productivity», in Amador J. - di Mauro F. (eds)*, The Age of Global Value Chains: Maps and Policy Issues*, *VoxEU.org*, eBook, CEPR Press, pp. 108-120.

Amador J. - Cappariello R. - Stehrer R. (2015), «Foreign Value Added in Eurozone Exports», in Amador J. - di Mauro F. (eds), *The Age of Global Value Chains: Maps and Policy Issues*, *VoxEU.org*, eBook, CEPR Press, pp. 24-35.

Amador J. - di Mauro F. (2015), «The Age of Global Value Chains: Maps and Policy Issues», *VoxEU.org*, eBook, CEPR Press.

Baldwin J. - Yan B. (2014), «Global Value Chains and the Productivity of Canadian Manufacturing Firms», *Economic Analysis Research Paper Series*, Statistics Canada, Ministry of Industry.

Baldwin R. (2009), «The Great Trade Collapse: Causes, Consequences and Prospects», *VoxEU.org*.

Baldwin R. - Venables A. (2013), «Spiders and Snakes: Offshoring and Agglomeration in the Global Economy», *Journal of International Economics*, vol. 90, pp. 245-254.

Bekes G. - Halpern L. - Koren M. - Murakozy B. (2011), «Still Standing: How European Firms Weathered the Crisis», *The Third EFIGE Policy Report*, Blueprint, no. 15, Bruegel.

Bems R. - Johnson R.C. - Yi K.M. (2010), «The Role of Vertical Linkages in the Propagation of the Global Downturn of 2008», *IMF Economic Review*, vol. 58, no. 2, pp. 295-326.

Bernard A.B. - Jensen J.B (1999), «Exceptional Exporter Performance: Cause, Effect, or Both?», *Journal of International Economics*, vol. 47, no. 1, pp. 1-25.

Brancati E. - Brancati R. - Maresca A. (2015), *Global Value Chains, Innovation and Performance: Firm-Level Evidence from Italy*, mimeo.

Bussière M. - Callegari G. - Ghironi F. - Sestieri G. - Yamano N. (2013), «Estimating Trade Elasticities: Demand Composition and the Trade Collapse of 2008-2009», *American Economic Journal, Macroeconomica*, vol. 5, no. 3, pp. 118-151.

Cappariello R. - Felettigh A. (2015), «How Does Foreign Demand Activate Domestic Value Added? A Comparison among the Largest Euro-Area Economies», in Banca d'Italia, *Temi di Discussione*, no. 1001, reprinted in Banca d'Italia, *Global Value Chains: New Evidence and Implications*, Seminari e Convegni, no. 21, 2016, pp. 3-31.

Cherubini L. - Los B. (2016), «Regional Employment Patterns in a Globalizing World: A Tale of Four Italies», in Banca d'Italia, *Global Value Chains: New Evidence and Implications*, Seminari e Convegni, Banca d'Italia, Rome, no. 21, pp. 213-235.

Constantinescu C. - Mattoo A. - Ruta M. (2015), «Explaining the Global Trade Slowdown», *VoxEu.org*, January 18.

Costinot A. - Vogel J. - Wang S. (2013), «An Elementary Theory of Global Supply Chains», *Review of Economic Studies*, vol. 80, pp. 109-144.

De Backer K. - Miroudot S. (2014), «Mapping Global Value Chains», European Central Bank, *Working Paper Series*, May, no. 1677.

Dell'agostino L. - Nenci S. (2016), «Il modello di specializzazione della manifattura italiana alla luce dei nuovi dati in valore aggiunto», in Ice, *Rapporto Ice 2015-16. L'Italia nell'economia internazionale*, Roma.

De Loecker J. (2007), «Do Exports Generate Higher Productivity? Evidence from Slovenia», *Journal of International Economics*, vol. 73, pp. 69-98.

Ferrantino M. - Taglioni D. (2014), «Global Value Chains in the Current Trade Slowdown», *VoxEu.org*, April 6.

Formai S. - Vergara Caffarelli F. (2015), «Quantifying the Productivity Effects of Global Value Chains», Cambridge, *Working Paper in Economics*, no. 1564, reprinted in Banca d'Italia, *Global Value Chains: New Evidence and Implications*, Seminari e Convegni, no. 21, 2016, pp. 157-184.

Gereffi G. - Humphrey J. - Sturgeon T. (2005), «The Governance of Global Value Chains», *Review of International Political Economy*, vol. 12, no. 1, pp. 78-114.

Giannola A. - Petraglia C. - Scalera D. (2016), «Net Fiscal Flows and Interregional Redistribution in Italy: A Long-Run Perspective (1951-2010)», *Structural Change and Economic Dynamics*, vol. 39, pp. 1-16.

Giovannetti G. - Marvasi E. - Sanfilippo M. (2015), «Supply Chains and the Internationalization of SMEs: Evidence from Italy», *Small Business Economics*, vol. 44, pp. 845-865.

Giunta A. - Nifo A. - Scalera D. (2012*),«*Subcontracting in Italian Industry. Labour Division, Firm Growth and the North-South Divide», *Regional Studies*, vol. 46, no. 8, pp. 1067-1083.

Grossman G.M. - Rossi-Hansberg E. (2006), «Trading Tasks: A Simple Theory of Offshoring», MIT Press, *NBER Working Paper*, no. 12721.

Helpman E. - Melitz M. - Yeaple S. (2004), «Exports versus FDI with Heterogeneous Firms», *American Economic Review*, vol. 94, pp. 300-316.

Humphrey J. - Schmitz H. (2002), «How Does Insertion in Global Value Chains Affect Upgrading in Industrial Clusters?», *Regional Studies*, vol. 36, no. 9, pp. 1017-1027.

Kasahara H. - Lapham B. (2013), «Productivity and the Decision to Import and Export: Theory and Evidence», *Journal of International Economics*, vol. 89, no. 2, pp. 297-316.

Koopman R. - Powers W. - Wang Z. - Wei S. (2011), «Give Credit Where Credit is Due: Tracing Value-Added in Global Production Chains», *NBER Working Paper*, no. 16426.

Mayer T. - Ottaviano G. (2007), *The Happy Few: The Internationalisation of European Firms. New Facts Based on Firm-Level Evidence*, Blueprint, no. 3, Bruegel.

Mazzeo E. (2016), «L'internazionalizzazione commerciale delle imprese italiane», in Ice, *Rapporto Ice 2015-16. L'Italia nell'economia internazionale*, Rome.

Melitz M.J. (2003), «The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity», *Econometrica*, vol. 71, no. 6, pp. 1695-1725.

Miroudot S. - Ragoussis A. (2009), «Vertical Trade, Trade Costs and FDI», OECD Publishing, Paris, Trade Policy, *Working Papers*, no. 89.

Oecd (Organisation for Economic Cooperation and Development) (2007), *Structural Adjustment and Economic Performance*, OECD Publishing, Paris.

-.- (2012), *Mapping Global Value Chains*, OECD Publishing, Paris.

-.- (2015), *The Future of Productivity*, OECD Publishing, Paris.

Razzolini T. - Vannoni D. (2011), «Export Premia and Subcontracting Discount: Passive Strategies and Performance in Domestic and Foreign Markets», *World Economy*, vol. 34, no. 6, pp. 984-1013.

Svimez (2016), *Rapporto Svimez 2016 sull'economia del Mezzogiorno*, Il Mulino, Bologna.

Veugelers R. (2013)*, Manufacturing Europe's Future*, Bruegel Blueprint Series, Volume XXI.

Veugelers R. - Barbiero F. - Blanga-Gubbay M. (2013), «Meeting the Manufacturing Firms Involved in GVCs», in Veugelers R. (ed.), *Manufacturing Europe's future*, Bruegel Blueprint Series, vol. XXI, pp. 108-138.

Yi K.M. (2009), «The Collapse of Global Trade: The Role of Vertical Specialisation», in Baldwin R. - Evenett S. (eds), *The Collapse of Global Trade, Murky Protectionism, and the Crisis: Recommendations for the G20*, pp. 45-48, *VoxEU.org*.

Comparative Advantage and Centrality in the World Network of Trade and Value Added: An Analysis of the Italian Position

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We examine Italy's market share on exports over time and its relation with countries' position in the World Trade Network (WTN). By means of network analysis, we assess Italy's position in overall world trade and in two different sectors of comparative advantage, placing emphasis on the network of trade partners of Italy. We focus on centrality indices, using both Italy's gross export flows and flows measuring domestic value added. The computed centrality measures help to explain sectoral export performance, and to assess Italian position in the WTN giving evidence on how Italy is increasing its distance from the world markets.
[JEL Classification: C02; F10; F14].

Keywords: Italy; comparative advantages; global value chains; trade in value added; network analysis.

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1. - Introduction

Italians are merchants (Kindleberger, 1996). They produced, bought and sold goods around the world for centuries. They did it, and they still do it in many countries and in many sectors. But between the 1980s and the 1990s many Italian trade economists started to be convinced that Italians were, at that time, producing, buying and selling the wrong kind of goods and that the Italian model of trade specialization was at best inappropriate to sustain the economic growth of the country (see Onida, 1978; Modiano, 1982; De Nardis and Traù, 1999, on this debate).[1] The question was not a moot point considering the dynamics of Italy's export displayed in Graph 1, showing the long-term pattern of Italy's world market share together with other relevant exporters in the world market.[2] From an initial world trade share of 2.5% in 1950, Italy did rapidly increase its export participation to international markets at the remarkable rate of more than 3% per year, reaching a share over 4% in the early 1970s. However, after the First Oil crisis, the Italian market share flattened out, and between 1973 and 1995 the Italian share of world exports oscillated around a horizontal drift, at a level of 4.5%. From 1995 onwards, Italian trade shares declined, reaching the 2.8% of the 2010s, and this new trend renovated the worrisome concerns emerged in the debate of the 1980s.

The inverted-U shape of Italian trade shares can be taken as a reference to delimit the three phases that characterize also the evolution of other countries' participation to international trade in the last sixty years.

In the first phase, that goes from the end of World War II to the first half of the 1970s, European countries regained international market shares to the United States, while China's trade dynamics was essentially null, and its export participation was mediated by Macao, Hong Kong and Taiwan. Germany's exports grew at a much faster pace than the ones of Italy, reaching a world trade share of 13%.

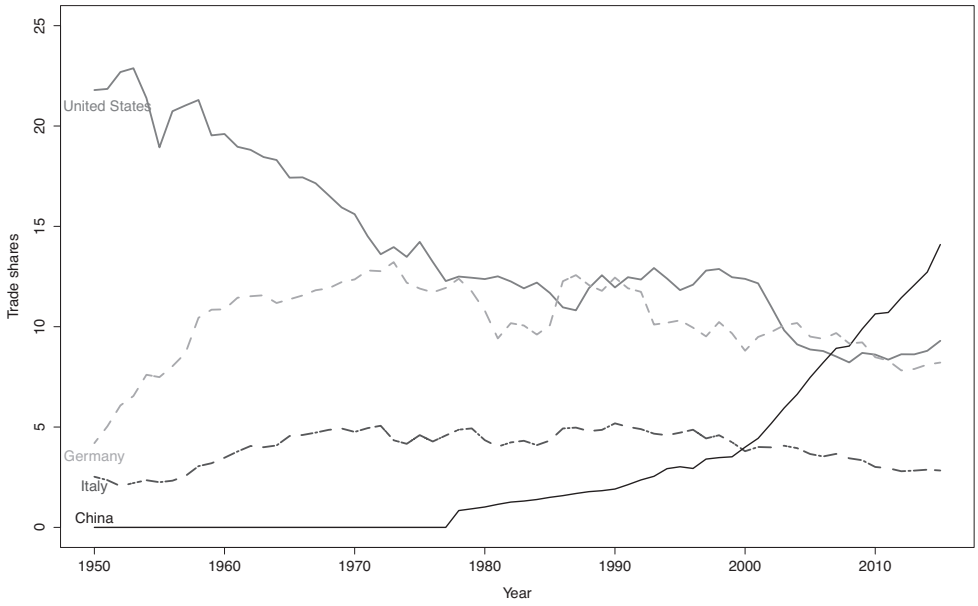
The second phase, running along the twenty years between the mid-seventies and the mid-nineties, is a phase of relative trade stability for Italy, Germany and the US. Their trade shares were around 4.7%, 10.3% and 11.8%, respectively. On the other hand, China started its remarkable export grow during these years.

[1] See also De Nardis S., Traù F. (2005) and De Benedictis L. (2005) for a review of the debate on the structure of sectoral specialization in Italy.

[2] The export market share by itself gives only limited information of the performance of a country in international markets, as it does not take into account many factors, such as the use of different forms of firms' internationalization, changes in other countries' market shares, relative and marginal effects of trade resistances (Anderson L.E., van Wincoop E., 2003). Therefore, the trends in the picture must be interpreted with all the necessary *caveat* applying.

Graph 1

LONG-TERM TRENDS IN EXPORT MARKET SHARES



Source: our elaboration on Imf Directions of Trade Statistics.

The third phase marks the contraction of export shares for Italy, Germany and the US and the large expansion of Chinese shares, which now reach 14.1% of world exports.

The literature of the 1980s ascribed the changes in Italian market shares, to the peculiar Italian model of trade specialization (De Benedictis, 2005), put under stress by the integration of the European market, the sudden change in the exchange rate regime, and the emergence of new international competitors, especially in Asia. The literature of the 2010s emphasizes instead the crucial role of firms' productivity in its relation with the export status of firms (Castellani, Serti,Tomasi, 2010), together with their capacity to adapt to the changing world markets, and to benefit from the opportunities arising from the international fragmentation of production (IFP) and the creation of global value chains (GVCs).

In this paper we offer a view on the evolution of the Italian model of trade specialization based on the analysis of the structure of Italian comparative advantages through the lenses of network analysis. To give account of role played by

global value chains in influencing the production structure of countries, we compare the information on Italian comparative advantages obtained using gross trade values, from the UN Comtrade database, and value added trade, from the WIOD database (Timmer *et* al., 2015). Our goal is not to identify one unique causal explanation to the dynamics of Italian export shares, but to complement previous discussions with an analysis of the structural dimension of Italian trade.

The rest of the paper is organized as follows: in Sect. 2 we examine Italy's comparative advantages over time using the traditional Balassa indicator, comparing what emerges with an analogous index computed using only the domestic value added content of exports. In Sect. 3 we illustrate which additional insights can be obtained considering the changes occurred in Italy's position in the world trade network (WTN), and especially in its centrality. In Sect. 4 we examine the structure of trade in value added in two of Italy's main sectors of comparative advantage to understand if this can shed light on the changes occurred in Italy's model of specialization. Finally, Sect. 5 concludes.

2. - Evolution of Italy's Comparative Advantages

2.1 *A Stable Model of Specialization?*

We evaluate the evolution of Italian comparative advantages focusing on one particular year for each of the three phases previously described: 1965, 1995, 2011. These specific years were selected as representative of the dynamics of Italian market shares in each phase and for comparability reasons with data in value added, which is available only for 2011 as the last year included in the WIOD database.

For each of these years we obtained from the UN Comtrade database the gross values of Italian and World exports, X_i and X_w, for the 67 sectors , s = 1, 2, …, 97, of the SITC rev.2 nomenclature. Then, we calculated, for Italy, the share of each sector on total Italian exports (domestic share), X_i^s/X_i, the share of each sector on world sectoral exports (world share), X_i^s/X_w^s, and the Balassa (1965) index of Revealed Comparative Advantages (RCA), $(X_i^s/X_i)/(X_w^s/X_w)$. All variables are included in Table 1.

Table 1

ITALIAN TRADE AND COMPARATIVE ADVANTAGES

SITC rev.2	Sector	1965 Domestic share X_i^s/X_i	1965 World share X_i^s/X_w^s	1965 RCA $(X_i^s/X_i)/(X_w^s/X_w)$	1995 Domestic share X_i^s/X_i	1995 World share X_i^s/X_w^s	1995 RCA $(X_i^s/X_i)/(X_w^s/X_w)$	2011 Domestic share X_i^s/X_i	2011 World share X_i^s/X_w^s	2011 RCA $(X_i^s/X_i)/(X_w^s/X_w)$
0	Live animals	0.01	0.06	0.01	0.02	0.43	0.09	0.01	0.21	0.07
1	Meat and meat preparations	0.30	0.69	0.15	0.40	1.94	0.40	0.63	2.35	0.81
2	Dairy products and eggs	0.55	1.90	0.43	0.38	2.85	0.59	0.59	3.71	1.27
3	Fish and fish preparations	0.04	0.22	0.05	0.15	0.75	0.16	0.15	0.65	0.22
4	Cereals and cereal preparations	1.56	1.68	0.38	1.00	3.98	0.83	1.09	3.09	1.06
5	Fruit and vegetables	7.64	13.52	3.03	2.13	7.10	1.48	1.85	4.59	1.58
6	Sugar, sugar preparations and honey	0.05	0.39	0.09	0.09	1.21	0.25	0.08	0.80	0.27
7	Coffee, tea, cocoa, spices, manufacs. thereof	0.19	0.41	0.09	0.35	2.58	0.54	0.57	2.92	1.00
8	Feed. stuff for animals excl. unmilled cereals	0.15	0.87	0.20	0.10	1.09	0.23	0.14	1.05	0.36
9	Miscellaneous food preparations	0.13	2.52	0.56	0.32	3.92	0.82	0.59	4.69	1.61
11	Beverages	1.03	6.15	1.38	1.20	8.61	1.80	1.60	8.66	2.98
12	Tobacco and tobacco manufactures	0.13	0.79	0.18	0.09	0.83	0.17	0.06	0.78	0.27
21	Hides, skins and furskins, undressed	0.18	1.38	0.31	0.04	1.42	0.30	0.06	2.43	0.83
22	Oil seeds, oil nuts and oil kernels	0.01	0.05	0.01	0.00	0.06	0.01	0.03	0.21	0.07
23	Crude rubber including synthetic and reclaimed	0.32	1.58	0.35	0.05	0.86	0.18	0.11	0.78	0.27
24	Wood, lumber and cork	0.04	0.13	0.03	0.13	0.86	0.18	0.08	0.72	0.25
25	Pulp and waste paper	0.03	0.14	0.03	0.01	0.09	0.02	0.08	0.86	0.29
26	Textile fibres, not manufactured, and waste	1.14	1.63	0.36	0.14	1.32	0.28	0.08	0.86	0.30
27	Crude fertilizers and crude minerals, nes	0.64	3.39	0.76	0.21	3.43	0.71	0.22	2.89	0.99
28	Metalliferous ores and metal scrap	0.18	0.34	0.08	0.12	0.65	0.13	0.33	0.44	0.15
29	Crude animal and vegetable materials, nes	0.74	4.78	1.07	0.29	3.60	0.75	0.29	3.37	1.16
32	Coal, coke and briquettes	0.05	0.22	0.05	0.01	0.12	0.03	0.04	0.13	0.05
33	Petroleum and petroleum products	5.35	4.15	0.93	1.26	1.30	0.27	4.77	0.99	0.34
34	Gas, natural and manufactured	0.05	1.63	0.36	0.02	0.21	0.04	0.10	0.13	0.05
35	Electric energy	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.95	0.33

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continued TABLE 1

SITC rev.2	Sector	1965 Domestic share X_i^s/X_i	1965 World share X_i^s/X_w^s	1965 RCA $(X_i^s/X_i)/(X_w^s/X_w)$	1995 Domestic share X_i^s/X_i	1995 World share X_i^s/X_w^s	1995 RCA $(X_i^s/X_i)/(X_w^s/X_w)$	2011 Domestic share X_i^s/X_i	2011 World share X_i^s/X_w^s	2011 RCA $(X_i^s/X_i)/(X_w^s/X_w)$
41	Animal oils and fats	0.04	0.68	0.15	0.02	1.95	0.41	0.03	2.66	0.92
42	Fixed vegetable oils and fats	0.13	0.98	0.22	0.37	4.39	0.91	0.42	2.41	0.83
43	Animal and vegetable oils and fats, processed	0.03	1.01	0.23	0.04	1.81	0.38	0.04	1.41	0.49
51	Organic chemicals	3.15	5.12	1.14	1.47	3.04	0.63	1.14	1.42	0.49
52	Inorganic chemicals	0.00	0.25	0.06	0.23	1.67	0.35	0.46	2.07	0.71
53	Dyeing, tanning and coloring materials	0.23	1.69	0.38	0.50	3.75	0.78	0.62	4.18	1.44
54	Medicinal and pharmaceutical products	0.84	3.63	0.81	1.60	5.07	1.06	4.05	4.18	1.44
55	Perfume materials, toilet & cleansing preptions	0.42	4.00	0.89						
56	Fertilizers, manufactured	1.14	6.88	1.54	0.02	0.37	0.08	0.07	0.49	0.17
57	Explosives and pyrotechnic products	0.05	2.93	0.66	0.01	1.45	0.30	0.01	0.94	0.32
58	Plastic materials, etc.	2.10	7.85	1.76	2.60	5.15	1.07	2.73	3.48	1.20
59	Chemical materials and products, nes	0.52	2.13	0.48	0.86	3.65	0.76	1.24	3.15	1.08
61	Leather, leather. manufs., nes, dressed fur skins	0.62	6.63	1.48	1.76	17.38	3.62	1.29	17.07	5.87
62	Rubber manufactures, nes	1.06	7.36	1.65	1.08	6.17	1.29	1.04	3.49	1.20
63	Wood and cork manufactures excluding furniture	0.75	5.81	1.30	0.43	3.28	0.68	0.36	2.95	1.02
64	Paper, paperboard and manufactures thereof	0.67	1.49	0.33	1.72	3.94	0.82	1.59	4.18	1.44
65	Textile yarn, fabrics, made up articles, etc.	8.86	7.87	1.76	5.65	7.95	1.66	2.95	4.91	1.69
66	Non metallic mineral manufactures, nes	2.16	4.54	1.02	3.80	8.48	1.77	2.28	3.55	1.22
67	Iron and steel	5.09	4.48	1.00	3.70	5.80	1.21	5.17	5.07	1.74
68	Non-ferrous metals	1.50	1.87	0.42	1.12	2.69	0.56	1.81	2.30	0.79
69	Manufactures of metal, nes	3.16	6.48	1.45	4.00	8.42	1.76	3.99	5.65	1.94
71	Power generating machinery and equipment	14.42	5.68	1.27	2.03	3.93	0.82	3.08	3.99	1.37
72	Machinery specialized for particular industries	5.98	5.06	1.13	7.28	10.03	2.09	6.18	6.72	2.31
73	Metalworking machinery				1.42	8.34	1.74	1.49	8.79	3.02
74	Gen. industrial machinery & eq., parts, nes				7.92	9.27	1.93	9.83	7.99	2.75
75	Office machines and autom. data processing eq.				2.33	2.14	0.45	0.67	0.57	0.20
76	Telecommunications, sound rec and reproducing eq.			1.17	1.40	0.29	0.96	0.71	0.24	

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continued Table 1

SITC rev.2	Sector	1965 Domestic share X_i^s/X_i	1965 World share X_i^s/X_w^s	1965 RCA $(X_i^s/X_i)/(X_w^s/X_w)$	1995 Domestic share X_i^s/X_i	1995 World share X_i^s/X_w^s	1995 RCA $(X_i^s/X_i)/(X_w^s/X_w)$	2011 Domestic share X_i^s/X_i	2011 World share X_i^s/X_w^s	2011 RCA $(X_i^s/X_i)/(X_w^s/X_w)$
77	Electric machinery, apparatus and appliances,parts				6.33	3.31	0.69	5.06	1.89	0.65
78	Road vehicles	9.84	4.96	1.11	8.40	4.39	0.92	7.00	2.82	0.97
79	Other transport equipment				1.34	2.72	0.57	2.20	3.00	1.03
81	Sanitary, plumbing, heating and lighting fixt.	0.38	6.79	1.52	0.96	14.54	3.03	0.74	7.61	2.62
82	Furniture	0.51	7.09	1.59	3.66	18.14	3.78	2.31	7.81	2.69
83	Travel goods, handbags and similar articles	0.35	15.71	3.52	0.69	10.55	2.20	1.07	10.15	3.49
84	Clothing	5.90	16.00	3.58	6.25	8.93	1.86	4.63	5.38	1.85
85	Footwear	2.93	31.67	7.09	3.22	17.88	3.73	2.06	9.89	3.40
86	Scientif. control instrum, photogr gds, clocks	1.33	3.29	0.74	1.09	3.09	0.64	1.33	1.77	0.61
89	Miscellaneous manufactured articles, nes	4.10	7.01	1.57	5.52	6.39	1.33	4.23	3.55	1.22
93	Special transact. not class. according to kind	0.00	0.00	0.00	0.87	1.57	0.33	2.17	1.63	0.56
94	Animals, nes, incl. zoo animals, dogs and cats	0,00	0.80	0.18	0.00	1.06	0.22	0.00	1.72	0.59
95	Firearms of war and ammunition therefor	1.21	9.79	2.19	0.04	1.52	0.32	0.05	2.64	0.91
96	Coin, other than gold coin, not legal tender	0.00	0.01	0.00	0.00	4.37	0.91	0.00	1.58	0.54
97	Gold, non-monetary, excluding gold ores				0.03	0.37	0.08	1.67	3.50	1.20
	TOTAL	100	4.47	1	100	4.80	1	100	2.91	1

Source: our elaboration on UN Comtrade database.

In 1965, Italy was still largely an agricultural country, 7.64% of its exports were in Fruits and Vegetables (13.52% of world sectoral exports), produced especially in the South of the country. In the North, the prominent Road vehicles sector (9.84% of Italian exports) and a Power generating machinery sector (14.42%) typify the industrial development of the country. The heritage of mediaeval and Renaissance handicraft emerged as a distinct industrial structure in medium-size cities of the North-East and the Center of the country, through the spread of Marshallian districts (Becattini, 1999) characterized by small firms exporting Textiles, Leather products, Clothing and Footwear, that together with other sectors producing design-goods defines the set of consumers' goods labeled and characterized as "Made in Italy".

The Italian sectoral specialization, the one that prevailed in the first twenty years of the postwar period, can be sketched through the RCA index in 1965: sectors with a RCA > 1 (a.k.a. $X_i^s/X_i > X_w^s/X_w$) are the ones which reveal a comparative advantage. As an example, in the case of Footwear 31.67% of world exports were made of Italian shoes, and the Italian domestic share (the numerator of the RCA index) was a little bit more than 7 times the world sectoral share (the denominator of the RCA index).

In 1995, the export landscape changed. Some sectors become so marginal at world level to disappear from the SITC classification (e.g. Perfume materials) and others acquired a new specific status in the classification (e.g. Other transport equipment). In Italy, the agricultural sector reduces its relevance and, as an example, the Fruit and vegetables sector reduces its share both at the domestic and at the world level. The "Made in Italy" compartment constitutes the backbone of the Italian model of trade specialization, together with the newly expanded mechanical sectors (e.g. SITC codes 71-77), reaching almost a quarter of the entire Italian export. The overall picture is multifaceted: some of the traditional sectors grew, like Leather (from 6.63% to 17.38% of world shares) and Furniture (from 7.09% to 18.14%); others shrunk, like Footwear (from 31.67% to 17.88%), or Clothing (from 16% to 8.93%), depending on local elements such as the evolving characteristics of industrial districts, or global ones, such as the booming of vertical integration, IFP and offshoring.

In 2011, the agricultural and agri-food sectors present a new diversified conformation: SITC sectors 2, 4, 5, 9, 11 confirm or acquire a RCA > 1. The presence of multinational firms favors the positive development, started in the 1990s, of a Medicinal and pharmaceutical products sector. At the same time, the Italian model of trade specialization confirms a very high degree of persistence (De Benedictis

and Tamberi, 2004), having its peculiarity on the existence of an elliptical structure with two focal points: the "Made in Italy" compartment and the Mechanical compartment, a structure which is more similar to the one of emerging economies that to the one of OECD countries with a similar level of income *per capita*.

This traditional analysis of Italian comparative advantages requires to be complemented on two different domains: the metric used and the account of the changes in the structure of the trade network.

2.2 *Revealed Comparative Avantages in Value Added*

A key feature of international trade patterns in the last decades is the development of international production chains stretching across different countries, where the various production phases and the creation of value added for a given final good is taking place in different locations. As a consequence of the growing relevance of trade in intermediate goods, directly related to the expansion of IFP and embodied in final goods, the observation of gross export values is less indicative of the actual comparative advantages of a country than in a context where only final goods are traded. This occurs because of double counting (some parts of goods can cross the border of a given country more than once) and because the domestic contribution to export can be overstated. This phenomenon has been studied extensively in the recent trade literature in order to understand how the shift from trade in final goods to this "vertical trade" affected the trade patterns and specialization of countries (Deardorff, 2001; Hummels *et* al., 2001; Yi, 2003; Johnson and Noguera, 2012), and it led scholars to partially revise the traditional measures of trade flows across countries and the related indexes of comparative advantage (Deardorff, 2005; Baldone *et* al., 2007; Stehrer, 2012; Koopman *et* al., 2014).

The matter is not only a measurement issue. This international reorganization of production can allow countries to modify and improve their competitiveness. Higher competitiveness through IFP can be reached through cost and, therefore, price reduction (Deardorff, 2001); it can arise through technological improvements or factors' productivity enhancement (Grossman and Rossi-Hansberg, 2008; Halpern *et* al., 2011) and through the quality of intermediate inputs and components from abroad incorporated in a country's final product. Therefore, the reorganization of production by means of IFP could have helped Italy to preserve its traditional comparative advantages (see Baldone *et* al., 2002).

But there can be also negative effects related to the adoption of IFP. In fact, a large gross export flow can generate a small effect on national income if the

amount of domestic value added embodied in exports is trivial. In a context where IFP is widespread, in order to assess the specialization model for a country, it is not enough to consider the structure of its gross exports, but it is important also to understand in which sectors value added, and therefore income, is generated. A country may present a revealed comparative advantage in a sector using a measure based on gross trade, but that advantage might be originated by foreign imported inputs and produce a small effect on the domestic economy.

It is therefore useful to assess whether the structure of comparative advantages emerging from the traditional trade measures is confirmed by an analysis undertaken using only the domestic value added embodied in exports to measure comparative advantages. This can be done using recent datasets based on inter-country input-output tables and accounting decomposition methodologies developed originally by Koopman *et* al. (2014).

In a recent paper, Dell'Agostino and Nenci (2016) analyze the Italian specialization pattern in trade comparing the Revealed Comparative Advantage index computed both in terms of gross exports and in terms of domestic value added in export. As usual, the RCA index is calculated as reported in Table 1. In the calculation using value added, only the domestic value added produced in sector *s* and embodied in exports (directly and indirectly, by the same sector or in export from other sectors) is used at the numerator, while the world value added at the denominator excludes double-counting.[3] Therefore, the index computed using value added in exports should capture the relative strength of sector*s* in producing and exporting, directly or indirectly, the value added generated in that sector.

[3] The number of sectors included in the WIOD database is far more limited than the one of UN Comtrade. See Dell'Agostino L., Nenci S. (2016) for details.

Table 2

RCA INDICATORS IN VALUE ADDED AND GROSS VALUE FOR THE ITALIAN MANUFACTURING SECTORS

ISIC rev. 3 code	Sectors	RCA in value added			RCA in gross value		
		1995	2007	2011	1995	2007	2011
19	Leather, leather products and footwear	2.436	2.273	2.565	4.181	4.525	4.831
29	Machinery, not elsewhere classified	1.813	2.040	2.030	2.130	2.419	2.454
36, 37	Manufacturing, not elsewhere classified *(a)*; recycling	2.175	1.621	1.571	2.384	1.618	1.384
27, 28	Basic metals and fabricated metal	1.304	1.378	1.457	1.123	1.389	1.608
17, 18	Textiles and textile products	1.703	1.632	1.454	1.920	1.813	1.513
21, 22	Pulp, paper, printing and publishing	1.064	1.227	1.345	0.637	0.784	0.862
24	Chemicals and chemical products	0.847	1.043	1.245	0.812	0.961	1.075
26	Other non-metallic mineral	1.296	1.123	1.086	2.623	2.279	2.086
25	Rubber and plastics	1.237	1.068	1.066	1.920	1.519	1.481
15, 16	Food, beverages and tobacco	0.768	0.953	1.041	0.778	1.026	1.137
34, 35	Transport equipment	0.813	0.898	0.932	0.791	0.919	0.896
20	Wood and products of wood and cork	0.750	0.764	0.812	0.553	0.705	0.764
30-33	Electrical and optical equipment *(b)*	0.567	0.629	0.591	0.549	0.537	0.553
23	Coke, refined petroleum and nuclear fuel	0.460	0.400	0.349	0.633	0.835	0.852

Source: Dell'Agostino L. and Nenci S. (2016) calculations on WIOD data, 1st release.
Note: Sectors listed by the decreasing value of the RCA value added in 2011; *(a)* It includes furniture; *(b)* It includes computers and office equipment, radios, televisions and telecommunication equipment.

From Table 2, we see that the overall picture of the Italian specialization does not change dramatically when considering only value added. On average, RCA in value added tends to be closer to the threshold value of 1 than RCA in gross exports. This concentration of the distribution around the threshold indicates that in terms of production of value added, the Italian economy is less polarized than in terms of gross exports, as it is expected for a mature economy.

The correlation between the indices in gross terms and in value added across sectors is quite high, but it is worth noting that it declines over time: from 0.89 in 1995, the correlation between the two sets of indices drops in 2007 and it sets to 0.77 in 2011. This confirms that as the Italian participation to GVCs increased in recent years, it becomes more important to take into account the role of such participation in determining the country's comparative advantages.

In 2011, in most sectors of comparative advantage, the index declines somewhat if considering value added only, as the international organization of production becomes more widespread also in these sectors. The sectors with the largest difference (in absolute terms) between the two indices are Paper and Printing, Non-metallic minerals, Leather products and Fuels. In Paper and Printing, the RCA in value added displays a comparative advantage that does not appear in gross terms. In the other sectors, the presence of comparative advantages or disadvantages is confirmed by both indices, but both in Leather Products and in Non-metallic minerals (two traditional sectors of specialization for Italy) the comparative advantage in terms of value added is much smaller, showing that the foreign inputs' content of these goods is large. This means that the role of foreign suppliers for producers in these sectors is very important. Instead, the Italian comparative advantage is slightly reinforced in terms of value added in Other Manufactures (including furniture) and in Chemicals, where the domestic value added content appears crucial for the revealed comparative advantage.

Given the growing relevance of the participation to GVCs, in Section 4 we take a closer look to the system of international linkages that Italy has in two of its main sectors of comparative advantage to understand how they evolved over time.

3. - Network Analysis of the Italian Position

3.1 *The Role of Network Analysis*

A useful way to assess the changing position of Italy in international markets is through the visual and topological representation of its position in the network of international trade flows. Italy, as every other country, is represented as a node

of the network, connected through trade link to its trade partners. The position in the network does not depend exclusively on the characteristics of the country itself but also on the influence that the position of others exerces.

The implication of this structural view is that the relation between country *i* and country *j* cannot be considered independently from the relation between *i* and *z*, and between *j* and *z*.This is very important when we want to understand Italy's position in the world markets, as even if the country's characteristics and specialization remained stable, the rest of the world changed dramatically the three phases depicted in Graph 1, inevitably affecting Italy's position. The application of Network Analysis (NA) can, therefore, nicely complement previous empirical evidence.

The network of trade links, in which Italy is involved directly or indirectly, can be examined in its binary version (just considering the partnership status of any pair of countries) or its weighted version (also considering export values). In both cases, network analysis provides several indicators to assess the importance of a node centrality, capturing different aspects of its position with respect to the structure of connections (Newman, 2010; Borgatti, 2005). In general, even if all indices share the same axiomatic configuration (Bloch, Jackson and Tebaldi, 2016), each of them,being constructed using different information on node's position, can provide different insights on the country's participation to international.

Centrality measures can be classified into four main groups (Jackson, 2010): *a)* degree centrality, that measures how much a node is connected to others (with strength centrality as a weighted version of degree centrality); *b)* closeness centrality, showing how easily a node can be reached by other nodes; *c)* betweenness centrality, describing how important a node is in terms of connecting other nodes; *d)* the fourth group of indexes, such as the eigenvector centrality measure, which associates node's centrality to the node neighbors' characteristics, directly referring to how important, central, influential or tightly clustered a node's neighbors are.[4] We compute these measures for Italy, in 1965, 1995 and 2011, to better understand the evolution of the position of the country and how this is connected to the changes occurred in its export market share.

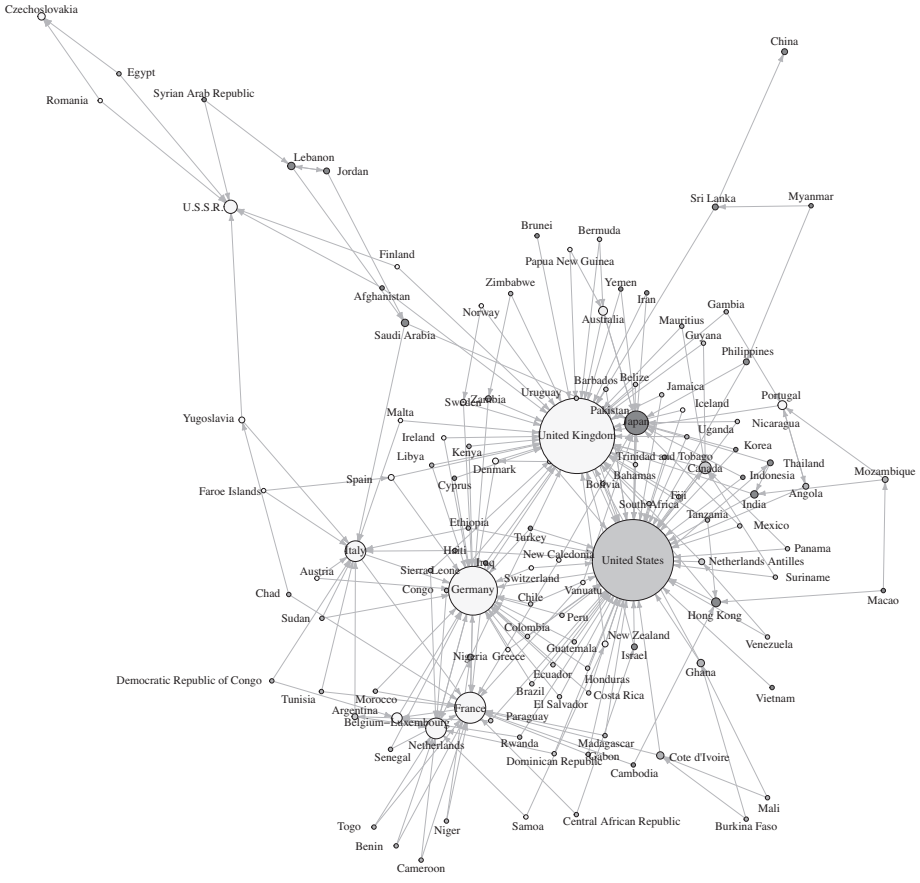
[4] For details on these measures of centrality, see De Benedictis L. *et* al. (2014). A general treatment of the issue can be found in Newman M. (2010).

3.2 *The Evolution of the Italian Position in the World Trade Network*

The network of world trade is represented in Graphs 2*a*, 2*b* and 2*c*, displaying the structure of exchanges among countries over time. Countries are the nodes of the graph and trade flows are the links connecting nodes. Countries from the same continent share the same node's color. Following De Benedictis *et* al. (2014) and Zhou, Wu and Xu (2016), in order to sparsify the trade matrix and focus on the backbone of trade connectivity, only the two largest export flows are displayed (the out-degree of the nodes is fixed to two) to keep the graphs readable, and the size of the dot representing each country is proportional to the number of incoming trade links of the country (the in-degree of the node).

GRAPH 2*A*

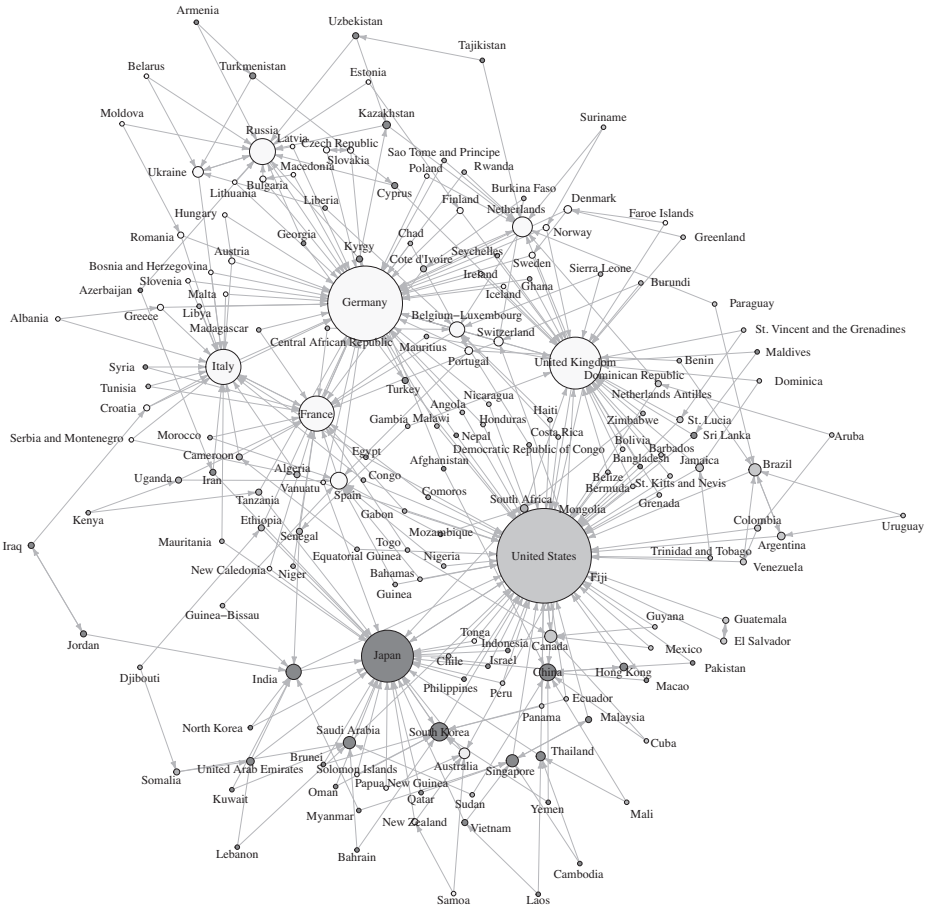
THE WORLD TRADE NETWORK IN 1965



Source: our elaboration on BACI-COMTRADE database.

Graph 2*b*

THE WORLD TRADE NETWORK IN 1995



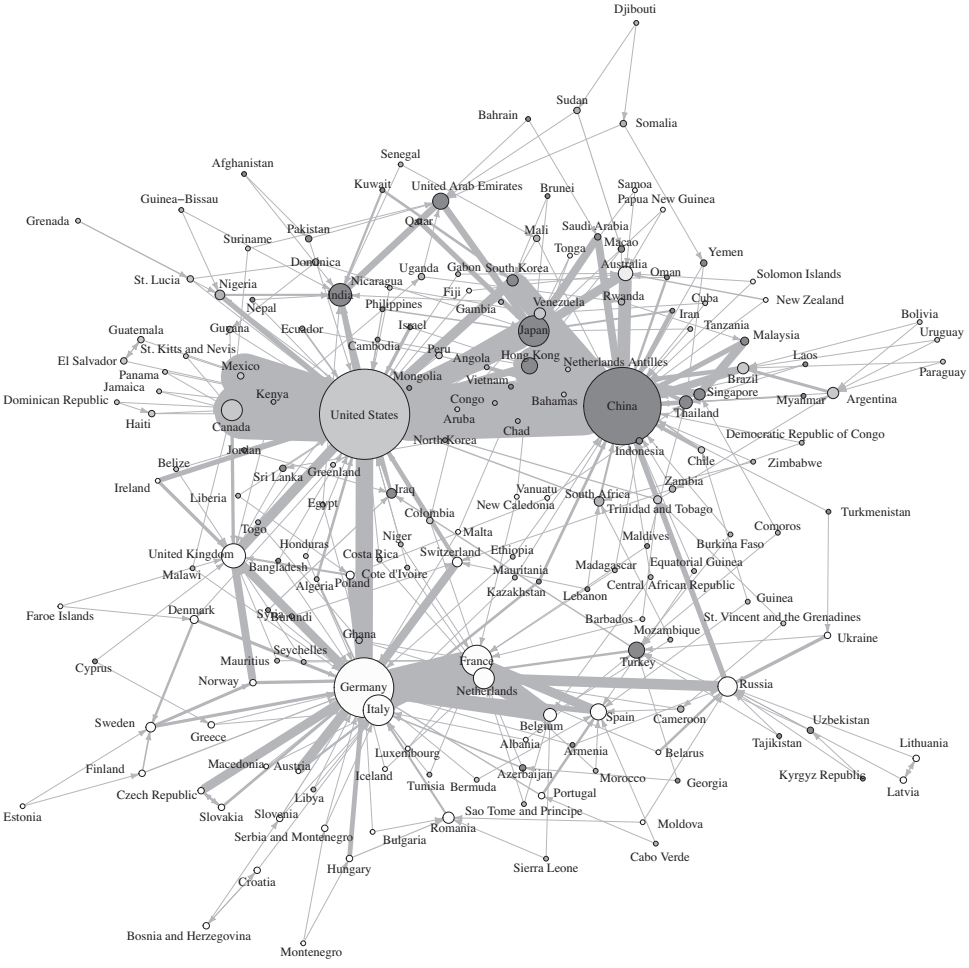
Source: our elaboration on Baci-Comtrade database.

As mentioned, a primary use of network analysis is to identify key-players by looking at the position they have in the system. The concept of centrality seeks to quantify graph theoretic ideas about an individual node's prominence within a network by summarizing structural relations among the nodes. A node with high degree centrality maintains numerous contacts with other network actors. Nodes have higher centrality to the extent they can gain access to or influence over others. A central node occupies a structural position (network location) that serves as a source or conduit for larger volumes of exchange with other nodes. In the visual representation of networks, central nodes are located at or near the cen-

ter in network diagrams of topological space. In contrast, a peripheral country maintains few or no relations and thus is located spatially at the margins of a network diagram. The algorithm (e.g. Force-directed algorithm) used to draw Graphs 2*a*, 2*b* and 2*c* follows this approach, and it places at the center of the graph the most connected countries, so that centrality in the graph is related to a central position in the world trade network in terms of overall linkages.

GRAPH 2*C*

THE WORLD TRADE NETWORK IN 2011



Source: our elaboration on BACI-COMTRADE database.

In Graph 2*a* we can see that the world trading system in 1965 was built around the USA and the UK. This last country was playing a key role in connecting Europe (white nodes) and the USA to many developing countries. In the graph, Italy is still a relatively peripheral country, but it is strongly connected to the trading center of Europe through its strong links to Germany and France. The picture in 1995 (Graph 2*b*) is substantially different. The UK still plays the role of bridging different parts of the network, but it is much less central. Japan appears as a much more relevant player, and other Asian countries are more visible, but to a large extent, developing countries are still quite peripheral. One of the areas that changed the most is Europe: the effects of the process of European integration are clearly visible. Italy, together with Germany and France, forms a strong trading group at the core of Europe. Italy also plays the role of connecting this core to some more peripheral parts of Europe and North Africa.

The process of European integration continues to be visible in Graph 2*c*, where the trade ties between Italy and Germany are so strong to make the two countries overlap in the graph, and where very strong ties appear among all the main EU members. But in 2011 the network structure suggests a partition of the world trading system in two: on the one hand, a very connected European bloc, strongly tied to its geographic neighbors and to some parts of Africa. Italy is at this point more connected and more central than the UK, still working as bridge, but much more peripheral than it used to be in the past. The second bloc in the picture is built around the strong trade ties between USA and China. China was hardly visible in the network graph in 1995, while it has become much more central in 2011. Over this time period, Italy moves closer to the center of the network, but its evolution is always very closely connected to the rest of Europe.

To better assess Italy's position, it is useful to analyze the topological indices related to the position of the country in the network, in order to correctly interpret the visual impression gathered from Graphs 2*a*, 2*b*, 2*c*.

TABLE 3

NETWORK INDICATORS FOR ITALY

		1965				1995				2011			
N(V, L)		N(1965) (134. 5293)				N(1995) (178. 15331)				N2011 (182. 21451)			
Density		0.30				0.48				0.65			
Zeros		12932 [0.70]				16353 [0.52]				11673 [0.35]			
Ego-network statistics - Italy		*L-in*	*L-out*	*W-in*	*W-out*	*L-in*	*L-out*	*W-in*	*W-out*	*L-in*	*L-out*	*W-in*	*W-out*
1	Centrality												
1.1	degree	0.90	0.91	4.02	4.53	0.97	1	3.89	4.83	0.99	1	3.23	3.01
1.2	closeness	0.87	0.92	0.93	0.98	0.97	1	0.81	0.13	0.99	1	0.99	0.01
1.3	betweenness	0.47		0.06		0.88		0.17		0.99		0.10	
1.4	eigenvector	0.95		0.96		0.98		0.23		0.99		0.19	
2	Distance	1.14	1.09	245.5	239.75	1.03	1	921.83	232.55	1	0.99	1241.31	246.22
2.1	Italy --> Germany	1	1	1.37	1.01	1	1	1.25	1.08	1	1	1.98	2.49
2.2	Italy --> UK	1	2	2.78	2.94	1	1	2.89	2.25	1	1	5.36	4.37
2.3	Italy --> United States	1	2	1.72	3.99	1	1	3.38	2.33	1	1	5.45	4.17
2.4	Italy --> Japan	1	2	2.33	4.60	1	1	3.59	3.07	1	1	5.27	5.55
2.5	Italy --> China	∞	4	∞	60.12	1	1	5.26	5.24	1	1	4.22	4.39
3.1	Hubness	0.98		0.23		0.99		0.30		0.99		0.17	
3.2	Authority	0.97		0.34		0.99		0.14		0.99		0.15	

Source: our elaboration on UN COMTRADE database.

In Table 3, we see the effects of growing globalization in the WTN: over time the number of trade links among countries increased (from 5,293 in 1965 to 21,451 in 2011), increasing the value of density in the network (the *ratio* between the number of existing links and the number of possible links) and reducing the number of countries' pairs with zero trade among them (from 12,932, that corresponds to 70% of the possible links – in square brackets –, in 1965, to 11,673 [35%] in 2011). The position of Italy is assessed looking at different position indicators, which consider separately whenever possible in-coming and out-going links (import flows and export flows, respectively), and consider the simple presence of links (binary network perspective, or the extensive geographic margin), or their strength (the value of trade carried on each link, or the intensive margin). Looking at the binary centrality indicators, we see that Italy's position in the system becomes more central over time, as the number of links that the country has with the rest of the world grows, and they connect the country with the main world markets, as seen also in Graph 2. But considering the centrality indicators that take into account the strength of the links, the resulting trend is quite different. As the complexity of the network increases and the role of emerging countries grows since the late 1990s, the relative centrality of Italy tends to diminish. This is in line with the decline in market shares observed in Graph 1, but additional information can be obtained considering the global Italian position in the system. The main reason of concern for the position of Italy comes from the reduction of the eigenvector centrality, which computes the position of a country in the WTN with respect to the main players of the system. The reduction of this indicator suggests that the Italian geographic orientation of its trade flows did not adapt to the evolution of the world trading system, as a large part of its trade flows is connecting the country to relatively peripheral nodes.

This is confirmed by looking at the second set of indicators, measuring the topological distance between countries in terms of trade flows. Over time, Italy has become more "distant" from the most relevant world markets and from the most relevant suppliers. We see that between 1965 and 1995, the relative distance from Germany, UK, USA and Japan decreased somewhat in terms of out-going links, in the period of expanding Italian exports, but it was increasing in terms of imports, as Italy's participation to the production chains of these countries was probably not very strong. Between 1995 and 2011, all distance indices with the main industrialized countries increase. The only country seeing a decline in distance for the overall period is China, but even in 2011 the Asian country was still far apart from Italy. The fact that Italy is no longer pointing mainly to the most

relevant nodes of the system is also visible looking at the hubness index, that should be high for a country exporting to the most important markets on the network: for Italy this indicator goes from 0.30 to 0.17 between 1995 to 2011.The authority index, showing how relevant a market is for the most important exporters, is more stable in this period, but still quite low for an advanced country.

4. - Comparative Advantages and the International Organization of Production

As mentioned above, in a world where the role of GVCs has been increasing rapidly, the involvement of a country in these international production processes can deeply affect its comparative advantages and its location in the WTN. Not only the extent of participation to GVCs can be relevant, but also the structure of the existing international production links and the position of a country along the GVC can determine its performance in international markets. In fact, for the same level of gross exports, countries can generate very different amounts of domestic value added (and therefore domestic income) according to the position they have in the production chain, and have different power in setting prices with respect to the final destination markets (Antràs *et* al., 2012; Baldwin and Lopez-Gonzales, 2015).

For these reasons, we want to examine more in details Italy's comparative advantages in two sectors of strong specialization considering the overall position of the country in the trading system, both in terms of gross exports and in terms of domestic value added content of export. The position of Italy in the global production network in these sectors can determine if a central position in gross trade is accompanied by a large amount of value added generated.

The sectors considered here are leather and footwear, and machinery. We chose these sectors as they are the two in which traditionally Italy holds the strongest comparative advantage (see Tables 1 and 2). But these sectors are very different in terms of technological content, and the competition in world markets in these sectors evolved differently.

4.1 *Trade Structures in Footwear and in Machinery*

Graphs 3 and 4 show the network of world trade in the two sectors analyzed, similarly to what was done for aggregate trade in Graph 2. In a traditional, labor intensive sector like footwear (Graph 3) we can observe the relevant role of many emerging and developing countries already in 1995. Italy appears as the second

most connected market in this industry, by farthe largest industrialized country in this network, confirming the "anomaly" of its specialization. Italy is closely linked to many European countries also in this sector, but it has a number of relevant ties to many small less developed countries as a relatively central player in both industries.

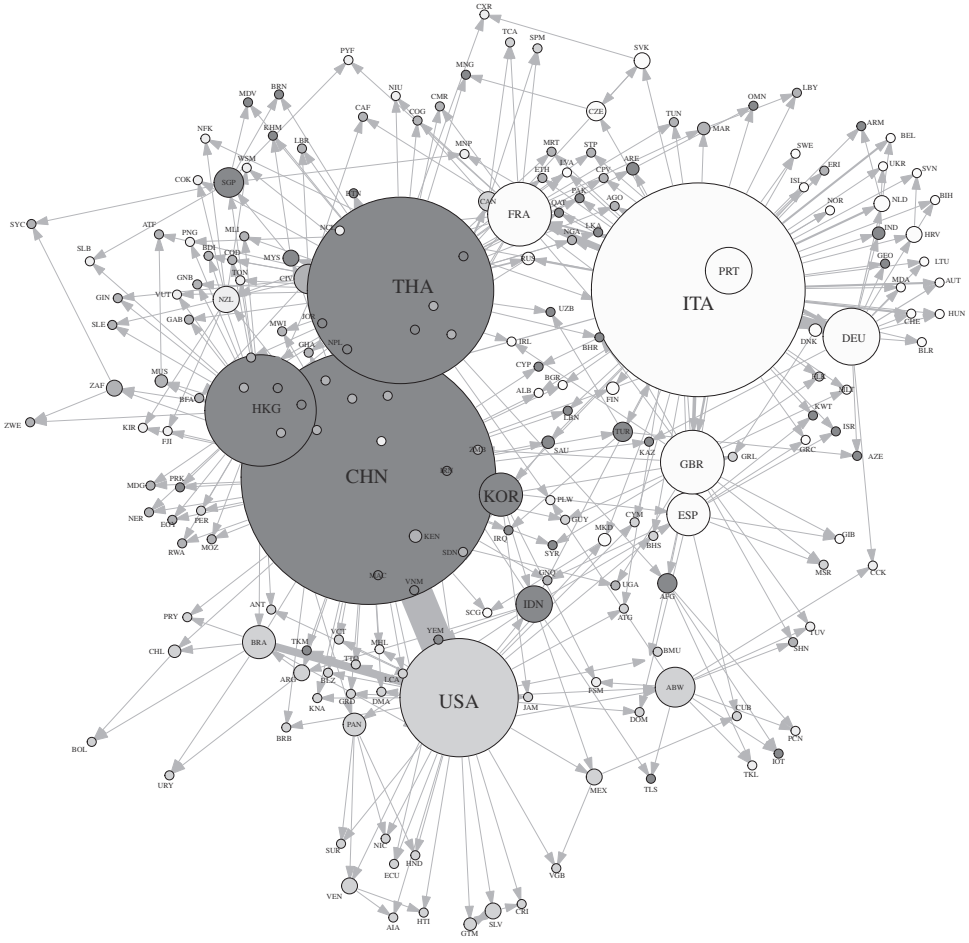
In 2011, the spectacular growth of China in footwear trade is evident, with the country reaching even more the central position of the network, connected in terms of gross exports to nearly every other country of the system, and outweighing most other countries. In this industry, Italy appears as the only country still competing with China for the most central position.

The trade network in machinery (Graph 4) shows even deeper changes in the trade structure. In 1995 the network is dominated by the large developed countries, with very close positions of the European group, and very close ties between the USA and Japan. Italy is part of this core group. Fifteen years later, China seems to have taken over the center of the network, while Japan and UK remain relatively central, but much less relevant, and European countries are no longer forming such a connected group. Italy's position in the European core of the network is preserved, as well as its ties with Germany.

GRAPH 3

TRADE NETWORK IN FOOTWEAR (HS 64), GROSS TRADE

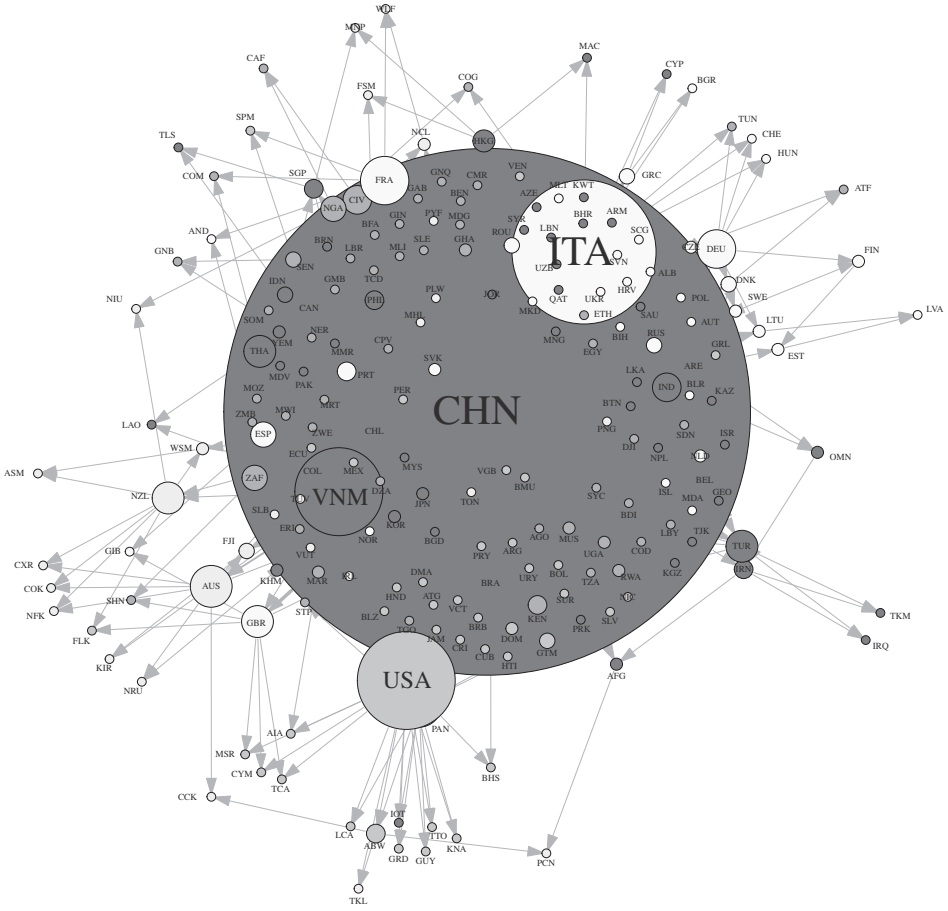
TRADE NETWORK IN 1995



continued Graph 3

TRADE NETWORK IN FOOTWEAR (HS 64), GROSS TRADE

Trade Network in 2011

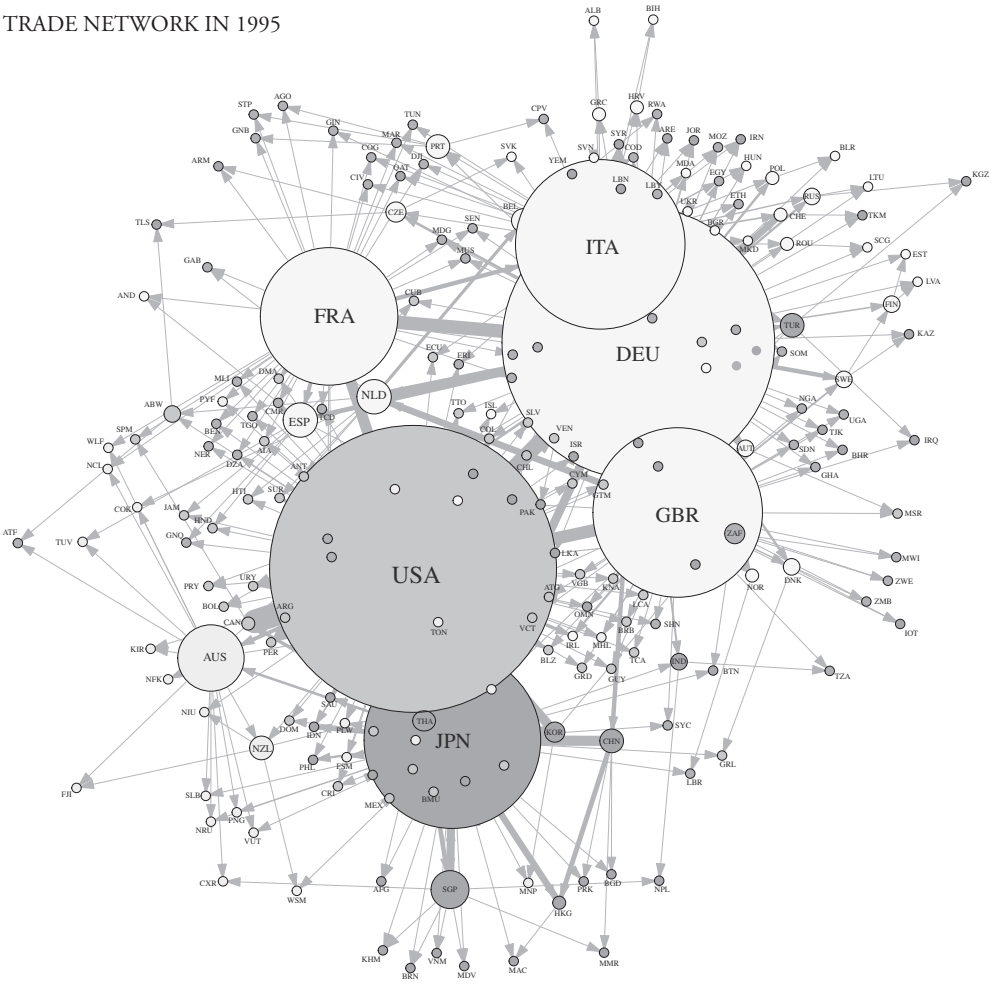


Source: our elaboration on Baci-Comtrade database.

GRAPH 4

TRADE NETWORK IN MACHINERY (HS 84), GROSS TRADE

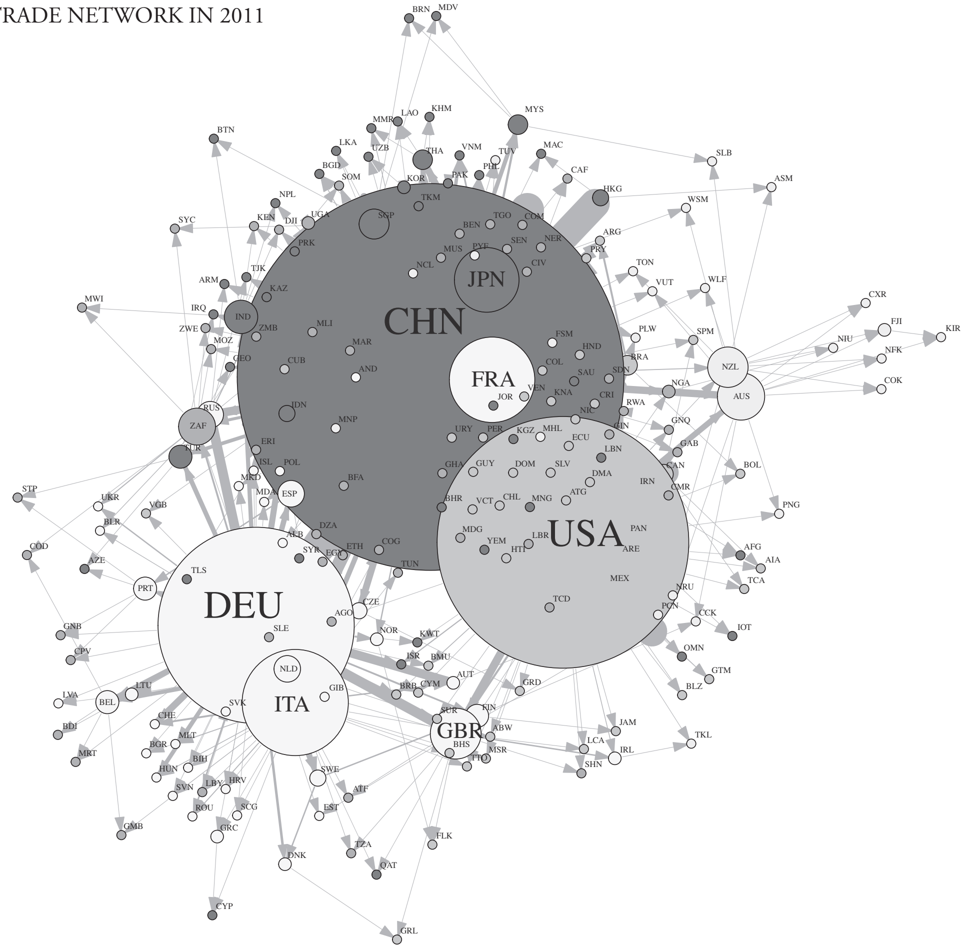
TRADE NETWORK IN 1995



continued GRAPH 4

TRADE NETWORK IN MACHINERY (HS 84), GROSS TRADE

TRADE NETWORK IN 2011



Source: our elaboration on BACI-COMTRADE database.

4.2 *Global Value Chains and Structure of Exchanges of Value Added in Footwear and Machinery*

In order to understand the role of GVCs in the deep changes observed in the examined network structures and in Italy's relative position, it is useful to start by considering the origin of the value added embodied in Italy's export in the two sectors. This can be done by computing the domestic and the foreign value added content of gross exports. The methodology used to assess value added at the sector level, taken from Wang *et* al. (2013), decomposes the final value of Italy's exports of a given sector *s* in the domestic part, originated in any domestic sector, and in the foreign parts, including both direct and indirect foreign value added from different countries. For Leather products and footwear, this decomposition is presented in Table 4.

The increase of the share of foreign value added in Italian gross exports of leather products and footwear confirms that also in this sector there has been a reorganization of the production processes and the extent of international fragmentation of production has increased somewhat. Both in 1995 and 2011 Germany was the main supplier of FVA for this industry, and a number of advanced, high income countries appear as relevant suppliers still in 2011, even if with a generally smaller share, indicating that also in a very traditional and labor-intensive sector, the delocalization of production phases is not relying only on low cost locations. At the same time, the change of position of China, whose share of value added in Italian export in this sector increased by more than 5 times confirms the relevance of this country in the manufacture of traditional goods even for countries that maintain a strong RCA in this sector (see Table 2). Also the FVA share of central and eastern countries members of the EU increased on average by more 50% in this period.

This shift toward foreign suppliers of inputs, especially in in emerging markets, means that because of the lower domestic value added share, in 2011 every euro of export in this sector was generating 3 cents less of income than in 1995. But in the same period, the higher FVA is associated with an increase of the RCA indices, and even if causality cannot be inferred from these simple observations, it is possible that this reorganization of production has allowed Italian firms in this sector to maintain a higher comparative advantage.

Table 4

ORIGIN OF VALUE ADDED IN ITALIAN EXPORT OF LEATHER PRODUCTS AND FOOTWEAR – DVA AND FVA SHARE OF GROSS EXPORTS (%)

1995		2011	
Domestic VA share	**84.729**	**Domestic VA share**	**81.744**
Total FVA share	**15.271**	**Total FVA share**	**18.256**
Germany	2.128	Germany	1.666
France	1.636	China	1.520
United States	1.483	United States	1.465
United Kingdom	0.904	Russia	1.194
Australia	0.604	Brazil	1.173
Netherlands	0.579	France	0.979
Belgium	0.575	United Kingdom	0.720
Russia	0.550	Spain	0.710
Spain	0.490	Netherlands	0.512
Brazil	0.424	South Korea	0.386
Japan	0.406	Australia	0.357
India	0.393	Belgium	0.330
China	0.278	Turkey	0.314
Austria	0.237	India	0.306
South Korea	0.180	Japan	0.272
Sweden	0.175	Austria	0.262
Canada	0.165	Indonesia	0.224
Indonesia	0.145	Poland	0.197
Turkey	0.144	Ireland	0.169
Ireland	0.137	Canada	0.167
Taiwan	0.128	Mexico	0.165
Poland	0.121	Sweden	0.130
Mexico	0.104	Czech Republic	0.127
Denmark	0.090	Romania	0.126
Slovenia	0.080	Taiwan	0.116
Finland	0.072	Hungary	0.107
Luxembourg	0.066	Denmark	0.069
Portugal	0.064	Portugal	0.067
Czech Republic	0.060	Slovak Republic	0.066
Hungary	0.055	Finland	0.063
Romania	0.053	Slovenia	0.053
Greece	0.042	Luxembourg	0.043
Slovak Republic	0.027	Greece	0.042
Lithuania	0.023	Bulgaria	0.035
Bulgaria	0.022	Lithuania	0.015
Malta	0.011	Malta	0.007
Latvia	0.006	Estonia	0.006
Estonia	0.004	Latvia	0.005
Cyprus	0.003	Cyprus	0.002
Rest of the world	***2.603***	***Rest of the world***	***4.088***

Source: our elaborations on Wiod database.

TABLE 5

ORIGIN OF FOREIGN VALUE ADDED IN ITALIAN EXPORT OF MACHINERY – DVA AND FVA SHARE OF GROSS EXPORTS (%)

1995		2011	
Domestic VA share	**81.977**	**Domestic VA share**	**79.484**
Total FVA share	**18.023**	**Total FVA share**	**20.516**
Germany	3.783	Germany	3.198
France	2.236	China	1.535
United States	1.558	France	1.415
United Kingdom	1.198	Russia	1.316
Belgium	0.746	United States	1.220
Russia	0.687	Spain	0.950
Netherlands	0.682	United Kingdom	0.767
Spain	0.611	Netherlands	0.694
Japan	0.581	Belgium	0.494
Austria	0.436	Turkey	0.446
Sweden	0.370	Austria	0.425
Canada	0.338	Brazil	0.397
China	0.227	South Korea	0.397
Brazil	0.211	Japan	0.381
South Korea	0.163	Poland	0.344
Australia	0.162	India	0.282
Turkey	0.161	Sweden	0.270
Finland	0.141	Canada	0.252
Romania	0.122	Australia	0.217
Luxembourg	0.119	Czech Republic	0.216
Poland	0.118	Indonesia	0.169
India	0.118	Taiwan	0.154
Taiwan	0.117	Romania	0.148
Denmark	0.110	Ireland	0.131
Ireland	0.107	Hungary	0.131
Mexico	0.105	Mexico	0.129
Indonesia	0.096	Slovak Republic	0.118
Czech Republic	0.088	Finland	0.110
Slovenia	0.082	Denmark	0.097
Hungary	0.072	Slovenia	0.081
Portugal	0.063	Bulgaria	0.080
Greece	0.057	Portugal	0.069
Slovak Republic	0.051	Luxembourg	0.058
Bulgaria	0.032	Greece	0.048
Malta	0.019	Lithuania	0.009
Lithuania	0.005	Estonia	0.007
Latvia	0.003	Malta	0.006
Cyprus	0.002	Cyprus	0.006
Estonia	0.002	Latvia	0.005
Rest of the world	***2.246***	***Rest of the world***	***3.745***

Source: our elaborations on WIOD database.

Also in Machinery, the share of FVA has increased moderately, and also in this case the first partner for Italy is Germany. In this sector, the share of German value added embodied in Italian exports is larger and more stable in time, but here too we observe a sharp increase in the Chinese share. Similarly to what was observed for the footwear industry, in machinery the larger participation to global value chains, measured through the FVA content of export, is not associated with lower comparative advantages, but quite the contrary: also in this industry the RCA for Italy increases in the past decade.

To better understand the Italian position in the world market in these sectors, we can analyze not only the change in the share of domestic value added and the shift in the shares of foreign suppliers, but also the underlying structure of production in these industries at the world level, by considering in trade flows only the domestic contribution to the value of the goods exported. In fact, more than the overall change of the Italian value added content in exports (complementing the increase in FVA observed in Tables 4 and 5), what can be relevant in terms of market power and efficiency is the Italian position in the international production system, its connectivity and its centrality (Baldwin and Lopez-Gonzales, 2015). An analysis of the network of trade in value added at the aggregate level as been undertaken recently by Amador and Cabral (2016), but this technique has not been applied yet to individual sectors.

To understand how the Italian position in two industries of comparative advantage changed in the past decade, we consider the network formed by the exchange of domestic value added in footwear and in machinery, respectively, built applying again the decomposition of Wang *et* al. (2013) to the WIOD database. In this case, links between countries are given by the domestic value added content of exports from country *i* to country *k* of a given sector *s*, regardless of the domestic sector in country *i* where this value added was produced. Using this backward perspective and including all upstream domestic inputs, DVA in bilateral export of good *j* embodies the underlying domestic production structure and it includes the overall contribution of domestic factors of production to the export of industry *j*. Therefore, it measures the domestic factors content of exports from a given sector. Unfortunately, in this networks our nodes are only 40, as this is the countries' coverage available in the WIOD database, but they cover more than 85% of world GDP and even larger share of world trade.

Looking at the picture of the trade network built using these links, we observe remarkable differences from the network of gross exports.In the footwear industry, again there is an important growth of China as a supplier of value added, but

the difference between Graphs 3 and 5 is striking. In terms of value added, the relevance of China in the network is much smaller than in the case of gross exports. Italy's position in the network of value added trade did not almost change. The decline in market shares and in centrality in gross export appears due to the reorganization of production at the international level, while the position in terms of value added centrality is much more stable. Still, the overall structure of the value added network in footwear changed remarkably over time. While in 1995, Italy was the clear center of the network, the 2011 structure displays two main hubs, closely connected to each other. In fact, Italy itself contributed to the rise of centrality of China. As shown in Table 4, the share of Chinese value added in Italy's footwear exports increased by more than five times in this period.

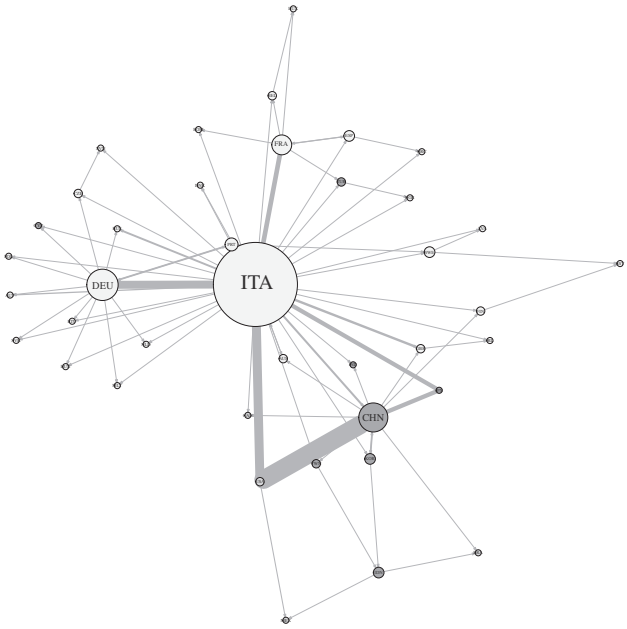
The difference between Graphs 4 and 6 is even more remarkable. In the machinery sector, in terms of value added, China still in 2011 is a quite peripheral node, even if more connected than in 1995. It is also possible to observe that while Germany maintained the thick links with the most relevant nodes of the network, in 2011 there is a large increase in the link between Germany and China.

In this sector, the center of the network of value added exchanges remains the Germany-Italy pair, showing an increased relevance of both countries and even closer ties betweenthe two. In spite of the small reduction in the share of exported value added in this sector (see Tables 2 and 5), Italy is still one of the main nodes of the system.But its position, far away from the non-European main nodes of this network, in 2011 just like in 1995, might create some difficulties as the center of system shifts in coming years.

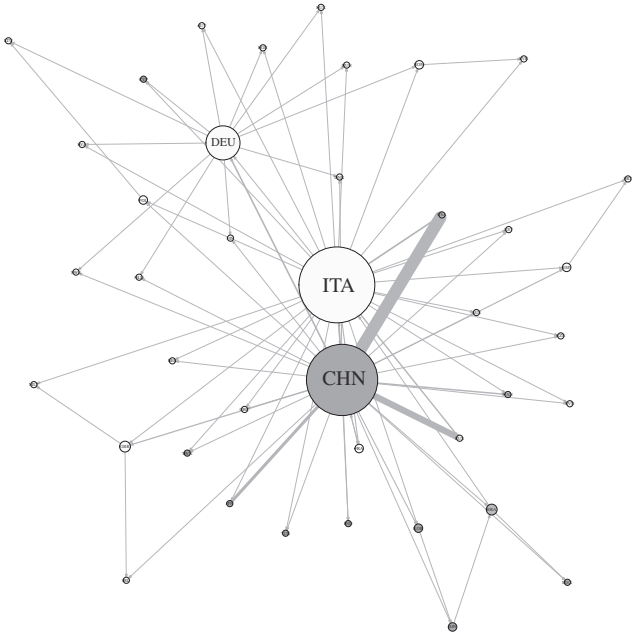
Graph 5

NETWORK OF EXPORTED VALUE ADDED IN FOOTWEAR (HS 64)

Network in 1995



Network in 2011



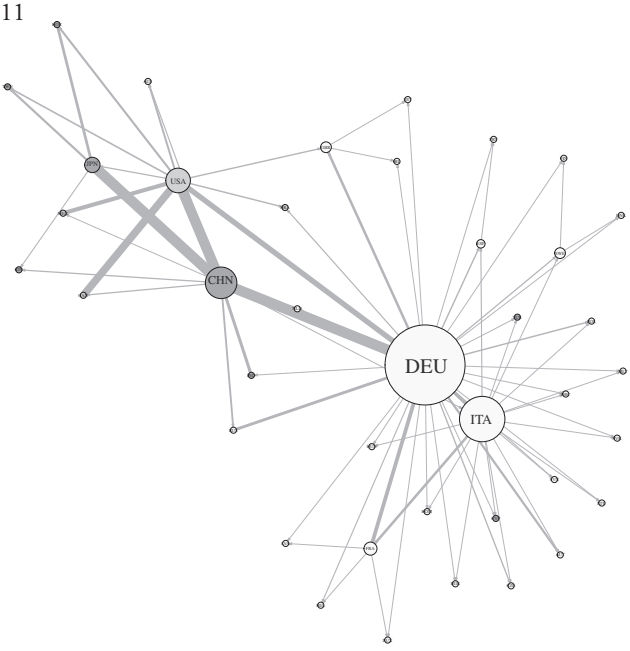
Source: our elaboration on WIOD database.

GRAPH 6

NETWORK OF EXPORTED VALUE ADDED IN MACHINERY (HS 84)

NETWORK IN 1995

NETWORK IN 2011



Source: our elaboration on WIOD database.

5. - Concluding Remarks

The analysis of the Italian specialization and position in the world trade markets suggests a general persistence of the model of specialization both in terms of sectors and in terms of overall connections to countries. This does not mean that no change is observable: in the past decades, like many other countries, Italy has become more involved in international production networks, with a partial reorganization in its production structure, and changing the role of some country-partners.This is visible not only through the indicators of GVC participation measuring the share of foreign value added in the country's export, but even more clearly looking at the changes in the network of flows of value added between countries, and the shift in Italy's position. Looking at Italy's overall structure of international trade linkages highlights an important element related to the diffusion of GVCs: a country's position in terms of exports flows is strictly connected to its import linkages, which should be considered when assessing the international situation of a country.

Increased participation to GVCs has affected to some extent Italy's specialization. On the one hand, the stronger involvement in international production networks might have allowed Italy to preserve some of its traditional comparative advantages even in presence of dramatic changes in international markets. On the other hand, some new sectors of specialization might arise thanks to the production links with other countries. The role of GVC in shaping a country's specialization is not univocal, as observed in the literature (Taglioni and Winkler, 2016).

A consideration based on the evolution of Italy's centrality in the world trade network is that Italy, even if preserving many characteristics of its specialization, is increasingly far from the main nodes of the network, both in terms of final destination markets as well as for production links.The relative loss of centrality of the European bloc in the past decade, both at the aggregate level and in the examined sectors of Italian comparative advantage, impacted negatively also on the position of Italy. The shift of the center of the world trade network left behind a part of Italian firms, especially the smaller ones that find difficult to reach markets that are far away and different in terms of institutional environment. In this respect, some concerns on the possibility of reversing the trend in the country's market share might arise, reopening the debate on the Italian model of specialization. On the other hand, complementing traditional analysis of comparative advantages with analyses in terms of value added and considering the entire structure of the trade network reinforce the argument against neo-mercantilist trade policies. When input and output flows are strongly interlinked proposing the promotion of export and the substitution of imports make little sense.

BIBLIOGRAPHY

Amador J. - Cabral S. (2016), «Networks of Value Added Trade», European Central Bank, *Working Paper Series*, no. 1931.

Anderson L.E. - van Wincoop E. (2003), «Gravity with Gravitas: A Solution to the Border Puzzle», *The American Economic Review*, vol. 93, no. 1, pp. 170-192.

Antras P. - Chor D. - Fally T. - Hillberry R. (2012), «Measuring Upstreamness of Production in Trade Flows», *American Economic Review Paper and Proceedings,* vol. 102 (3), pp. 412-416.

Balassa B. (1965), «Trade Liberalisation and "Revealed" Comparative Advantage», *The Manchester School*, vol. 33, no. 2, pp. 99-123.

Baldone S. - Sdogati F. - Tajoli L. (2002), «Moving to the Central-Eastern Europe: Fragmentation of Production and Competitiveness of the European Textile and Apparel Industry», *Rivista di Politica Economica,* vol. 92, no. 1, pp. 209-282.

-.-,-.-,-.- (2007), «On Some Effects of International Fragmentation of Production on Comparative Advantages, Trade Flows and Income of Countries», *The World Economy*, vol. 30, no. 11, pp. 1726-1779.

Baldwin R. - Lopez-Gonzalez J. (2015), «Supply-Chain Trade: A Portrait of Global Patterns and Several Testable Hypotheses», *The World Economy*, vol. 38, pp. 1682-1721, doi:10.1111/twec.12189.

Becattini G. (1999), *Distretti industriali e made in Italy. Le basi socioculturali del nostro sviluppo*, Boringhieri, Torino.

Borgatti S.P. (2005), «Centrality and Network Position», *Social Networks*, vol. 27, no. 1, pp. 55-71.

Castellani D. - Serti F. - Tomasi C. (2010), «Firms in International Trade: Importers' and Exporters' Heterogeneity in Italian Manufacturing Industry», *The World Economy*, vol. 33, no. 3, pp. 424-457.

Deardorff A.V. (2001), «Fragmentation across Cones», in Arndt S.W. - Kierzkowski H. (eds), *Fragmentation. New Production Patterns in the World Economy*, Oxford University Press, pp. 35-51.

-.- (2005), «Ricardian Comparative Advantage with Intermediate Inputs», *North American Journal of Economics and Finance*, vol. 16, pp. 11-34.

De Benedictis L. (2005),«Three Decades of Italian Comparative Advantages», *The World Economy*, vol. 28, no. 11, pp. 1679-1709.

De Benedictis L. - Nenci S. - Santoni G. - Tajoli L. - Vicarelli C. (2014), «Network Analysis of World Trade using the BACI-CEPII Dataset», *Global Economy Journal*, 14(3-4), pp. 287-343.

De Benedictis L. - Tamberi M. (2004), «Overall Specialization Empirics: Techniques and Applications», *Open Economies Review*, vol. 15, no. 4, pp. 323-346.

De Benedictis L. - Tajoli L. (2011), «The World Trade Network», *The World Economy*, vol. 34, no. 8, pp. 1417-1454.

-.-,-.- (2013), «Vantaggio comparato e centralità sui mercati internazionali: alcuni risultati relativi alla specializzazione italiana», in *L'Italia nell'economia internazionale. Rapporto ICE 2012-2013.*

De Nardis S. - Traù F. (1999), «Specializzazione settoriale e qualità dei prodotti: misure della pressione competitiva dell'industria italiana», *Rivista Italiana degli Economisti*, vol. 4, no. 2, pp. 177-212.

-.-,-.- (2005), *Il modello che non c'era: l'Italia e la divisione internazionale del lavoro industriale*, Rubbettino Editore.

Dell'Agostino L. - Nenci S. (2016), *Specialization, International Supply and Production Networks Using Value Added Trade Data: The Case of Italy*, paper presented at ETSG Annual Conferece 2016, Helsinki.

Grossman G. - Rossi-Hansberg E. (2008), «Trading Tasks: A Simple Theory of Offshoring», *American Economic Review*, vol. 98, no. 5, pp. 1978-1997.

Halpern L. - Koren M. - Szeidl A. (2011), «Imported Inputs and Productivity», *CeFIGWorking Paper*, n. 8.

Hummels D. - Ishii J. - Yi K. (2001), «The Nature and Growth of Vertical Specialization in World Trade», *Journal of International Economics*, vol. 54, pp. 75-96.

Jackson M. (2010), *Social and Economic Networks*, Princeton University Press.

Johnson R. - Noguera G.(2012), «Accounting for Intermediates: Production Sharing and Trade in Value Added», *Journal of International Economics*, vol. 86, no. 2, pp. 224-236.

Kindleberger C.P. (1996), *World Economic Primacy: 1500-1990*, Oxford University Press.

Koopman R. - Wang Z. - Wei S.J. (2014), «Tracing Value-Added and Double Counting in Gross Exports», *American Economic Review*, vol. 104, no. 2, pp. 459-494.

Modiano P. (1982), «Competitività e collocazione internazionale delle esportazioni italiane: il problema dei prodotti tradizionali», *Economia e Politica Industriale*, vol. 33, no. 6.

Newman M. (2010), *Networks: An Introduction*, OUP Oxford.

Onida F. (1978), *Industria italiana e commercio internazionale*, Il Mulino, Bologna.

Stehrer R. (2012), «Trade in Value Added and the Value Added in Trade», WIOD, *Working Paper,* no. 8.

Taglioni D. - Winkler S. (2016), «Making Global Value Chains Work for Development», World Bank, *Economic Premise Series*, 143.

Timmer M.P. - Dietzenbacher E. - Los B. - Stehrer R. - de Vries G.J. (2015), «An Illustrated User Guide to the World Input-Output Database: The Case of Global Automotive Production», *Review of International Economics*, vol. 23, no. 3, pp. 575-605.

Wang Z. - Wei S.J. - Zhu K. (2013), «Quantifying International Production Sharing at the Bilateral and Sector Levels», *NBER Working Paper*, no. 19677.

Yi K.-M. (2003), «Can Vertical Specialization Explain the Growth of World Trade?», *Journal of Political Economy*, vol. 111, no. 1, pp. 52-102.

Zhou M. - Wu G. - Xu H. (2016), «Structure and Formation of Top Networks in International Trade, 2001–2010» *Social Networks*, 44, pp. 9-21.

Export Participation and Misallocation after the Financial Crisis: Evidence from Italy

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We study the allocation of capital and labor in a representative sample of Italian manufacturers from 2001 to 2014, emphasizing the comparison between exporters and non-exporters before and after the global financial crisis. Both before and after 2008 factors are misallocated with inefficiently small exporters and inefficiently large non-exporters, but this pattern has become more pronounced after the crisis. This is due to frictions that disproportionately reduce product and factor market access for exporters. Investigating firm characteristics significantly associated with misallocation, we find that, controlling for the export status, finance, innovation and growth strategies play a significant role.
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1. - Introduction

The dismal performance of the Italian economy in the last 25 years is a well-known fact. Hassan and Ottaviano (2013) and Calligaris *et* al. (2016) show how this is associated with a slowdown of "productivity" growth and an increase of resource "misallocation" between but, most of all, within sectors.

Against this general background, the aim of this paper is to zoom in on Italian exporters, documenting the corresponding patterns of "productivity" and "misallocation" in comparison with non-exporters. Following a methodology similar to Calligaris *et* al. (2016), we also want to identify the main firm characteristics associated with those patterns.

Graph 1 depicts the evolution of real aggregate exports since the 1990s. It reveals an overall positive trend, with a clear shock in 2008 due to the global financial crisis. However, looking at aggregate exports is not enough to get a sense of Italian export performance as one needs to take into account that: *i)* global trade has expanded greatly since 1990, with the share of trade over world GDP rising from 38% to 61% at the pre-crisis peak; and *ii)* the trade share of high-income countries such as Italy has decreased from 83% to 68%.

To account for these parallel developments, Graph 2 looks at the share of Italian exports over high-income OECD countries exports (excluding Italy). This graph shows a less comforting trend than Graph 1. There are three broad phases: *1)* during the 1990s Italian exports grew less than those of other peer countries, with the exception of a short-lived recovery after the 1992 devaluation, with the share of exports falling from 6.8% to 5.2%; *2)* in the early 2000s the negative trend reverted and, contrary to a common perception in Italy, this reversion coincided with the adoption of the Euro; *3)* with the global financial crisis, Italian exports lost competitiveness with their share stabilising at a lower level. All in all, the post-crisis average share has been 0.5 percentage points lower than the pre-crisis average share since the beginning of new millennium, corresponding to a significant decline in Italian exports of roughly 40bn. This paper focuses on the performance of Italian manufacturers in phases 2 and 3, analysing pre- vs. post-crisis patterns since the early 2000s with an emphasis on the relation between export participation and "productivity".

The concept of "productivity" we focus on is "Total Factor Productivity" (henceforth, simply "TFP"), which measures how effectively given amounts of productive factors (capital and labor) are used. Clearly the economy's aggregate TFP depends on its firms' TFP. This happens along two dimensions. On the one

hand, for given amounts of factors used by each firm, aggregate TFP grows when individual firm TFP grows, for example thanks to the adoption of better technologies and management practices. If market imperfections prevent firms from seizing these opportunities, the economy's productive apparatus is exposed to obsolescence and senescence with adverse effects on aggregate TFP.

On the other hand, for given individual firm TFP, aggregate TFP depends on how factors are allocated across firms. As long as market frictions "distort" the allocation of product demand and factor supply away from high TFP firms towards low TFP rivals, they lead to lower aggregate TFP than in an ideal situation of frictionless markets. Building on the distinction between physical TFP (*i.e.*, measured in terms of physical output) and revenue TFP (TFPR, *i.e.*, measured in terms of revenues) first introduced by Foster *et* al. (2008), Hsieh and Klenow (2009) construct a model of monopolistic competition in which, although firms can differ in their physical TFP, in the absence of frictions TFPR is is the same for all firms. The idea behind this result is simple: with no frictions, the marginal revenue product of inputs should be equalized across firms as factors move from from low marginal revenue to high marginal revenue firms. Hsieh and Klenow (2008) call deviations from a situation in which TFPR is equalized "misallocation", and propose a simple way to measure its consequences on aggregate TFP. This is also the definition of "misallocation" we adopt. It implies that the dispersion of TFPR across firms can be used to measure the extent of misallocation. It also implies that firms with a TFPR higher than the sectoral average are inefficiently small, while those with a TFPR below the sectoral average are inefficiently large. These are the two key implications of the misallocation literature that we use in this paper.

With these definitions in mind, we study a sample of firms representative of Italian manufacturers from 2001 to 2014 and find strong evidence of misallocation. Both before and after the crisis, exporters are inefficiently small whereas non-exporters are inefficiently large but this pattern has become more pronounced after the crisis. We interpret this feature within the framework of Hsieh and Klenow (2009) in terms of distortions that reduce product and factor markets access more for exporters than for non-exporters, and increasingly so after the crisis. While distortions that restrict capital market access are less severe for exporters than for non-exporters, they are not strong enough to fully compensate the differential severity of the other distortions. Misallocation also appears within the group of exporters, as firms earning a larger fraction of their revenues from exports are inefficiently smaller relative to those relying less on exports for their revenues.

Investigating firm characteristics significantly associated with misallocation, we find that finance, innovation and growth strategies play a significant role while this is is not the case for ownership structure, management style and labor force composition. In particular, we find that credit-constrained firms are inefficiently large with respect to their efficient size both before and after the crisis. Non-exporters with high involvement in product innovation, process innovation and R&D become inefficiently small while those with low involvement in these activities become inefficiently large after the crisis. The same applies to exporters with respect to process innovation, R&D and patents before the crisis; and only with respect to process innovation and patents after the crisis. In terms of growth strategies, among both exporters and non-exporters firms attributing their growth to the expansion of their distribution network are inefficiently large both before and after the crisis. The same applies before the crisis to non-exporters attributing their growth to increasing brand recognition and expanding after-sales networks as well as to exporters attributing their growth to lower production costs. It also applies, after the crisis, to both exporters and non-exporters suffering from demand constraints, and to exporters attributing their growth to lower production costs.

Our work relates to a number of studies that have used the framework of Hsieh and Klenow (2009) to measure the extent of misallocation in various countries, such as Bellone and Mallen-Pisano (2013); Bollard *et* al. (2013); Ziebarth (2013); Chen and Irarrazabal (2014); Crespo and Segura-Cayuela (2014); Dias *et* al. (2014); Garcia-Santana *et* al. (2015), and Gopinath *et* al. (2015). Our paper is also related to studies that have analysed more specifically the issue of the Italian productivity slowdown since the 1990s, such as Faini and Sapir (2005); Barba-Navaretti *et* al. (2010); Bugamelli *et* al. (2010); Bugamelli *et* al. (2012); Lusinyan e Muir (2013); Michelacci and Schivardi (2013); Bandiera *et* al. (2014); De Nardis (2014); Lippi and Schivardi (2014); Pellegrino and Zingales (2014); Calligaris (2015); Daveri and Parisi (2015); and Calligaris *et* al. (2016). The contribution of this paper to the existing literature is the analysis of the patterns of misallocation for Italian manufacturers with a specific focus on the comparison between exporters and non-exporters, as well as on the firm-level characteristics associated with those patterns.

Though broadly used, the idea of Hsieh and Klenow (2009) of interpreting the observed dispersion of TFPR across firms as evidence of inefficiency has also been critized. Asker, Collard-Wexler and De Loecker (2014) argue that, in the presence of adjustment costs in investment, idiosyncratic TFP shocks across firms naturally generate dispersion of the marginal revenue product of capital

("MRPK"). In this case, as long as adjustment costs are determined by technological factors, the dispersion of MRPK is an efficient outcome and thus the observed gaps ("wedges") in MRPK should not be taken as evidence of any misallocation. In this respect, Hsieh and Klenow (2009) neglect the distinction between technology-driven adjustment costs (such as the natural time needed to build a new plant) and wasteful frictions (such the bureaucratic procedures of authorisation that may delay the construction and activation of a new plant). From a different angle, De Loecker and Goldberg (2014) and Haltiwanger (2016) argue that a reduction in the observed wedges does not necessarily imply more market efficiency. For example, if firms had the same TFP but different initial market power due to demand characteristics, convergence of market power to the top would reduce TFPR dispersion but could be hardly considered an improvement in efficiency. While we adopt the Hsieh and Klenow (2009) interpretation for ease of comparison with the bulk of the aforementioned literature, it should nonetheless be remembered that the changing wedges in marginal revenue products and TFPR we observe in the data could be due not only to changing wasteful frictions but also changing market power across firms, changing volatility of idiosyncratic shocks or changing (technology-driven) adjustment costs.

The rest of the paper is organized as follows. Section 2 introduces the methodological approach. Section 3 presents the main features of the database. Section 4 reports our aggregate findings on productivity and misallocation. Section 5 discusses the characteristics of firms affecting misallocation. Section 6 concludes.

2. - Measuring Misallocation

We follow Hsieh and Klenow (2009; henceforth HK) in defining "misallocation" as an inefficient allocation of productive factors (labor and capital) across firms with different TFP. Inefficiency is defined with respect to the ideal allocation of factors that would result in a world of frictionless product and factor markets where consumers are free to spend their income on the firms quoting the lowest prices and owners of productive factors are free to supply the firms offering the highest remunerations. In this ideal allocation the value of the marginal product ("marginal revenue product"; henceforth MRP) of each factor is equalized across firms so that the factor's remuneration is the same for all firms. This is an equilibrium as consumers have no incentive to change their spending decision,

firms have no incentive to change their production decisions and factor owners have no incentive to change the provision of their services. It is also a stable equilibrium as any exogenous shock creating gaps in a factor's MRP across firms would trigger a reallocation of that factor from low to high MRP firms until its remuneration is again equalized across all firms.

Shocks that can create such gaps are idiosyncratic shocks that increase the TFP of some firms relative to others. As firms with higher MRPs after the shocks are able to offer higher factor remunerations at the pre-shocks equilibrium allocation, they have the opportunity to expand their operations by attracting additional factor services away from less productive firms until convergence in factors' MRPs restores the equalisation of factor remuneration across firms in the new post-shocks equilibrium. In this respect, observed gaps in factors' MRPs across firms reveal a "distorted" factor allocation across them as factors are inefficiently used. This inefficient allocation of resources is what HK call "misallocation" and its extent can be measured by the width of the observed gaps ("wedges") in factors' MRPs between firms. It implies that, though offering higher remunerations, more productive firms are not able to attract the factors they would need to grow and thus remain inefficiently small. Vice versa, though offering lower remunerations, less productive firms are inefficiently large.

Specifically, consider firm in sector facing facing demand with constant elasticity and technology captured by the constant-return-to-scale Cobb-Douglas production function

$$Y_{si} = A_{si} K_{si}^{\alpha_s} L_{si}^{1-\alpha_s}, \alpha_s \in (0,1) \tag{1}$$

where Y_{si} is output, A_{si} is TFP, K_{si} is capital input and L_{si} is labor input. The firm faces two types of frictions. First, to sell a unit of output, the firm has to produce $1/(1-\tau_{si}^{Y})$ units, where τ_{si}^{Y} is an "output distortion" creating a gap between quantity produced Y_{si} and quantity sold $(1-\tau_{si}^{Y})Y_{si}$ at delivered price P_i. Second, to usefully employ a unit of capital, the firm has to hire $(1+\tau_{si}^{K})$ units, where τ_{si}^{K} is a "capital distortion" creating a gap between capital hired $(1+\tau_{si}^{K})K_{si}$ at rental rate R and capital employed K_{si}. Examples of output distortions include government restrictions on size, transportation costs or public output subsidies or taxes. Example of capital distortions include various types of credit constraints. While there is no specific friction for labor, the output friction can be equivalently in-

terpreted as a friction that affects access to capital and labor proportionately while the capital friction can be equivalently interpreted as a friction that affects access to capital disproportionately.[1]

Due to these distortions, the firm maximizes profit

$$\pi_{si} = P_{si}\left(1-\tau_{si}^{Y}\right)Y_{si} - WL_{si} - R\left(1+\tau_{si}^{K}\right)K_{si}$$

where L_{si} is labor hired and employed at wage W. Considering the production function *(1)* and the constant demand elasticity σ, profit maximization with respect to capital and labor requires the "before-tax" marginal revenue products of capital

$$MRPK_{si} \equiv \frac{\partial\left(P_{si}Y_{si}\right)}{\partial K_{si}} = P_{si}\left(1-\frac{1}{\sigma}\right)\alpha_{s}\frac{Y_{si}}{K_{si}}$$

and labor

$$MRPL_{si} \equiv \frac{\partial\left(P_{si}Y_{si}\right)}{\partial L_{si}} = P_{si}\left(1-\frac{1}{\sigma}\right)\left(1-\alpha_{s}\right)\frac{Y_{si}}{L_{si}}$$

to satisfy

(2)
$$MRPK_{si} = \alpha_{s}\frac{\sigma-1}{\sigma}\frac{P_{si}Y_{si}}{K_{si}} = R\frac{1+\tau_{si}^{K}}{1-\tau_{si}^{Y}}$$

and

(3)
$$MRPL_{si} = \left(1-\alpha_{s}\right)\frac{\sigma-1}{\sigma}\frac{P_{si}Y_{si}}{L_{si}} = W\frac{1}{1-\tau_{si}^{Y}}$$

respectively. Expressions *(2)* and *(3)* show that, in the efficient benchmark without distortions ($\tau_{si}^{Y} = \tau_{si}^{K} = 0\ \forall \in s$), the marginal revenue products of the two fac-

[1] See *(2)* and *(3)* below.

tors are equalized across firms. Hence, at the efficient allocation the within-sector distributions of $MRPK_{si}$ and $MRPL_{si}$ exhibit zero dispersion around the means $\overline{MRPK}_s$ and $\overline{MRPL}_s$. Equalization fails, instead, in the presence of distortions, with dispersion growing with their size. Intuitively, the "after-tax" marginal revenue products are equalized across firms whereas the "before-tax" marginal revenue products may be higher for firms that face disincentives, and lower for firms that face incentives. The more so, the larger the distortions. The dispersion of $MRPL_{si}$ can thus be used as a measure of the output distortion while the (differential) dispersion of $MRPK_{si}$ can be used as a measure of the (differential) capital distortion.

The dispersions of marginal revenue products map into the dispersion of "revenue TFP". This is defined as revenue per unit of the (Cobb-Douglas) input composite

$$TFPR_{si} = P_{si}A_{si}\frac{P_{si}Y_{si}}{K_{si}^{\alpha_s}L_{si}^{1-\alpha_s}} = P\left(\frac{Y_{si}}{K_{si}}\right)^{\alpha_s}\left(\frac{Y_{si}}{L_{si}}\right)^{-\alpha_s} \tag{4}$$

in the same way as TFP represents output per unit of the (Cobb-Douglas) input composite

$$TFPR_{si} = A_{si} = \frac{Y_{si}}{K_{si}^{\alpha_s}L_{si}^{1-\alpha_s}} = \left(\frac{Y_{si}}{K_{si}}\right)^{\alpha_s}\left(\frac{Y_{si}}{L_{si}}\right)^{-\alpha_s} \tag{5}$$

Then, using *(2)* and *(3)* to substitute for Y_{si}/K_{si} and Y_{si}/L_{si} in *(4)*, one obtains

$$TFPR_{si} = \frac{\sigma}{\sigma-1}\left(\alpha_s\right)^{-\alpha_s}\left(1-\alpha_s\right)^{-(1-\alpha_s)}R^{\alpha_s}W^{1-\alpha_s}\frac{\left(1+\tau_{si}^{K}\right)}{1-\tau_{si}^{Y}}$$

or equivalently

$$TFPR_{si} = \frac{\sigma}{\sigma-1}\left(\alpha_s\right)^{-\alpha_s}\left(1-\alpha_s\right)^{-(1-\alpha_s)}\left(MRPK_{si}\right)^{\alpha_s}\left(MRPL_{si}\right)^{1-\alpha_s}$$

Hence, in the absence of distortions also $TFPR_{si}$ is the same for all firms, and its dispersion around the mean $\overline{TFPR_s}$ can be used as a measure of the overall frictions jontly due to output and capital distortions.

Under the HK assumptions, more dispersion is, in turn, associated with more inefficient allocation and lower welfare ("misallocation").[2] At the level of an individual firm i, $TFPR_{si}/\overline{TFPR_s} = 1$ implies that the firm is inefficiently small and should be allocated more inputs in order to be able to increase its output and decrease its price until . Conversely, $TFPR_{si}/\overline{TFPR_s} < 1$ implies that the firm is inefficiently large and should be allocated less inputs in order to be able to decrease its output and increase its price until $TFPR_{si}/\overline{TFPR_s} = 1$.

3. - Dataset Description

Our empirical analysis is based on a sample of Italian manufacturing firms drawn from the EU-EFIGE/Bruegel-UniCredit dataset (*http://bruegel.org/publications/datasets/efige/*; henceforth, simply "EFIGE dataset"). This dataset surveys the international activities of almost 15,000 firms in seven European economies (Austria, France, Germany, Hungary, Italy, Spain, United Kingdom). The survey was run in 2010 covering the period 2007-2009. For each country the sample is representative of firms above 10 employees. EFIGE researchers also combined the survey data with balance sheet information from the Amadeus database of Bureau van Dijk (itself covering the period 2001-2014), which is needed to compute MRPK, MRPL and TFPR.[3]

We restrict the analysis to Italian firms. For firm i in sector s, $MRPK_{si}$, $MRPL_{si}$ and $TFPR_{si}$ are determined according to the definitions in *(2)*, *(3)* and *(4)*. $P_{si}Y_{si}$ is measured by value added to net out intermediates that are not considered in *(4)*. The labour coefficient $(1-\alpha_s)$ is computed as the sectoral average of the firm-level *ratio* of total cost of labour (*i.e.* costs of employees) to value added. The capital coefficient (α_s) is the corresponding complement to one. The demand elasticity σ is set to 3 based on the median estimate reported by Head and Mayer

[2] As discussed in the Introduction, this is not necessarily the case when markups vary across firms (Asker J., Collard-Wexler A., De Loecker J., 2014), or firms incur adjustment costs in reacting to idiosyncratic shocks (De Loecker J. and Goldberg P., 2014; Haltiwanger D., 2016).

[3] As firms below 10 employees are not considered, the EFIGE dataset is not representative of smaller firms. See Altomonte C. and Aquilante T. (2012) for detailed information on the dataset and its representativeness.

(2014). All variables have been deflated using Eurostat deflators. We have trimmed the tails of the TFPR distribution, as well as firms with missing or zero labour force (18 firms), value added (15 firms), total assets (3 firms) and cost of employees (4 firms). After this data cleaning, we are left with the 2,945 firms. Summary statics across firms and sectors are described in Table 1 and 2 respectively. The former table distinguishes between two periods before and after the global financial crisis, 2001-2007 and 2008-2014. The latter table groups firms into 21 2-digit sectors according to the Nace Rev. 1.1 classification.[4]

4. - Export and Misallocation

Graph 3 depicts the distributions of log TFPR averaging across years before and after the crisis. Not all density is concentrated at the mean and, given the log transformation of TFPR, the symmetry of the distribution reveals that the share of firms with below average TFPR is substantially larger than the share of firms with above average TFPR. According to HK, this is clear evidence of misallocation, with some firms being too small and other too large relative to the optimal size. Taking into account that in our data firm size tends to increase with TFPR, the graph suggests that it is large firms that tend to be too small and small firms that tend to be too large. While this pattern holds both before and after the crisis, the leftward shift of the distribution after 2008 shows that the share of firms with below average TFPR, and therefore too large, has increased after 2008.

Graph 4 looks at the same patterns distinguishing between exporters and non-exporters. While the leftward shift is evident in both cases, it is more pronounced for non-exporters, with the differential shift driven by a drop in the fraction of firms with TFPR above the pre-crisis mean. This explains why in Graph 5 the distribution of exporters clearly dominates that of non-exporters after the crisis whereas it is very similar before the crisis.

[4] The manufacturing sectors are: “Food products and beverage”; “Textiles”; “Wearing apparel”; “Leather and leather products”; “Wood and wood products”; “Pulp, paper and paper products”; “Publishing and printing”; “Printing and reproduction of recorded media”; “Coke, refined petroleum products and nuclear fuel”; “Chemicals, chemical products”; “Rubber and plastic products”; “Other non-metallic mineral products”; “Basic metals”, “Fabricated metal products”; “Machinery and equipment n.e.c.”; “Manufacture of computer, electronic and optical products”; “Manufacture of electrical equipment”; “Other manufacturing”; “Repair and installation of machinery and equipment”; “Motor vehicles, trailers and semi-trailers”; “Other transport equipment”; “Furniture”.

These visual patterns are confirmed in Table 3, which reports the results of a regression of log $TFPR_{st}/\overline{TFPR_s}$ on firm exporter status with sector and time fixed effects. The table shows that the TFPR *ratio* is larger for exporters than non-exporters and the exporter premium grows after the crisis. This implies that both before and after the crisis there is a significant misallocation of resources in favor of non-exporters (which are too large) and to the detriment of exporters (which are too small) but this misallocation between exporters and non-exporters has become more pronounced after the crisis.

To understand whether it is more output or capital distortions that underly these findings, Tables 4 and 5 respectively report the results from regressing the logs of the marginal revenue product ratios $MRPK_{st}/\overline{MRPK_{st}}$ and $MRPL_{st}/\overline{MRPL_{st}}$ on firm exporter status with sector and time fixed effects. As the exporter premium is negative in Table 4 and positive in Table 5, the inefficiently small size of exporters is due to more severe output distortions for them than for non-exporters, with less severe differential capital distortions only partially compensating. Moreover, as the impact of the latter distortions has remained virtually unchanged after the crisis, it is actually the former that are responsible for the suboptimal size of exporters becoming even more pronounced after the crisis. As we discussed, an equivalent interpretation is that frictions affecting the access to capital and labor proportionately are more severe for exporters while frictions affecting access to capital disproportionately are more severe for non-exporters, and these features have become starker after the crisis.

Finally, it is also interesting to see whether there is any misallocation *within exporters*. We check this by regressing log $TFPR_{st}/\overline{TFPR_{st}}$ on firm *i*'s revenue share of exports ("export intensity"), number of products exported and an indicator of whether the firm exports to "tough" (*i.e.* large and distant) destinations like China and India, controlling once more for sector and time fixed effects. The results of these regressions, before and after the crisis as well as overall, are reported in Table 6. None of the regressors significantly affects log $TFPR_{st}/\overline{TFPR_s}$ before the crisis. Differently, after the crisis the relation between log $TFPR_{st}/\overline{TFPR_s}$ and export intensity becomes significantly positive (and this relation is strong enough to engender an analogous positive relation over the entire period of observation). This reveals a higher degree of misallocation with the group of exporters after the crisis whereby firms obtaining a larger fraction of their revenues from exports are inefficiently smaller.

5. - Markers of Misallocation

In the previous section we have investigated how exporter status affects a firm's relative TFPR (log $TFPR_{st}/\overline{TFPR_s}$) and, conditional on exporter status, how export intensity, the number of products exported and exporting to tough destinations further affects the firm's relative TFPR. In this section we take a different perspective and investigate, instead, the relations between log log $TFPR_{st}/\overline{TFPR}$ and key firms' characteristics ("markers"), checking whether these relations are affected by exporter status and change after the crisis.

Specifically, for each potential marker Z_{sit}, we extend the regression of relative TFPR on exporter status underlying Table 3 as follows:

$$\log \frac{TFPR_{sit}}{\overline{TFPR_{st}}} = \beta_0 + \beta_1 Exporter_{si} + \beta_2 Exporter_{si} * Post08 + \\ + \beta_3 Z_{sit} + \beta_4 Exporter_{sit} * Z_{sit} + \beta_5 Z_{sit} * Post08 + \\ + \beta_6 Exporter_{sit} * Z_{sit} * Post08 + \gamma_t + \gamma_s + \varepsilon_{sit} \qquad (6)$$

where: i, s and t refer to firm, sector and year respectively; $TFPR_{sit}$ is the TFPR of firm i in sector s at time t; $\overline{TFPR_{st}}$ is average TFPR in sector s at time t; $Exporter_{si}$ is a dummy variable equal to 1 if firm i is exporting in 2008 or has been exporting before 2008, and 0 otherwise; $Post08$ is a dummy equal to 0 until 2007 and 1 from 2009; γ_t is a year dummy capturing common shocks to all firms in year t; γ_s is a sector fixed effect controlling for time-invariant sector characteristics that may influence the effect of the marker; ε_{sit} is the error term.[5]

In equation *(6)* the main variable of interest is marker Z_{sit}. Its coefficient β_3 could be zero in two different scenarios. First, it would be zero if the allocation of resources were efficient, as $TFPR_{st}/\overline{TFPR_s} = 1$ would hold for all firms. As we have already seen, this is not the case in our data. Second, even if the allocation of resources were not efficient, β_3 would be zero if Z_{sit} did not directly affect relative TFPR. In the end, only the second scenario is relevant, so we can conclude

[5] For robustness, in the regression we also enter the marker raised to the second power to allow for possible non-linearity.

[6] The export status and the markers come from the survey collected in 2008. TFPR is constructed from balance sheets data, available for 2001-2014. Both the export status and the markers are therefore treated as fixed firm characteristics, measured in 2008, while TFPR varies over time. This is likely to introduce some measurement error, possibly biasing our estimates towards zero.

that a non-zero estimate for β_3 reveals that the marker increases misallocation.[7] In particular, larger (smaller) values of the marker lead to more misallocation for positive (negative) estimated . In other words, if the estimated β_3 is positive, firms with relatively large (small) Z_{sit} are inefficiently small (large); vice versa, if the estimated β_3 is negative, firms with relatively large (small) Z_{sit} are inefficiently large (small).

In addition to the estimated coefficient β_3 of the marker (and, as before, the estimated coefficients β_1 and β_2 of exporter status before and after the crisis), we are also interested in the estimated coefficient β_4, β_5 and β_6 of the interactions involving the marker. Each interaction measures the differential combined effect associated with the corresponding variables with respect to the benchmark consisting of non-exporters in the pre-crisis period. Accordingly, the estimated β_4 tells us how the effect of marker Z_{sit} differs between exporters and non-exporters before the crisis; the estimated β_5 tells us how the effect of the marker differs before and after the crisis; coefficient β_6 tells us how any differential effect of the marker between exporters and non-exporters changes after the crisis.

We have studied several markers, from firm ownership structure to management style, from labor force composition to access to credit and internal funding, from innovation to growth factors. We have not found any significant evidence of a relation between relative TFPR on the one side and either labor force composition, ownership structure or management style on the other.[8] Hence, in what follows we focus on the remaining markers.[9]

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[7] In Calligaris S. *et* al. (2016) we show that a marker could still be linked to misallocation even if β_3 is zero, if it is related to the dispersion of the residuals of equation *(6)*. We have checked whether this is the case and found no evidence, which implies that $\beta_3 \neq 0$ is the necessary and sufficient condition for a marker to induce misallocation. We omit these results for parsimony but they are available from the authors on request.

[8] The variables we have used are: skill intensity of blue collars; share of white collars; share of people with fixed term contract; whether the firm's manager is a family member; whether the firm is family owned. Note that this does not necessarily imply that these factors are not related misallocation in general: in fact, our regressions are conditional on export status and on the pre-post crisis interactions. The results are omitted for parsimony but are available from the authors on request.

[9] Regressions are weighted by the *ratio* of the population-to-sample ration of the number of firms in a given industry and size class pair. The weights are included in the EFIGE dataset. For their construction, the sample was split into 33 cells, by 11 NACE-CLIO industries and 4 size classes (10-19; 20-49; 50-250; more than 250 employees) on which the stratification was carried out.

Credit and Funding

In Table 7 we study how relative TFPR is related to being financially constrained and to tapping internal or external sources of funding for investments.

The variable *Credit Constrained* is defined as equal to if in 2008 the firm was willing to increase its borrowing even at a higher interest rate and applied for more credit but was refused. The estimated coefficients in column 1 suggest that credit constraints firms are inefficiently large and less resources should be allocated to them. In this respect, the fact that they are denied more credit is efficiency enhancing. This result holds for both exporters and non-exporters and it gets stronger for the latter after 2008. This implies that after the crisis exporters denied credit are the ones with lower relative TFPR.

Turning to internal and external sources of finance, the variable *Internal Funding* and *External Funding* are defined as the percentage of investments in machines, equipment etc. financed through internal sources (intra-group included) and external sources (venture capital, bank credit, leasing and factoring) respectively over the period 2007-2009. The coefficients of *Internal Funding* and *External Funding* (β_3 in columns 2 and 3 respectively) have opposite signs (and similar magnitudes). Both signs point at misallocation: firms with a high (low) share of internally financed investment have high (low) relative TFPR and should expand, while firms with a high (low) share of externally financed investment have low (high) relative TFPR and should shrink (expand). However, despite the statistical significance of the coefficients in columns 2 and 3, their magnitude is very close to zero. These features do not differ between exporters and non-exporters and have not changed significantly after the crisis.

Innovation

The EFIGE dataset reports a number of indicators related to firms' innovation activities. In Table 8, we focus on key dimensions of innovation. First, we consider whether firms carried out any product (variable Product Inn.), process (variable Process Inn.), market (variable Mkt Inn.) or organizational (variable Organ. Inn.) innovation in the years 2007-2009. We then consider whether over the same period firms have undertaken R&D activities (variable R&D). Finally, we consider whether in the same period the firm applied for a patent, registered an industrial design or trade mark, or claimed copyright (variable *Patents*).

The results in Table 8 show no significant relation between all these markers and misallocation for the benchmark group of non-exporters in the pre-crisis pe-

riod. The exception is patents for which the negative coefficient hints at inefficiently large (small) size for applicants (non applicants). For the group of non-exporters misallocation materializes only after 2008. In particular, after the crisis non-exporters with high (low) involvement in product innovation, process innovation and R&D are inefficiently small (large). The same holds for exporters with respect to process innovation, R&D and patents before the crisis; and only with respect to process innovation and patents after the crisis. Differently, market and organisational innovations do not appear to have any relation with relative TFPR both before and after the crisis.

Growth Factors

Table 9 analyses the relation between misallocation and several "growth factors". These are markers that consider whether a firm declared it suffered from demand constraints (variable Demand Constr.), and whether it attributed its growth to: reducing production costs (variable Prod. Costs); improving product quality (variable Prod. Quality); broadening the range of products (variable Prod. Range); increasing brand recognition (variable Brand); expanding the after-sales support network (variable After-sale); or expanding the distribution network (variable Distribution).[10]

A consistent finding across types of firms and periods is the significant negative coefficient of the distribution variable: firms that attribute their growth to expanding their distribution network are inefficiently large. This holds also: before the crisis, for non-exporters attributing their growth to increasing their brand recognition and expanding their after-sales network as well as for exporters attributing their growth to reducing production costs; after the crisis, for both non-exporters and exporters suffering from demand constraints costs as well as for exporters attributing their growth to reducing production costs. Another consistent finding across firm types and periods is the lack of any relation of relative TFPR with quality and product range variables.

[10] Firms' answers to what determine their growth might depend on the market condition in which they operate ("exogenous factor") and the way they decide to compete and place themselves on the market ("endogenous factor"). Sector fixed effects partially control for the former, although the 2-digit level of aggregation might not fully capture that dimension. Nevertheless, the results are informative of the relation between the way firms compete and misallocation.

6. - Conclusion

After the decline Italian exports suffered during the 1990s relative to those of other advanced economies, there had been a significant relative recovery at the beginning of the new millennium. This positive development stopped abruptly with the global financial crisis and has not regained momentum since then.

Within this broad framework, we have analysed the evolution of productivity of Italian manufacturing firms since the early 2000s, emphasising the comparison between exporters and non-exporters. After documenting a productivity decline for both exporters, and especially non-exporters after the crisis, we have focused on the evolution of the allocation of resources across firms with different productivity and its inefficiency ("misallocation"). Our analysis of misallocation suggests that both before and after the crisis exporters, were inefficiently small whereas non-exporters were inefficiently large. This is due to distortions that reduce product and factor market access more for exporters than for non-exporters. Distortions that restrict capital more than labor market access are less severe for exporters than for non-exporters but their effects are still not strong enough to offset those of the differential severity of overall distortions. There is evidence of misallocation also within the group of exporters with firms earning a larger fraction of their revenues from exports being inefficiently smaller with respect to those relying less on foreign sales.

We have then investigated which firm characteristics ("markers") are significantly associated with misallocation comparing exporters and non-exporters pre- and post-crisis. When it comes to access to finance, we have found evidence that credit-constrained firms are too large with respect to their efficient size, so in this sense it is would seem appropriate that they are not getting funded. This finding holds for both exporters and non-exporters and it gets stronger for the latter after the crisis. As for innovation, in the case of non-exporters misallocation materializes only after 2008 when firms with high involvement in product innovation, process innovation and R&D become inefficiently small while those with low involvement in these activities become inefficiently large. The same holds for exporters with respect to process innovation, R&D and patents before the crisis, and only with respect to process innovation and patents after the crisis. Finally, turning to the perceived growth drivers, a consistent finding across types of firms and periods is that firms attributing their growth to expanding their distribution network are inefficiently large. The same holds before the crisis for non-exporters attributing their growth to increasing their brand recognition and expanding their

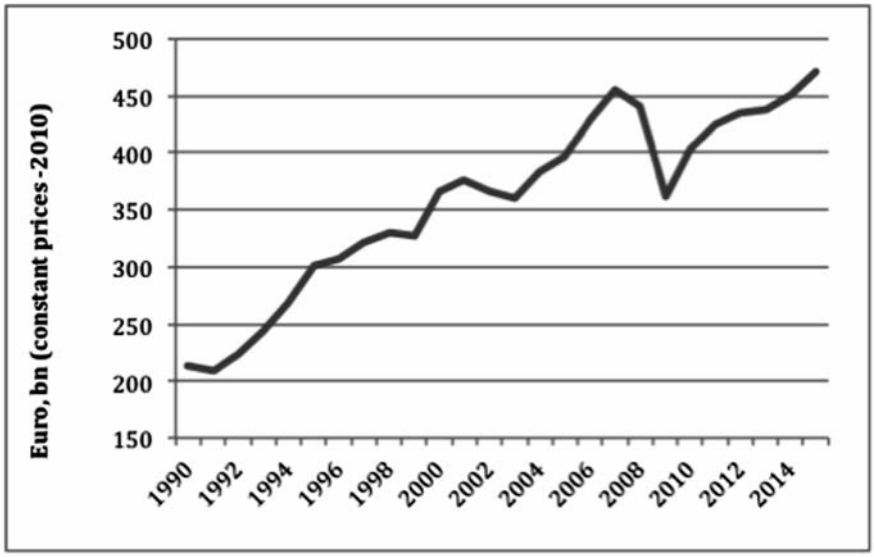
after-sales network as well as for exporters attributing their growth to reducing production costs. It also holds after the crisis for both non-exporters and exporters suffering from demand constraints as well as for exporters attributing their growth to reducing production costs.

Policies that set the incentives to balance all these firm-level features of misallocation could provide support to a recovery of Italian productivity and exports.

GRAPHS and TABLES

GRAPH 1

REAL EXPORTS 1990-2015
(2010 constant prices)



Source: UN-COMTRADE.

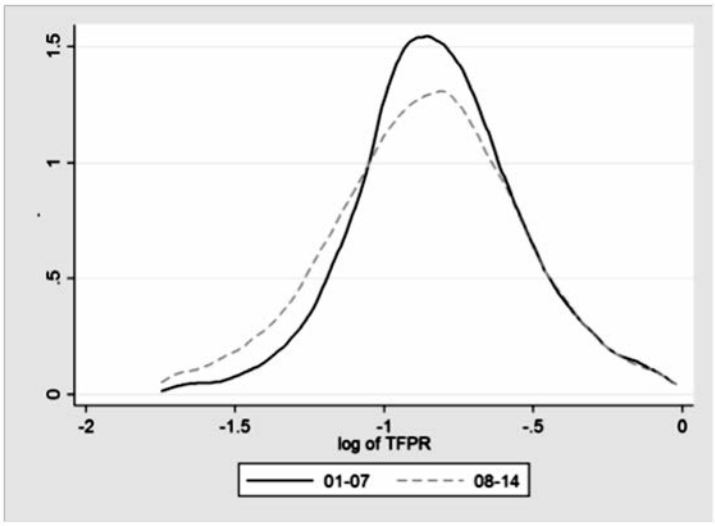
GRAPH 2

ITALIAN EXPORTS AS A SHARE OF HIGH-INCOME OECD COUNTRIES EXPORTS
1990-2015

Source: UN-COMTRADE.

Graph 3

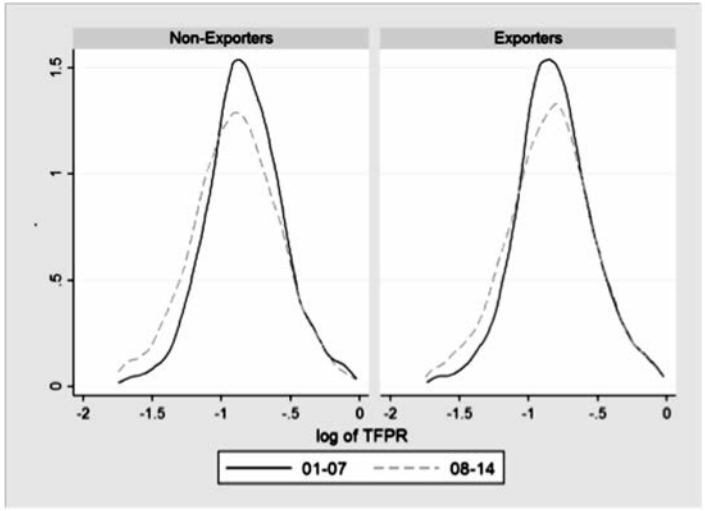
PRODUCTIVITY DISTRIBUTION OF FIRMS, AVERAGE *PRE- vs. POST*-2008



Source: Efige dataset.

Graph 4

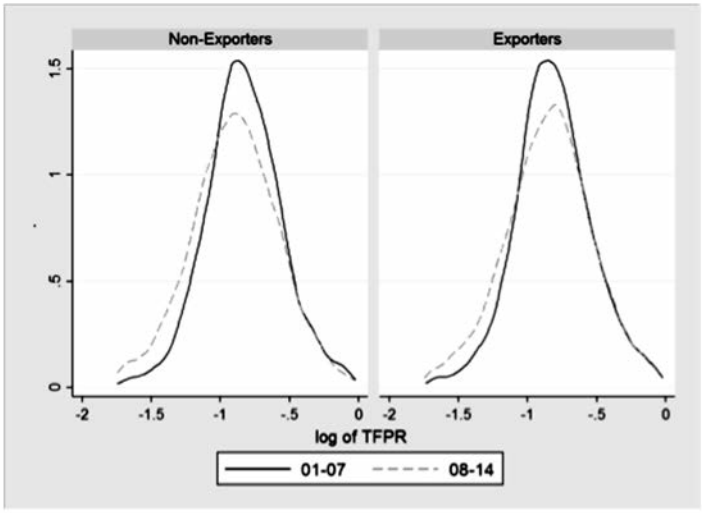
PRODUCTIVITY DISTRIBUTION OF FIRMS BY EXPORT STATUS, AVERAGE *PRE- vs. POST*-2008



Source: Efige dataset.

GRAPH 5

PRODUCTIVITY DISTRIBUTION OF FIRMS BY PERIOD, EXPORTERS *vs.* NON-EXPORTERS



Source: EFIGE dataset.

TABLE 1

DESCRIPTIVE STATISTICS

	Value added	Capital stock	N. employees	N. firms	Obs.
Overall	26.25	106.05	43.79	2,945	23,825
Non-exporters	13.59	49.94	26.31	775	5,865
(% of total)	12.7%	11.6%	14.8%	26.3%	
Exporters	30.39	124.37	49.49	2,170	17,960
(% of total)	87.3%	88.4%	85.2%	73.7%	
2002-2007	28.044	106.995	46.424	2,855	11,691
(% of total)	0.524	0.495	0.52	0.9694	
2009-2014	24.528	105.14	41.247	2,689	12134
(% of total)	0.476	0.505	0.48	0.9131	

Note: Main variables expressed both in absolute values and in percentages of the total. Absolute values of value added and Capital stock per employee are expressed in thousand of 2010 euros.

Table 2

DESCRIPTIVE STATISTICS, BY SECTOR

	Value added	Capital stock	N. employees	N. firms	Obs.
Overall	26.25	106.05	43.79	2,945	23,825
Food products and beverages	21.78	116.99	33.37	234	2,084
(% of total)	7.3%	9.6%	6.7%	7.9%	
Textiles	22.15	91.19	42.71	192	1,564
(% of total)	5.5%	5.6%	6.4%	6.5%	
Leather and leather products	13.051	54.876	34.351	108	756
(% of total)	0.016	0.016	0.025	3.7%	
Leather and leat	13.633	55.137	30.431	113	839
(% of total)	0.018	0.018	0.024	3.8%	
Wood and wood products	12.99	59.83	28.07	87	638
(% of total)	1.3%	1.5%	1.7%	3.0%	
Pulp, paper and paper products	36.81	164.71	46.85	70	566
(% of total)	3.3%	3.7%	2.5%	2.4%	
Printing and reproduction of recorded material	16.586	56.629	30.593	102	566
(% of total)	0.02	0.017	0.022	3.5%	
Coke, refined petroleum products	160.881	1344.453	81.5	7	60
(% of total)	0.015	0.032	0.005	0.2%	
Chemicals, chemical products	67.87	306.51	88.76	104	906
(% of total)	9.8%	11.0%	7.7%	3.5%	
Rubber and plastic products	29.02	107.96	50.96	166	1,412
(% of total)	6.6%	6.0%	6.9%	5.6%	
Other non-metallic mineral products	23.829	101.694	40.372	165	1,289
(% of total)	0.049	0.052	0.05	5.6%	
Basic metals	75.733	319.68	98.505	74	638
(% of total)	0.077	0.081	0.06	2.5%	
Fabricated metal products	17.20	58.41	30.72	603	4,852
(% of total)	13.3%	11.2%	14.3%	20.5%	
Computer, electronic and optical products	31.70	94.84	55.94	56	439
(% of total)	2.2%	1.6%	2.4%	1.9%	
Electrical equipment	28.204	100.463	48.581	142	1,139
(% of total)	0.051	0.045	0.053	4.8%	
Machinery and equipment n.e.c.	29.86	106.799	49.055	371	3,106
(% of total)	0.148	0.131	0.146	12.6%	
Motor vehicles, trailer	31.61	115.56	56.67	43	331
(% of total)	1.7%	1.5%	1.8%	1.5%	
Other transport equipment	33.00	153.04	60.15	31	331
(% of total)	1.3%	1.5%	1.4%	1.1%	

./.

continued TABLE 2

	Value added	Capital stock	N. employees	N. firms	Obs.
Other manufacturing	19.688	78.903	41.412	209	1,604
(% of total)	0.05	0.05	0.064	7.1%	
Repair and installation of machinery	31.68	98.024	57.578	68	590
(% of total)	0.03	0.023	0.033	2.3%	

Note: Main variables expressed both in absolute values and in percentages of the total. Absolute values of value added and Capital stock per employee are expressed in thousand of 2010 euros.

TABLE 3

RELATIVE TFPR AND EXPORT STATUS

	(1) Whole period	*(2)* *Pre*-2008	*(3)* *Post*-2008
Exporter	0.0294***	0.0169*	0.0409***
	(0.00917)	(0.00944)	(0.0115)
Observations	27,751	13,541	14,210
R-squared	0.003	0.002	0.004
Sector FE	YES	YES	YES
Year FE	YES	YES	YES

Note: Dependent Variable: Relative TFPR (log). ***, **, * significant values at 99, 95, 90%. Clustered (by firm) standard errors in parenthesis.

TABLE 4

RELATIVE MRPK AND EXPORT STATUS

	(1) Whole period	*(2)* *Pre*-2008	*(3)* *Post*-2008
Exporter	-0.178***	-0.182***	-0.175***
	(0.0225)	(0.0236)	(0.0253)
Observations	27,751	13,541	14,210
R-squared	0.030	0.034	0.027
Sector FE	YES	YES	YES
Year FE	YES	YES	YES

Note: Dependent Variable: Relative MRPK (log). ***, **, * significant values at 99, 95, 90%. Clustered (by firm) standard errors in parenthesis.

Table 5

RELATIVE MRPL AND EXPORT STATUS

	(1) Whole period	*(2)* *Pre*-2008	*(3)* *Post*-2008
Exporter	0.108***	0.0920***	0.123***
	(0.0135)	(0.0133)	(0.0164)
Observations	27,751	13,541	14,210
R-squared	0.018	0.016	0.020
Sector FE	YES	YES	YES
Year FE	YES	YES	YES

Note: Dependent Variable: Relative MRPL (log). ***, **, * significant values at 99, 95, 90%. Clustered (by firm) standard errors in parenthesis.

Table 6

WITHIN EXPORTERS RELATIVE TFPR

	(1) Whole period	*(2)* *Pre*-2008	*(3)* *Post*-2008
Export Intensity	0.000483**	0.000123	0.000834***
	(0.000194)	(0.000201)	(0.000248)
Number of products	0.00106	0.00488	-0.00279
	(0.00474)	(0.00500)	(0.00601)
Export to China/India	0.000494	-9.93e-05	0.00107*
	(0.000524)	(0.000496)	(0.000640)
Observations	17,667	8,740	8,927
R-squared	0.008	0.006	0.013
Sector FE	YES	YES	YES
Year FE	YES	YES	YES

Note: Dependent Variable: Relative TFPR (log). ***, **, * significant values at 99, 95, 90%. Clustered (by firm) standard errors in parenthesis.

TABLE 7

MARKERS OF RELATIVE TFPR: CREDIT AND FUNDING

Marker Variable *(Z):*	*(1)* Credit Constrained	*(2)* Internal Funding	*(3)* External Funding
Non-exporters, *pre*-2008 (β_3)	-0.0940***	0.0006642***	-0.000552***
	(0.0175)	(0.000206)	(0.000203)
Non-exporters, *post*-2008 ($\beta_3 + \beta_5$)	-0.0635*	0.0010662***	-0.000965***
	(0.0225)	(0.000254)	(0.0002548)
Exporters, *pre*-2008 ($\beta_3 + \beta_4$)	-0.0736***	0.0006473***	-0.0006076***
	(0.0103)	(0.0001177)	(0.0001185)
Exporters, *post*-2008 ($\beta_3 + \beta_4 + \beta_5 + \beta_6$)	-0.1029***	0.0006201***	-0.0005761***
	(0.0131)	(0.0001466)	(0.000147)
Non-exporters, *pre- vs. post*-2008 (β_5)	0.0305	0.000402*	-0.000413*
	(0.0212)	(0.000233)	(0.000233)
Exporters, *pre- vs. post*-2008 ($\beta_5 + \beta_6$)	-0.0293**	-0.0000272	0.0000315
	(0.0122)	(0.0001297)	(0.0001295)
Exporters *vs.* non-exporters, pre-2008 (β_4)	0.0204	-.0000169	-.0000559
	(0.0203)	(0.000236)	(0.000233)
Exporters *vs.* non-exporters, post-2008 ($\beta_4 + \beta_6$)	-0.0394	-0.0004461	0.000389
	(0.0260)	(0.000292)	(0.0002929)
Change in exporters *vs.* non-exporters (β_6)	-0.0598**	-0.000429	0.000445*
	(0.0244)	(0.000267)	(0.000267)
Observations	27,751	22,811	22,811
R-squared	0.020	0.015	0.013
Sector FE	YES	YES	YES
Year FE	YES	YES	YES

Source: EFIGE dataset.
Note: Dependent Variable: Relative TFPR (log). ***, **, * significant values at 99, 95, 90%; clustered (by firm) standard errors in parenthesis.

Table 8

MARKERS OF RELATIVE TFPR: INNOVATION ACTIVITIES

Marker Variable *(Z):*	*(1)* Product Inn.	*(2)* Process Inn.	*(3)* Mkt Inn.	*(4)* Organ. Inn.	*(5)* R&D	*(6)* Patents
Non-exporters, *pre*-2008 (β_3)	0.0177	0.0225	-0.0296	-0.0242	0.0131	-0.0493*
	(0.0182)	(0.0165)	(0.0195)	(0.0192)	(0.0178)	(0.0300)
Non-exporters, *post*-2008 ($\beta_3 + \beta_5$)	0.0519**	0.0679***	0.0370	0.0153	0.0670***	0.0272
	(0.0218)	(0.0194)	(0.0254)	(0.0213)	(0.0205)	(0.0312)
Exporters, *pre*-2008 ($\beta_3 + \beta_4$)	-0.0017	0.0333***	0.0003473	0.0041	0.0253***	0.0216**
	(0.0116)	(0.0092)	(0.0094762)	(0.0098)	(0.0097)	(0.0101)
Exporters, *post*-2008 ($\beta_3 + \beta_4 + \beta_5 + \beta_6$)	0.0012	0.0335**	0.0021	0.0119	0.0365**	0.0160
	(0.0232)	(0.0113)	(0.0114)	(0.0118)	(0.0120)	(0.0123)
Non-exporters, *pre- vs. post*-2008 (β_5)	0.0342*	0.0455**	0.0666***	0.0395**	0.0540***	0.0765**
	(0.0201)	(0.0178)	(0.0232)	(0.0197)	(0.0188)	(0.0326)
Exporters, *pre- vs. post*-2008 ($\beta_5 + \beta_6$)	0.0029	0.00017	0.0017	0.0078	0.0113	-0.0055
	(0.0103)	(0.01027)	(0.0105)	(0.0109)	(0.0105)	(0.0112)
Exporters *vs.* non-exporters, pre-2008 (β_4)	-0.0194	0.0108	0.0300	0.0283	0.0122	0.0709**
	(0.0204)	(0.0188)	(0.0216)	(0.0215)	(0.0201)	(0.0314)
Exporters *vs.* non-exporters, post-2008 ($\beta_4 + \beta_6$)	-0.0507**	-0.0344	-0.0350	-0.0034	-0.0305	-0.0112
	(0.0246)	(0.0224)	(0.0278)	(0.0243)	(0.0237)	(0.0334)
Change in exporters *vs.* non-exporters (β_6)	-0.0312	-0.0453**	-0.0649**	-0.0317	-0.0427**	-0.0820**
	(0.0225)	(0.0206)	(0.0255)	(0.0225)	(0.0215)	(0.0345)
Observations	27,751	27,751	27,751	27,751	27,751	27,751
R-squared	0.004	0.008	0.004	0.004	0.007	0.004
Sector FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Source: EFIGE dataset.
Note: Dependent Variable: Relative TFPR (log). ***, **, * significant values at 99, 95, 90%; Clustered (by firm) standard errors in parenthesis.

TABLE 9

MARKERS OF RELATIVE TFPR: GROWTH FACTORS (BASED ON FIRMS' PERCEPTION)

Marker Variable *(Z)*:	*(1)* Demand Constr.	*(2)* Prod. Costs	*(3)* Prod. Quality	*(4)* Prod. Range	*(5)* Brand	*(6)* After-sale	*(7)* Distribution
Non-exporters, *pre*-2008 (β_3)	-0.0152	-0.0186	-0.00257	-0.0198	-0.0842***	-0.0473*	-0.0503***
	(0.0165)	(0.0168)	(0.0160)	(0.0178)	(0.0222)	(0.0242)	(0.0165)
Non-exporters, *post*-2008 ($\beta_3 + \beta_5$)	-0.0384*	-0.0012	0.0044	-0.0052	-0.0151	-0.0416	-0.0440**
	(0.0198)	(0.0207)	(0.0196)	(0.0210)	(0.0263)	(0.0314)	(0.0217)
Exporters, *pre*-2008 ($\beta_3 + \beta_4$)	-0.0109	-0.0216**	0.0078	0.0051	-0.0021	-0.0050	-0.0228**
	(0.0096)	(0.0100)	(0.0094)	(0.0094)	(0.0104)	(0.0115)	(0.0093)
Exporters, *post*-2008 ($\beta_3 + \beta_4 + \beta_5 + \beta_6$)	-0.0472***	-0.0364***	0.0073	0.0020	-0.0175	-0.0334**	-0.0427***
	(0.0115)	(0.0120)	(0.0117)	(0.0117)	(0.0131)	(0.0161)	(0.0113)
Non-exporters, *pre- vs. post*-2008 (β_5)	-0.0232	0.0174	0.00697	0.0146	0.0691***	0.00562	0.00628
	(0.0184)	(0.0186)	(0.0180)	(0.0195)	(0.0254)	(0.0264)	(0.0198)
Exporters, *pre- vs. post*-2008 ($\beta_5 + \beta_6$)	-0.0364***	-0.0147	-0.0005	-0.0031	-0.0153	-0.0284*	-0.0199*
	(0.0103)	(0.0108)	(0.0105)	(0.0104)	(0.0111)	(0.0146)	(0.0102)
Exporters *vs.* non-exporters, pre-2008 (β_4)	0.00434	-0.00300	0.0104	0.0249	0.0821***	0.0423	0.0275
	(0.0191)	(0.0195)	(0.0185)	(0.0202)	(0.0244)	(0.0267)	(0.0189)
Exporters *vs.* non-exporters, post-2008 ($\beta_4 + \beta_6$)	-0.0088	-0.0351	0.0029	0.0072	-0.0024	0.0082	0.0013
	(0.0229)	(0.0239)	(0.0229)	(0.0240)	(0.0292)	(0.0352)	(0.0245)
Change in exporters *vs.* non-exporters (β_6)	-0.0132	-0.0321	-0.00745	-0.0177	-0.0845***	-0.0340	-0.0262
	(0.0211)	(0.0215)	(0.0208)	(0.0221)	(0.0277)	(0.0301)	(0.0223)
Observations	26,831	27,737	27,737	27,737	27,737	27,737	27,737
R-squared	0.007	0.006	0.004	0.004	0.005	0.005	0.008
Sector FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES

Note: Dependent Variable: Relative TFPR (log). ***, **, * significant values at 99, 95, 90%; Clustered (by firm) standard errors in parenthesis.

BIBLIOGRAPHY

Altomonte C. - Aquilante T. (2012), «The EU-EFIGE/Bruegel-Unicredit Dataset», no. 753, *http://bruegel.org/2012/10/the-eu-efigebruegel-unicredit-dataset/*

Asker J. - Collard-Wexler A. - De Loecker J. (2014), «Dynamic Inputs and Resource (Mis)Allocation», *Journal of Political Economy*, 122(5), pp. 1013-1063.

Barba-Navaretti G. - Bugamelli M. - Schivardi F. - Altomonte C. - Horgos D. - Maggioni D. (2010), «The Global Operations of European Firms», Second EFIGE, *Policy Report*.

Bellone F. - Mallen-Pisano J. (2013), «Is Misallocation Higher in France than in the United States?», GREDEG, *Working Paper*, no. 38.

Bloom N. - Sadun R. - Van Reenen J. (2012), «Americans Do IT Better: US Multinationals and the Productivity Miracle», *The American Economic Review*, 102(1), pp. 167-201.

Bollard A. - Klenow P. - Sharma G. (2013), «India's Mysterious Manufacturing Miracle», *Review of Economic Dynamics*, 16(1), pp. 59-85.

Bugamelli M. - Cannari L. - Lotti F. - Magri S. (2012), «The Innovation Gap of Italy's Production System: Roots and Possible Solutions», Bank of Italy, *Occasional Paper*, no. 121.

Bugamelli M. - Schivardi F. - Zizza R. (2010), «The Euro and Firm Restructuring», in Alesina A. - Giavazzi F. (eds), *Europe and the Euro,* University of Chicago Press.

Calligaris S. (2015), «Misallocation and Total Factor Productivity in Italy: Evidence from Firm-Level Data», *Labour*, 29(4), pp. 367-393.

Calligaris S. - Del Gatto M. - Hassan F. - Ottaviano G.I.P. - Schivardi F. (2016), «Italy's Productivty Conundrum», European Commission, *Discussion Paper*, no. 030.

Chen K. - Irarrazabal A. (2014), «The Role of Allocative Efficiency in a Decade of Recovery», *Review of Economic Dynamics*, 18, pp. 523-550.

Crespo A. - Segura-Cayela R. (2014), «Understanding Competitiveness», *EUI Working Papers*, 2.

Daveri F. - Parisi M.L. (2015), «Experience, Innovation, and Productivity Empirical Evidence from Italy's Slowdown», *ILR Review*, 68(4), pp. 889-915.

De Loecker J. - Goldberg P. (2014), «Firm Performance in a Global Market», *Annual Review of Economics*, 6, pp. 201-227.

De Nardis S. (2014), «Efficienza e specializzazione», *Nomisma*, October 9.

Dias D.A. - Marques Robalo C. - Richmond C. (2014), «Misallocation and Productivity in the Lead Up to the Eurozone Crisis», Banco de Portugal, *Working Paper*, no. 11.

Faini R. - Sapir A. (2005), «Un modello obsoleto? Crescita e specializzazione dell'economia italiana», *Oltre il declino*, Bologna, Il Mulino, pp. 19-77.

Foster L. - Haltiwanger J. - Syverson C. (2008), «Reallocation, Firm Turnover, and Efficiency: Selection on Productivity or Profitability?», *The American Economic Review*, 98(1), pp. 394-425.

Garcia-Santana M. - Moral-Benito E. - Pijoan-Mas J. - Ramos R. (2015), «Growing Like Spain: 1995-2000», Banco de Espana, *Working Paper*, no. 1609.

Gopinath G. - Kalemli-Ozcan S. - Karabarbounis L. - Villegas-Sanchez C. (2015), «Capital Allocation and Productivity in South Europe», *NBER Working Paper*, no. 21453.

Haltiwanger D. (2016), «Firm Dynamics and Productivity: TFPQ, TFPR, and Demand-Side Factors», *Economía*, 17, pp. 3-26.

Head K. - Mayer T. (2014), «Gravity Equations: Workhorse, Toolkit, and Cookbook», in Helpman E. - Rogoff K. - Gopinath G. (eds), *Handbook of International Economics*, vol. 4, Elsevier, pp. 131-195.

Hassan F. - Ottaviano G.I.P. (2013), «Productivity in Italy: The Great Unlearning», *VoxEu*, December 14.

Hsieh C. - Klenow P. (2009), «Misallocation and Manufacturing TFP in China and India», *Quarterly Journal of Economics*, 124(4), pp. 1403-1448.

Lippi F. - Schivardi F. (2014), «Corporate Control and Executive Selection», *Quantitative Economics*, 5(2), pp. 417-456.

Lusinyan L. - Muir D. (2013), «Assessing the Macroeconomic Impact of Structural Reforms: The Case of Italy», *IMF Working Paper*, no. 13/22.

Michelacci C. - Schivardi F. (2013), «Does Idiosyncratic Business Risk Matter for Growth?», *Journal of the European Economic Association*, 11(2), pp. 343-368.

Pellegrino B. - Zingales L. (2014), *Diagnosing the Italian Disease*, unpublished manuscript.

Ziebarth N. (2013), «Are China and India Backwards? Evidence from the 19th Century U.S. Census of Manufactures», *Review of Economic Dynamics*, 16(1), pp. 86-99.

Productivity in Italy: Recent Developments and the Role of International Competition

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Productivity slowdown is a concern around the world, especially after the Great recession. Italy is a special case: since the end of the nineties productivity growth has been unsatisfactorily low. We describe the evolution of Italian productivity and discuss what could be the main structural determinants of such a dismal performance. A particular attention is devoted to the link between productivity and competition: while the lack of competition in some service sectors and the unfair competition generated by a diffused tax evasion negatively affect productivity dynamics, the pressures exerted by international competition on the manufacturing industry have instead sustained it.
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1. - Introduction

In the aftermath of the Great recession, the global slowdown in productivity growth around the world has become a serious concern for policy makers. In 2015, according to the Conference Board, growth in global output per worker slowed down further in emerging and developing countries, while in mature ones it remained steady, although at modest, growth rates; no rebound is foreseen for 2016, as a number of headwinds persists.

According to the discussion in policy and academic *fora*, growth prospects are hindered by cyclical and structural factors. In emerging and developing economies, the cyclical factors included the recent decline in commodity prices, the large capital outflows and the resulting increase in financial market volatility. In developed economies growth is negatively affected by slowing demand – investment in particular – persistently low levels of inflation, political and macroeconomic uncertainty, growing dependence on monetary stimulus, as well as concerns on the timing and the possible effects of central banks' tapering activities.

As pointed out by Gordon (2012), future economic growth may slow further owing to a number of structural issues related to the supply-side, and common to most developed countries: demography, inequality, globalization, environment protection, and the overhang of consumer and government debt.

In the US the share of population aged 60 or older is projected to increase by 21 percent between 2010 and 2020, and by 39 percent between 2010 and 2050 (Administration on Aging, 2014). This notable shift in the age structure of US population – effect of historical declines in fertility and mortality – has the potential to negatively impact the performance of the economy as well as the sustainability of government entitlement programs, and could result in a decline in consumption for the population as a whole. Recent estimates for the US show that a 10 percent increase in the fraction of older population would decrease growth in GDP per capita by 5.5 percent (Maestas *et* al., 2016). Moreover, decomposing GDP per capita into its components, namely GDP per worker and the employment-to-population *ratio*, Maestas *et* al. (2016) find that two-thirds of the decline in GDP growth is driven by a reduction in the rate of growth of GDP per worker, *i.e.* labor productivity, while only one-third is due to slowing labor force growth. The age composition of the US population is very similar to European countries, including Italy, where recent reforms of the pension system aimed at increasing retirement age kept older workers in the labor force (Carta and D'Amuri, 2016).

Rising inequality is also a concern: largely reflecting the increased dispersion in average wages paid across firms (Card, Heining and Kline, 2013), it is a threat to growth. Part of the increase in inequality is due to the combined effect of technology and globalization: cheap labor from emerging countries competes not just through outsourcing, but also through imports which combine lower wages with growing technological capabilities.

Part of any effort to cope with global warming represents a payback for past growth, says Gordon (2012); but innovations aimed at coping with environmental regulations systematically differ from other innovations in their effect on productivity, with a generally lower return than non-environmental innovations, with a negative effect on productivity, at least in the short-run (Lotti and Marin, 2016). Finally, household, but in particular government high deficits and debts are a serious drag on growth, especially in some European countries.

As said, most of these headwinds, either cyclical or structural, apply to EU countries, too. Italy is surely among them: population is aging, inequality growing[1], government debt exceptionally high, investment activity still 30 per cent below the pre-crisis level, the level of demand persistently low.

However, studying the Italian case means taking a different and richer perspective. First of all, the trend in productivity has been dismal even before the financial crisis of 2007-2008, and Italy is the only country that recorded both negative labor productivity and TFP growth over the period 1995-2014. This is to say that Italy's productivity growth has been unsatisfactorily low for a much longer period than the latest recession and has been so even when compared with the main European countries that shared with Italy the adoption of the euro and the European fiscal rules, among many other features (Figure 1). If we rely on a standard GDP growth decomposition framework, only population growth, entirely due to immigration, and the increase in the employment rate have allowed the Italian economy to reach a modest average increase in GDP of 0.4 percent per year. In prospective terms, while EU15 productivity is projected to grow at a modest 0.08 percent, Italy's one is expected to be *nihil* in 2016.

It should not be surprising that a lot of economists' analytical efforts and policy makers' attention have been devoted to identify the main structural weaknesses underlying the lack of competitiveness of the Italian economy and understand the mechanisms through which any of these weaknesses act as obstacles to growth.

[1] This is evident also in Italy, where the interquartile range of the average daily wage more than doubled from 1990 to 2014.

It goes beyond the scope of this paper to critically review all the available empirical evidence on the structural and institutional factors that hinder productivity growth in Italy. Some of them are internal to the firms: small size, low propensity to innovate, low management skills and inadequate management practices, a financial structure too centered around banks' credit. Others relate to the external economic and institutional context: ineffectiveness of the general government sector, diffused corruption, excessive and distortive regulations in some relevant markets and sectors, limited supply of human capital, inefficiency of civil justice, lack or low quality of material and immaterial infrastructures. Here we limit our analysis to competition and send to other works for a more thorough discussion of the so-called Italy's productivity conundrum (see, among others, Brandolini and Bugamelli, 2009; Bank of Italy, 2014; Pellegrino and Zingales, 2014; Calligaris, Del Gatto, Hassan, Ottaviano and Schivardi, 2016).

On competition, we will highlight different forces at play: on one side the negative effects stemming from the lack of competition in some service sectors and the unfair competition generated by a diffused tax evasion, on the other the positive effects exerted by increased international competitive pressures, the so called "globalization". As to the latter the evidence on Italy will be carefully discussed after reviewing the rich international trade literature based on heterogeneous firms.

Before turning to the description of the data and the empirical evidence, a word of caution is needed on the measurement of productivity. As neatly pointed out by De Loecker and Goldberg (2014), most of the studies aimed at estimating the impact on productivity «[…] *has been loose in its use of the term productivity. What it actually delivers is a measure of firm performance or profitability*». This is due to the fact that omitted variables often bias the estimates of total factor productivity, confounding true technical efficiency with prices which in turn reflect product differentiation and markups. These omitted variables have mostly to do with output and input price heterogeneity: if not appropriately accounted for, as it is the case in the great majority of studies, the effects on costs and markups cannot be separately identified from those on productivity. In such cases, it is said that the estimated effect is on revenue productivity (named TFPR) rather than on technical efficiency (TFPQ) as desired.

Recent papers by De Loecker (2011); De Loecker and Warzynski (2012); De Loecker, Goldberg, Khandelwal and Pavcnik (2016); Forlani *et* al. (2016); and Lamorgese, Linarello and Warzynski (2016) make a step forward and use a mix of data on prices and modeling assumptions to better control for output and input price heterogeneity and provide an estimate of TFPQ.

2. - Italy's Productivity Slump: When Headwinds Meet Structural Weaknesses

Since the early 2000s, productivity in Italy exhibited lower levels with respect to other EU countries: in 2000 hourly labor productivity in Italy was 20 percent lower than in Germany, 25 percent less than in France. In the subsequent years and until the financial crisis, the productivity gap widened, mostly due to a lagging Italy. After a temporary interruption during the financial crisis of 2008-2009, this divergent trend remerged: for Italy it meant going back to productivity stagnation (Figure 1).

However, a closer look at this aggregate dynamics uncovers very different productivity paths between manufacturing and service industries (Figure 2). In manufacturing, the positive trend of 2015 was in line with the data – repeatedly revised upwards by National Institute of Statistics (Istat) – of the previous years. Despite the sharp, but brief, collapse of 2008-2009, cumulative growth since 2004 stands at 15.6 per cent. On the contrary, in the private non-financial services sector, hourly productivity has declined by 0.4 per cent on average over the last fifteen years, mainly because of the developments in the sector of professional, scientific, and business technical support activities.

There is a first cut of the data that, in our view, is so specific to Italy to be very informative for the direction to be taken in subsequent analyses on the determinants of such productivity underperformance.

Italy is the country with the most fragmented productive system with respect to other EU economies. In Italy microenterprises, those with less than 10 employees, account for 95 percent of the total number of firms, for 29 percent of the total value added. On the other tail of the distribution, large companies, with more than 250 employees, do not reach 0.1 per cent in terms of number of firms, against 0.5 and 0.2 in Germany and France, respectively (Figure 3). This feature does not reflect Italy's productive specialization in the so-called "traditional" sectors, like textile, leather, shoes, and clothing, where economies of scale matter less. A standard shift-share decomposition shows how the main contribution to the firm size difference with respect to the other main euro area countries originates within sector, that is to say that in any sector Italian firms are on average smaller than foreign ones (Table 1).

What is the problem with this structure? By simply looking at productivity, both levels and dynamics, across firm size classes and countries, it is quite clear that Italy's peculiarity is a serious drag on aggregate productivity. On one side, in all countries and for technological reasons the correlation between productivity

and size is positive: in Italy the productivity level in larger firms more than doubles that of companies with fewer than 10 employees. This implies that the predominance of small and micro firms in Italy negatively affects aggregate figures for a simple composition effects.

But there is more. Comparing productivity levels and dynamics across countries but within size class, it emerges that Italian smaller firms are relatively less efficient than their European counterparts: the same gap between larger and smaller firms in Germany is only 48 per cent (Figure 4).

By contrast Italy's medium-sized enterprises (50-249 employees), whose productivity was already slightly higher before the crisis, recorded greater improvements between 2007 and 2013 than similarly German firms, especially in the manufacturing sector. In particular, if we look at Italy's medium-sized manufacturing firms, we see a bulk of highly productive firms competing in the international market. The medium-sized enterprises account for as much as 32 percent of total manufacturing exports, a markedly higher value than that of the same size class in the other major euro area economies. More limited is, instead, the role of Italian large firms when compared with the other countries and, in particular, with Germany, where they contribute to well above 80 percent of total exports.

This simple correlation between firm size and productivity has been substantiated by various empirical analyses. For example, a smaller firm size is associated to worse management practices (Bugamelli, Cannari, Lotti and Magri, 2012) that can in turn lead to a limited innovation (Pagano and Schivardi, 2003) and internationalization capacity. Interestingly, it appears that this peculiar structure of the Italian productive system, that has been successful until the late 80s, has rapidly become unfit to face three big changes occurred since the end of the 90s: the ICT revolution, the increased globalization and the adoption of the euro (Brandolini and Bugamelli, 2009).

3. - The Role of International Competition

Before focusing on international competition and productivity, it is worthwhile to briefly address the more general issue of the effects that a more competitive environment could have on productivity.

The theoretical literature on the impact of competition on innovation has reached very few solid conclusions. This is so because several factors may change

the sign of the relationship: incentives to innovate change with the prevailing market structure, with the nature of innovation (radical vs marginal), with the distance between leading firms and laggards. Indeed, the influential paper by Aghion, Bloom, Blundell, Griffith and Howitt (2005) proposes an inverted U-shaped relationship, whereby more competition is beneficial to innovation when the initial degree of competition is relatively low, but it becomes disruptive when competition is too fierce to start with. From a strictly empirical perspective, it must be said that there are indeed many studies concluding for a positive effect of competition on innovation.

The relationship between international competition and productivity is widely studied in the trade literature. While earlier empirical analyses have been focusing on country- and/or industry-level data, more recently the increasing availability of very rich firm-level dataset has allowed to better identify the mechanisms through which trade shocks may impact on a country, their distributional effects and therefore the productivity and welfare gains from trade.

In this section, we keep the debate on TFPR vs TFPQ on a side and loosely speak of the productivity effects of trade, even when productivity is not appropriately measured. This is in a sense inevitable because not only, as already said, most of the literature is plagued by such biases but also and more importantly because, to the best of our knowledge, no work on Italian data has taken into account the role of demand, prices and markups when estimating total factor productivity.

From a country perspective the intensification of trade flows can be the result of different shocks or policies and materialize through different channels. Taking into explicit account where the change in trade exposure comes from and how it affects a country's productive system is key to interpret the results and derive welfare and policy implications.

A country can experience a significant increase in its exposure to trade flows because of a *trade liberalization policy*, either in the same country or in one of its trading partners, or the *entry of new big "players" in international markets*, as happened over the last decades with China and other emerging and developing countries, or even because of *relevant technological advancements reduce trade costs*. In the empirical literature a trade shock has been identified using either one of the above mechanisms, being obvious that trade liberalization episodes have, at least recently, interested only some developing and emerging economies.

A given trade shock can affect a country and its firms through three main channels. The most standard one is a *competition channel*. Reasonably enough, when international trade intensifies a country's firms end up facing stronger competitive

pressures, both in the domestic market via increased import penetration and in the foreign markets where they export (or intend to export) (Melitz, 2003; Bernard, Eaton, Jensen and Kortum, 2003). Globalization and trade openness imply also an enlargement of a firm's (potential) market size. This *demand size channel* on one side reinforces the competition effect since larger markets are reasonably assumed to be more competitive (Mayer, Melitz and Ottaviano, 2014 and 2016), on the other generates a scale effect that may induce firms to modify their technological and production strategies. Finally, trade affects a firm not only through its output markets but also modifying the structure of its intermediate inputs' markets: typically, thanks to international trade a firm may gain access to *cheaper and/or higher quality inputs* (Amiti and Konings, 2007; Halpern, Koren and Szeidl, 2015).

Last but not least, given the specific nature of the trade shock, a country's productivity and profitability may change because the shock may induce a reaction at the firm-level or trigger a reallocation of market share across firms with different level of efficiency. The empirical literature is quite rich with respect to the within firm effects, while fewer have dealt with the reallocation effects of international trade.

That trade may have a positive effect on a country's productivity through reallocation is central to the seminal theoretical paper by Melitz (2003) and the many others that followed. It can also be indirectly inferred from the growing literature on misallocation and allocative efficiency (see, among others, Hsieh and Klenow, 2009; Asker, Collard-Wexler and De Loecker, 2014; Bartelsman, Haltiwanger and Scarpetta, 2013): among the set of relevant frictions generating distortions and negatively affecting the efficiency of resource allocation, trade frictions can be easily hosted.

At the empirical level, Pavcnik (2002) provides evidence in favor of a clear connection between Chile's trade reform and reallocation of market shares across firms with different productivity levels. Trefler (2004) shows that after the Canada-US Free Trade Agreement the contraction of low-productivity firms sustained productivity growth in industries where tariff cuts were deepest.

Various studies offer indirect evidence that trade shocks can trigger productivity-enhancing reallocation effects by forcing a downsizing of the least productive firms, a stronger reduction in their output prices and profit margins, an increase in their probability to exit the market. All this gives a start to a redistribution of market shares that leads to sectorial and aggregate productivity improvements (Bernard, Eaton, Jensen and Kortum, 2003; Melitz and Ottaviano, 2008). On the basis of U.S. plant-level data, Bernard, Jensen, and Schott (2006*a*) find that the sectorial exposure to imports from low wage countries is negatively

correlated with employment growth and positively correlated with the probability of plant death.[2] Analogous results on employment and firm survival emerge from studies focused on European countries (Coucke and Sleuwagen, 2008; Bloom, Draca, and Van Reenen, 2016; Mion and Zhu, 2013).

Turning to within-firm effects of international trade, the literature can be organized according to the margins that define a firm's reaction to increased competitive pressures.

Early works have studied the relationship between exports and productivity with the aim of disentangling the selection effect, embedded in the idea that only more productive firms find it convenient to pay the fixed cost of exporting[3], from a firm's incentive to achieve efficiency gains in order to keep up with greater competitive pressures in foreign markets. The latter is known as the "learning-by-exporting" hypothesis (Clerides, Lach and Tybout, 1998; Bernard and Wagner, 1997).

Against vast evidence in favor of the selection effect, some studies find the productivity increases may follow exporting activity. De Loecker (2007) uses data on newly exporting firms in Slovenia and finds that these firms become more productive after entry and that their productivity gap with respect to domestic firms increases over time. On Community Innovation Survey data, Crespi, Criscuolo, and Haskel (2008) show that exporters, who claim to learn from foreign buyers, have also recorded higher productivity growth compared to domestic firms. Using the Canada-US Free Trade Agreement as identification strategy,

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[2] According to Khandelwal A. (2010), the effect on employment and output is larger in industries where the scope for product quality differentiation is smaller. Using data on US local labor markets, Autor D.H., Dorn D. and Hanson G.H. (2013) unveil a broader set of labor market effects stemming from imports from China: lower employment, higher unemployment, lower labor force participation, and reduced wages.

[3] According to the self-selection idea, the difficulty of exporting is ascribed to the presence of fixed costs specific to export activity, such as product transport, distribution and marketing costs or the costs of hiring qualified personnel to manage relations with international customers. The hypothesis of fixed export costs, which was first put forward by Baldwin R.E. (1988 and 1989); Baldwin R.E. and Krugman P.R. (1989); Dixit A. (1989) and Krugman P.R. (1989) and underlies theoretical models with heterogeneous firms *à la* Melitz, implicitly presupposes a barrier to entry in foreign markets that the less productive firms are unable to overcome. Starting with the work of Roberts M.J. and Tybout G.R. (1997), numerous empirical studies have corroborated this hypothesis: Bernard A.B. and Wagner J. (1997) for Germany; Bernard A.B. and Jensen J.B. (2004) for the United States; Campa J.M. (2004) for Spain; Poddar T. (2004) for India, and Girma S., Greenaway D. and Kneller R. (2004) for the United Kingdom. For Italy, the presence of fixed export costs has been demonstrated by Castellani D. (2002) and by Bugamelli M. and Infante L. (2003).

Lileeva and Trefler (2010) find that labor productivity of Canadian firms increases as a consequence to US tariff cut and that this effect is stronger among ex-ante smaller and less productive firms. Reviewing 45 studies on 33 countries published between 1995 and 2006, Wagner (2007) concludes that exporting firms are definitely more productive than average owing to a self-selection effect, whereas entering foreign markets does not necessarily lead to an increase in efficiency at firm level. These results have been confirmed by an international comparative research project launched by (ISGEP, 2008)[4].

The productivity gains may be difficult to identify also because it likely takes time for them to be observable to the econometrician (leaving aside the estimation problems we referred to earlier). Thus, the literature has developed in the direction of searching for trade effects on observable factors related to a firm's product mix, inputs, technology, and organization. Even though in different ways and with different relevance and timing, these are all adjustment margins that at the end should affect firm productivity.

The main argument goes through strengthened innovation efforts and outcomes. Focusing on increased import penetration after China's accession to the World Trade Organization in 12 European countries, Bloom, Draca and Van Reenen (2016) find that firms more exposed to such imports increased their R&D expenditure, patenting and adoption of information technology. Autor, Dorn, Hanson, Pisano and Shu (2016) find the opposite effect of Chinese import penetration on US manufacturing firms' patents.

A similar effect is found on the export side where the trade shock brings about an enlargement of market size. Bustos (2011) shows that Argentinean firms respond to the Mercosur Free Trade Agreement by increasing both their export market participation and their technology spending. She also finds that the impact of the exogenous reduction in tariffs on technological adoption is heterogeneous across firms, and stronger among those in the middle-upper tail of the size distribution.

Productivity and innovation improvements are often due to and call for changes in the workforce in the direction of raising the demand for skills. Mion and Zhou (2013) analyze the impact of increased imports from different origin on Belgian manufacturing firms. Among other things, they find that imports

[4] The project sought to study the relationship between exports and productivity by reducing methodological and statistical differences. Some 40 researchers took part, conducting analyses of firm-level data from 14 countries (Austria, Belgium, Chile, China, Colombia, Denmark, France, Germany, Ireland, Italy, Slovenia, Spain, Sweden and the United Kingdom). Davide Castellani, Francesco Serti and Chiara Tomasi joined the project for Italy.

from China induced a significant skill upgrading in low-tech industries, accounting for almost half of the total increase in the share of highly educated workers.

Related to innovation is product quality upgrading. Martin and Mejean (2014) estimate a significant increase in the mean quality of French aggregate exports in the markets where import penetration by low wage countries has increased relatively more. Amiti and Khandelwal (2013) find that countries with tougher competition in domestic markets – inversely related to the level of import tariffs – export higher quality products to the US.

Another interesting product margin of adjustment is a reallocation one within firm: as pointed out by Bernard, Jensen and Schott (2006*b*), trade liberalization may foster productivity growth by inducing firms to shed marginally productive products. A similar within-firm cross-product reallocation effect has been further investigated by Mayer, Melitz and Ottaviano (2014, 2016). Mayer, Melitz and Ottaviano (2014) build a theoretical model whereby multi-product firms may vary their product mix as a function of destination markets' toughness of competition. They show how tougher competition, shifting down the entire distribution of markups across products, induces firms to skew their export sales toward their better performing products. This reaction is strongly confirmed by the behavior of French exporters across destination markets. In a second paper Mayer, Melitz and Ottaviano (2016) takes this argument even further by showing that this evidence holds not only across markets but also within markets when competition becomes tougher. Importantly for our purposes, they estimate that this positive productivity effect stemming from the reallocation of production toward "better" products is relevant and explain an important share of aggregate productivity fluctuations for French manufacturing.

4. - What Do We Know about Italy?

In section 2 we pointed out how productivity sluggishness has been particularly strong in the service sector as compared with manufacturing. This may indeed be related to competition. Ciapanna and Genito (2014) find a negative relationship between regulatory restrictiveness in the professional services, as measured by the OECD indicators of regulation in non-manufacturing sectors (NMR)[5] and productivity. They also show how this works through firm size: a

[5] Although this index shows a slight improvement in the last decade, its value is among the highest in European countries.

higher degree of legal constraints appears to be associated to lower firm size and, through this channel, to lower productivity growth.

On the basis of data for 15 industrial sectors in 17 OECD countries for the period 1996-2002, Barone and Cingano (2011) focus on energy provision, transport, communications and professional services, and show that regulation of the contestable segments of the markets has negative effects on the growth of value added, labor productivity and exports of the manufacturing sector. These effects derive mainly from the lack of competition in professional activities (notaries, lawyers, engineers, accountants, etc.) and in the energy sector (production and distribution of electricity and gas), for which a reduction in regulation would lead to increments in the growth rates of the user sectors comparable in size to those that the literature estimates would come from the development of the financial markets.

Some evidence on the link between import competition and allocative efficiency for Italy is produced by Linarello and Petrella (2016). Using the database on the universe of Italian manufacturing firms previously described, they show that import penetration, measured as the share of imports from developing countries over domestic consumption at 4-digit industry level, has a strong and positive effect on reallocation (Table 2). However, they do not find a significant impact on aggregate productivity.

As to indirect evidence on trade and reallocation, Federico (2014) finds that competition from low wage countries is negatively correlated to employment and other measures of domestic activity for 230 manufacturing sectors; the contractionary effect is significantly smaller in more skill, capital- and R&D-intensive sectors. Bugamelli, Fabiani and Sette (2015) analyze the impact of increase import penetration from China on the dynamics of firm-level output prices in Italy. Accounting for potential endogeneity biases they find a significant and negative causal relationship: a 0.1 percentage point higher Chinese import penetration restrains price growth by 0.17 percentage points per year. This relationship reflects a procompetitive effect induced by cheaper imports and implies a reduction in profits and markups which is driven by low-productivity firms within less skill-intensive sectors. A negative impact of import competition on markups is documented also by Altomonte and Barattieri (2015).

An interesting result included in the ISGEP project regards Italy which turns out to be the sole exception to the generalized finding of no learning-by-exporting: Serti and Tomasi (2008) show that Italian firms that start to export subsequently are able to improve their productivity further and to grow in size.

Following the work by Bustos (2011), Accetturo, Bugamelli, Lamorgese and Linarello (2016) use Italian firm-level data and European Patent Office (EPO) records to show that an exogenous increase in exports has a positive effect on the probability that a firm applies for a patent. This effect is mostly driven by larger firms. In a companion paper, Accetturo, Bugamelli and Lamorgese (2013) show that an analogous increase in foreign sales cause a sizeable skill upgrading of the workforce, in terms of both average education and share of non-production workers. Using the 1992 devaluation of the Italian lira for identification purposes, Macis and Schivardi (2016) show that the devaluation increased the demand for higher skills, in particular for those more useful for exporting, driving their relative price up.

All in all, it can be assessed that boosts to trade, both on the export and the import side, have positive effects on Italian productivity via reallocation effects and within firm adjustments. Obviously, there are negative side-effects in terms of employment that must be properly addressed by well-designed welfare policies.

We would like to conclude with a study that, even if not related to international competition, proposes a novel mechanism – and, needless to say, very relevant for the Italian case – through which a distortion to the competitive environment may adversely affect innovation and productivity dynamics. Based on a general equilibrium model that takes account of firm heterogeneity, Bobbio (2016) shows that a heavy fiscal burden and high levels of tax evasion can help to explain the weak growth of an economy and, at the same time, some structural characteristics like the prevalence of an exceptionally large share of small and very small firms, a weak innovation activity by private firms (Bugamelli, Cannari, Lotti and Magri, 2012) and a relatively poor ability to allocate resources to the more productive sectors and enterprises (Andrews and Cingano, 2014).

The mechanism behind the result is quite interesting. On the assumption that the opportunities for evasion diminish as firm size increases, smaller companies have less incentive to invest in innovation and to expand their business, thereby keeping the competitive advantage tied to evasion. The unfair competition of these firms reduces the expected returns to innovation for all the others, which consequently undertake projects with less growth potential. At the aggregate level, the lower rate of innovation resulting from the choices made by individual firms entails less selective pressure, which is reflected in the survival of small, less productive and less innovative firms, and in an increase in the relative size of the underground economy. The allocative efficiency gets consequently reduced.

Using Istat's official estimates of the shadow economy in Italy, Bobbio

(2016)'s model implies that, without evasion, from 1995 to 2006 the annual GDP growth rate would have been at least 0.2 percentage points higher, thanks to a larger number of innovative firms and a greater propensity to innovate.

5. - Concluding Remarks

Since 2008 the Italian economy has suffered from the global crisis: value added and productivity have declined and the business birth rate has fallen. But growth had already suffered in the previous decade from a series of unresolved structural problems that highlighted the difficulty the Italian economy had in adjusting to the major changes in the world economy and technology. Productivity had risen less than in the past and more slowly than in other countries; Italy had lost market shares of world trade, also in comparison with the other European economies; the participation of Italian firms in global production chains remained generally marginal and subordinate.

The persistently unsatisfactory productivity performance is the reflection of many factors. Some of them are internal to the firms: small size, low propensity to innovate, low management skills and inadequate management practices, a financial structure too centered around banks' credit. Others relate to the external economic and institutional context: ineffectiveness of the general government sector, diffused corruption, excessive and distortive regulations in some relevant markets and sectors, limited supply of human capital, inefficiency of civil justice, lack or low quality of material and immaterial infrastructures.

Indeed, since 2011 an extensive reform effort has been initiated with the aim of creating conditions more conducive to growth. Measures have been adopted to make the labor market more efficient, improve the institutional environment for business, facilitate firms' recourse to equity capital and provide incentives for investments in venture capital funds and in the equity of start-ups, improve the functioning of civil justice, step up the construction of infrastructure and combat corruption.

In this paper we have focused on competition and shown that competition fosters productive and allocative efficiency and provides an incentive to make the best use of resources both within each firm and in the market. It helps to stimulate innovation and productivity gains. This applies to Italy, too.

In this regard, we recall that in Italy after the liberalization measures adopted in 2011 and 2012 there has been further limited progress in opening markets to

competition. In this regard and on the basis of the evidence herein provided, policy-makers should not only act in a decisive manner through the annual law on competition but also pay attention to distortions to competition that may arise as a consequence of other structural features; the tax evasion story by Bobbio (2016) is a clear point in case.

TABLES and FIGURES

TABLE 1

SHIFT-SHARE DECOMPOSITION OF AVERAGE PRODUCTIVITY BY SIZE CLASS IN MANUFACTURING IN MAJOR EUROPEAN COUNTRIES

COUNTRY	PJ	P_AVERAGE	DIFFERENCE	SECTOR EFFECT	COUNTRY EFFECT	INTERACTION
SIZE CLASS [0- 9]						
France	44.9	35.3	9.6	-0.1	8.8	0.9
Germany	32.4	35.3	-2.9	0.5	-2.4	-0.9
Italy	26.1	35.3	-9.3	-1.0	-8.9	0.6
Spain	27.2	35.3	-8.1	-0.6	-7.7	0.2
UK	50.4	35.3	15.1	2.3	14.3	-1.5
SIZE CLASS [10-19]						
France	49.0	41.8	7.2	0.4	5.5	1.3
Germany	38.3	41.8	-3.5	0.5	-3.8	-0.2
Italy	40.9	41.8	-0.9	-0.1	-0.9	0.1
Spain	38.4	41.8	-3.3	-0.5	-4.1	1.2
UK	47.9	41.8	6.1	2.0	4.7	-0.7
SIZE CLASS [20-49]						
France	55.2	48.8	6.4	1.0	4.9	0.5
Germany	44.0	48.8	-4.8	0.8	-5.1	-0.5
Italy	49.5	48.8	0.7	-0.4	0.7	0.4
Spain	46.8	48.8	-2.0	0.4	-2.2	-0.2
UK	49.2	48.8	0.4	1.4	-0.5	-0.5
SIZE CLASS [50-249]						
France	60.9	58.2	2.7	0.4	2.1	0.2
Germany	52.7	58.2	-5.5	1.0	-6.8	0.3
Italy	64.1	58.2	5.9	1.8	4.4	-0.3
Spain	56.6	58.2	-1.5	0.8	-2.0	-0.4
UK	61.3	58.2	3.1	0.4	2.0	0.7
SIZE CLASS [250+]						
France	81.5	80.7	0.9	3.2	-2.0	-0.3
Germany	79.7	80.7	-1.0	0.4	-2.3	0.9
Italy	77.6	80.7	-3.1	1.5	-4.5	-0.1
Spain	74.0	80.7	-6.7	2.7	-8.8	-0.6
UK	88.3	80.7	7.6	3.6	4.6	-0.6

Source: CIAPANNA E. (2015), based on EUROSTAT, *Structural Business Statistics*, 2012, 2008 prices.
Note: PJis labor productivity of country J.; P_AVERAGE is average productivity across countries. The DIFFERENCE is decomposed in: SECTOR EFFECT, representing the extent to which sectorial specialization affects productivity (the weight difference in terms of added value of the sector I in country J compared to the average weight in the other countries), a COUNTRY EFFECT, that measures the difference between the productivity of sector I in country J and the average productivity of sector I, and an INTERACTION term which is just a residual.

Table 2

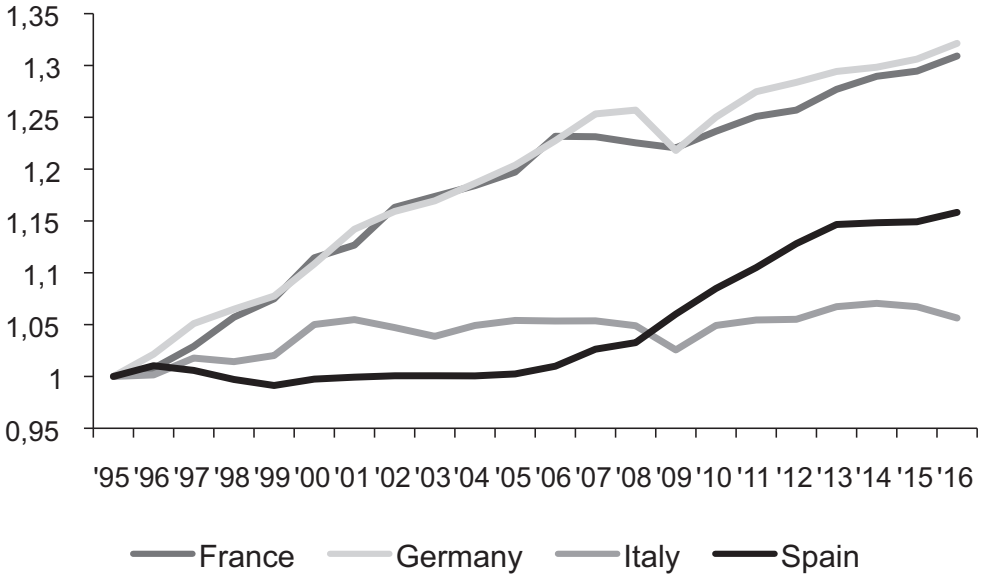
PRODUCTIVITY AND COMPETITION IN ITALY

	Average productivity	Reallocation	Entry	Exit	Aggregate productivity
			Panel *(a)*:		
log Herfindahl	-0.8766	1.6105**	0.3955*	-0.6597***	1.4351**
	[0.884]	[0.732]	[0.214]	[0.197]	[0.706]
N	580	580	577	576	580
R2	0.007	0.032	0.016	0.052	0.026
			Panel *(b)*:		
ImpPen developing	-8.9043	25.7745*	-5.1873	22.7467***	18.7375
	[15.348]	[13.732]	[5.632]	[4.613]	[16.677]
N	184	189	191	190	190
R2	0.003	0.037	0.020	0.224	0.016

Source: Linarello A. and Petrella A. (2016). Robust standard errors. All the regressions have been weighted by the number of employees in each sector. The regressions in panel *(a)* have been performed on data disaggregated at the 5-digit level. Those in panel *(b)*, instead, refer to manufacturing sector only, and have been performed at the 4-digit level, since data on import penetration were not available at a more disaggregated level.

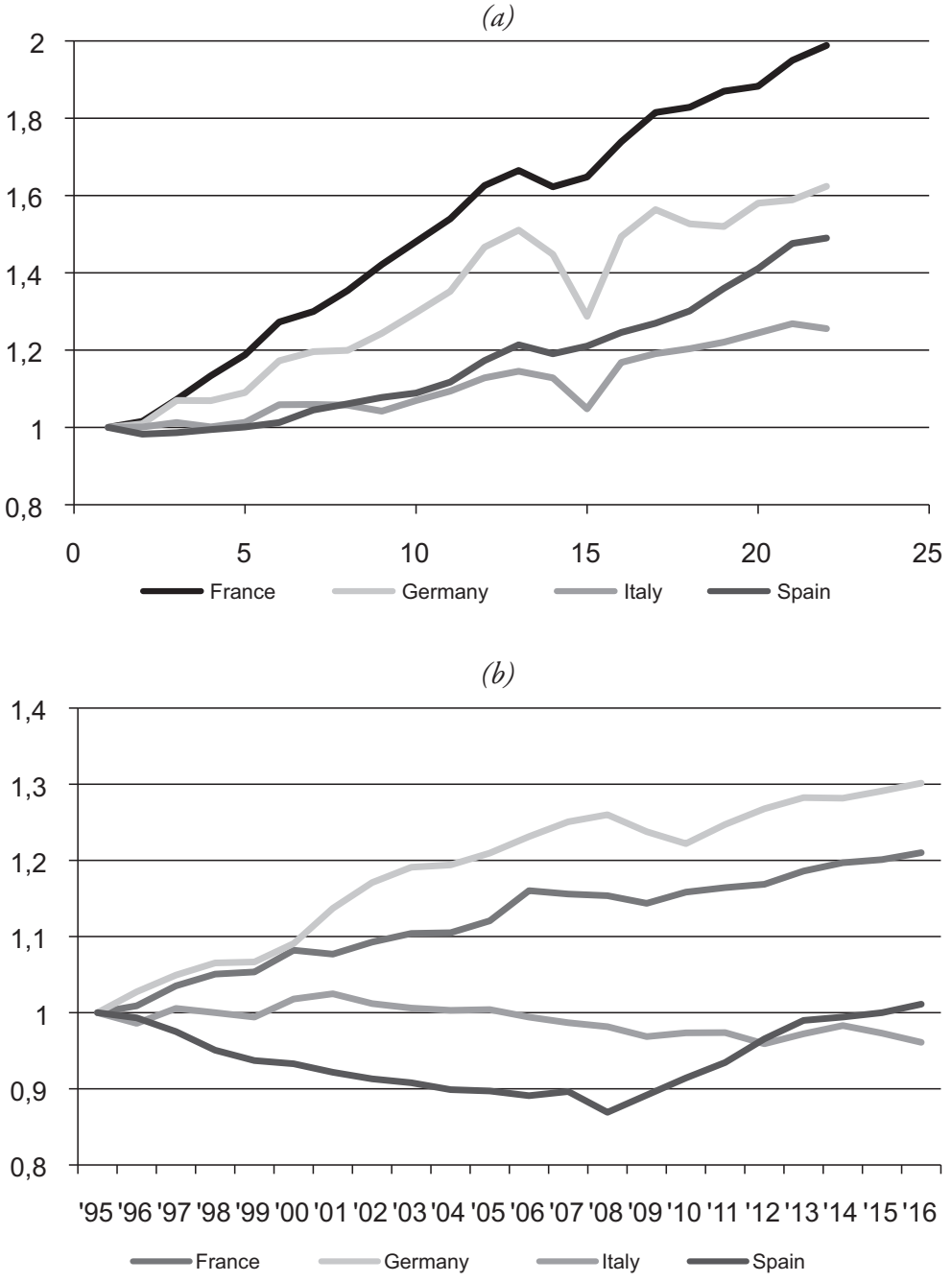
Figure 1

HOURLY LABOR PRODUCTIVITY (2001 = 1)



Source: Eurostat National accounts.

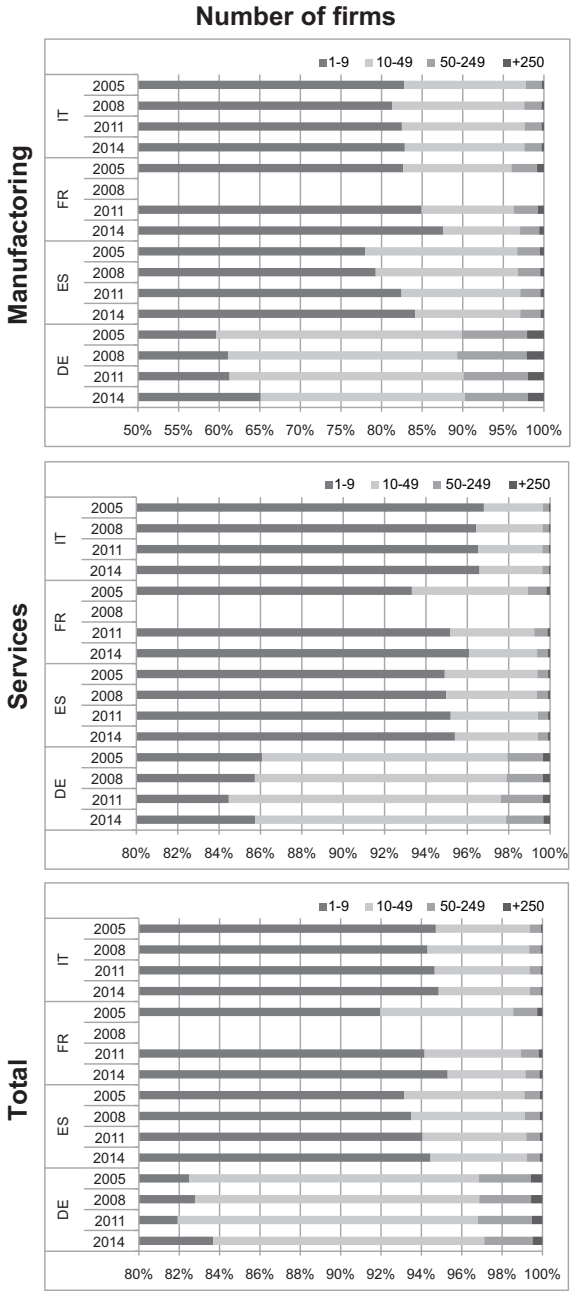
FIGURE 2
HOURLY LABOR PRODUCTIVITY (2001 = 1), MANUFACTURING *(a)* AND NON-FINANCIAL BUSINESS SERVICES *(b)*



Source: EUROSTAT NATIONAL accounts.

Figure 3

CLASS SIZE COMPOSITION OVER TIME



continued FIGURE 3

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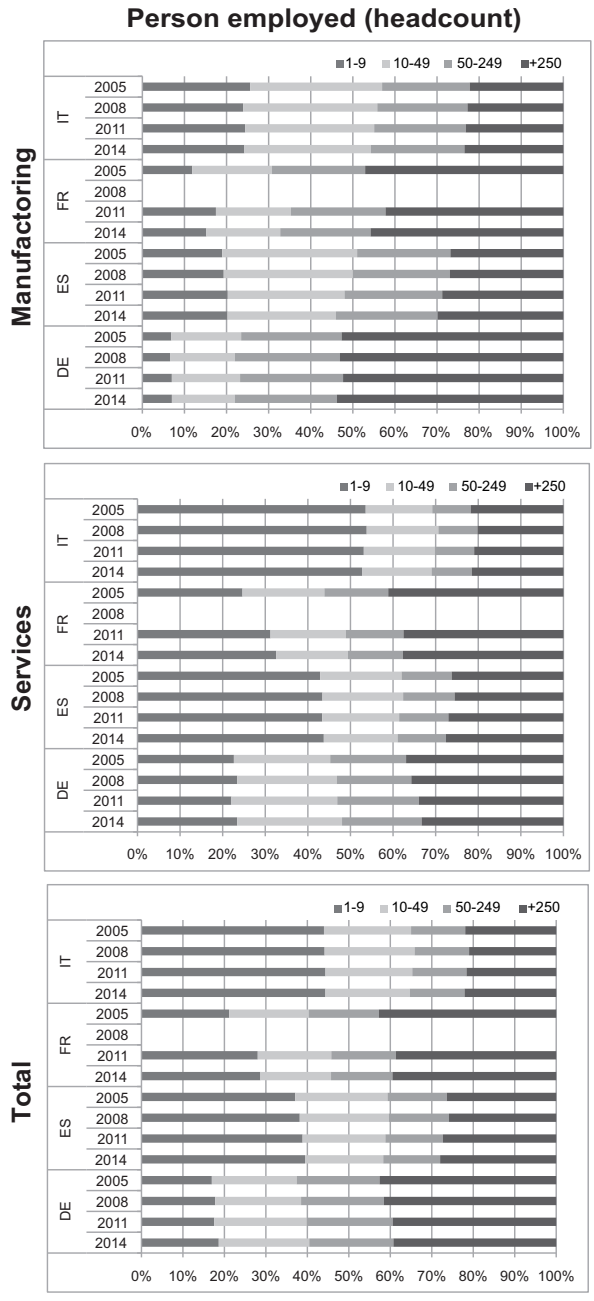
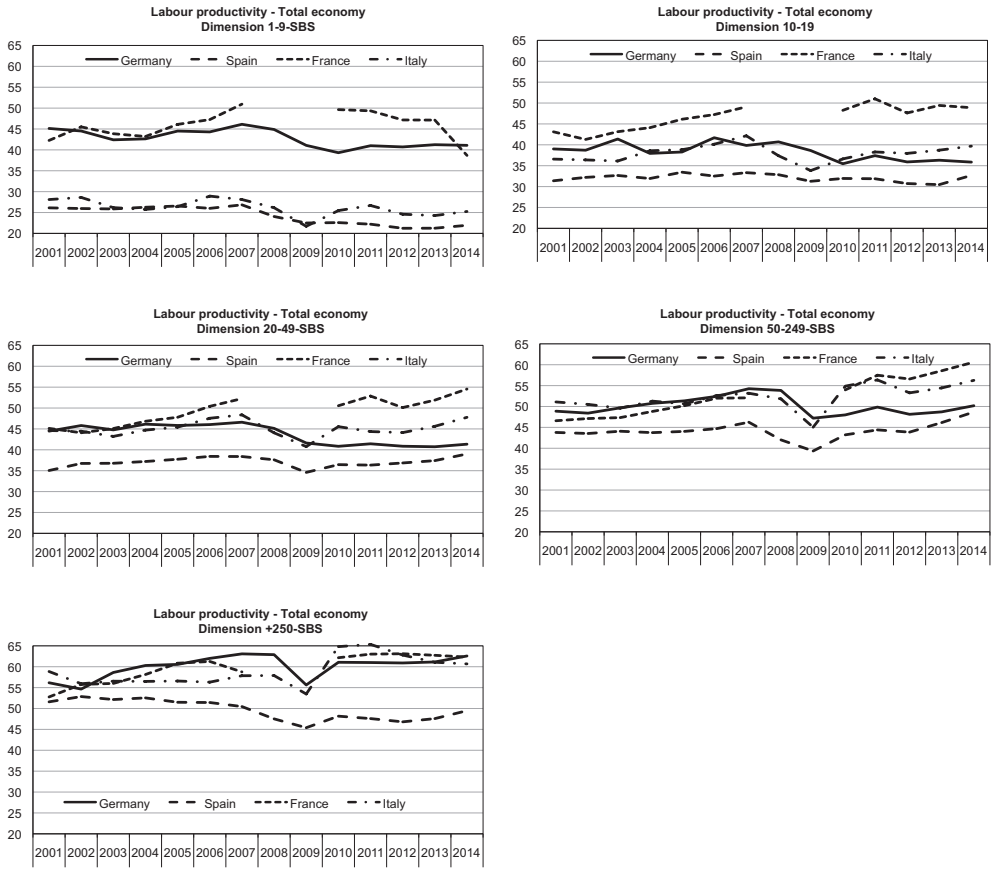
continued Figure 3



Source: Eurostat, Structural Business Statistics.

FIGURE 4

LABOR PRODUCTIVITY BY CLASS SIZE: TOTAL ECONOMY



Source: EUROSTAT, Structural Business Statistics.

BIBLIOGRAPHY

Accetturo A. - Bugamelli M. - Lamorgese A. (2013), «Skill Upgrading and Exports», *Economics Letters*, vol. 121, no. 3, pp. 417-420.

Accetturo A. - Bugamelli M. - Lamorgese A. - Linarello A. (2016), *Innovation and Trade. Evidence from Italian Manufacturing Firms*, mimeo.

Administration on Aging (2014), *Projected Future Growth of the Older Population*, U.S. Department of Health and Human Services.

Aghion P. - Bloom N. - Blundell R. - Griffith R. - Howitt P. (2005), «Competition and Innovation: An Inverted U Relationship», *Quarterly Journal of Economics*, vol. 120, no. 2, pp. 701-728.

Altomonte C. - Barattieri A. (2015), «Endogenous Markups, International Trade and the Product Mix», *Journal of Industrial Competition and Trade*, vol. 15, no. 3, pp. 205-221.

Amiti M. - Khandelwal A.K. (2013), «Import Competition and Quality Upgrading», *Review of Economics and Statistics*, vol. 95, no. 2, pp. 476-490.

Amiti M. - Konings J. (2007), «Trade Liberalization, Intermediate Inputs, and Productivity: Evidence from Indonesia», *American Economic Review*, vol. 97, no. 5, pp. 1611-1638.

Andrews D. - Cingano F. (2014), «Public Policy and Resource Allocation: Evidence from Firms in OECD Countries», *Economic Policy*, vol. 29, no. 78, pp. 253-296.

Asker J. - Collard-Wexler A. - De Loecker J. (2014), «Dynamic Inputs and Resource (Mis) Allocation», *Journal of Political Economy*, vol. 122, no. 5, pp. 1013-1063.

Autor D.H. - Dorn D. - Hanson G.H. (2013), «The China Syndrome: Local Labor Market Effects of Import Competition in the United States», *American Economic Review*, vol. 103, no. 6, pp. 2121-2168.

Autor D.H. - Dorn D. - Hanson G.H. - Pisano G. - Shu P. (2016), *Foreign Competition and Domestic Innovation: Evidence from U.S. Patents*, mimeo.

Baldwin R.E. (1988), «Hysteresis in Import Prices: The Beachhead Effect», *American Economic Review*, vol. 78, no. 4, pp. 773-785.

-.- (1989*),* «Sunk Costs Hysteresis», Cambridge (Mass.), *NBER Working Paper*, no. 2911.

Baldwin R.E. - Krugman P.R. (1989), «Persistent Trade Effect of Large Exchange Rate Shocks», *Quarterly Journal of Economics*, vol. 104, no. 4, pp. 635-654.

Banca d'Italia (2014), *Annual Report on Year 2013*.

Barone G. - Cingano F. (2011), «Service Regulation and Growth: Evidence from OECD Countries», *Economic Journal*, vol. 121, no. 555, pp. 931-957.

Bartelsman E. - Haltiwanger J. - Scarpetta S. (2013), «Cross-Country Differences in Productivity: The Role of Allocation and Selection», *The American Economic Review*, vol. 103, no. 1, pp. 305-334.

Bernard A.B. - Eaton J. - Jensen J.B - Kortum S. (2003), «Plants and Productivity in International Trade», *American Economic Review*, vol. 93, no. 4, pp. 1268-1290.

Bernard A.B. - Jensen J.B. (2004), «Why Some Firms Export», *Review of Economic and Statistics*, vol. 86, no. 2, pp. 561-569.

Bernard A.B. - Jensen J.B. - Schott P.K. (2006*a*), «Trade Costs, Firms and Productivity», *Journal of Monetary Economics*, vol. 53, no. 5, pp. 917-937.

-.-,-.-,-.- (2006*b*), «Survival of the Best Fit: Exposure to Low Wage Countries and the (Uneven) Growth of US Manufacturing Plants», *Journal of International Economics*, vol. 68, no. 1, pp. 219-237.

Bernard A.B. - Wagner J. (1997), «Exports and Success in German Manufacturing», *Weltwirtschaftliches Archiv*, vol. 133, pp. 134-157.

Bloom N. - Draca M. - Van Reenen J. (2016), «Trade Induced Technical Change? The Impact of Chinese Imports on Innovation, IT and Productivity», *Review of Economic Studies*, vol. 83, no. 1, pp. 87-117.

Bobbio E. (2016), «Tax Evasion, Firm Dynamics and Growth», Banca d'Italia, *Questioni di Economia e Finanza*, no. 357.

Brandolini A. - Bugamelli M. (eds) (2009), «Rapporto sulle tendenze nel sistema produttivo italiano», Banca d'Italia, *Questioni di Economia e Finanza*, no. 45.

Bugamelli M. - Cannari L. - Lotti F. - Magri S. (2012), «The Innovation Gap of Italy's Production System: Roots and Possible Solutions», Banca d'Italia, *Questioni di Economia e Finanza*, no. 121.

Bugamelli M. - Fabiani S. - Sette E. (2015), «The Age of the Dragon: Chinese Competition and the Pricing Behavior of Italian Firms», *Journal of Money, Credit and Banking*, vol. 47, no. 6, pp. 1091-1118.

Bugamelli M. - Infante L. (2003), *Sunk Costs of Exports*, in Atti del Convegno in memoria di Stefano Vona, Banca d'Italia.

Bustos P. (2011), «Trade Liberalization, Exports, and Technology Upgrading: Evidence on the Impact of Mercosur on Argentinian Firms», *American Economic Review*, vol. 101, no. 1, pp. 304-340.

Calligaris S. - Del Gatto S. - Hassan F. - Ottaviano G.I.P. - Schivardi F. (2016), «Italy's Productivity Conundrum», *European Commission Discussion Paper*, no. 30.

Campa J.M. (2004), «Exchange Rates and Trade: How Important is Hysteresis in Trade?», *European Economics Review*, vol. 48, no. 3, pp. 527-548.

Card D. - Heining J. - Kline P. (2013), «Workplace Heterogeneity and the Rise of West German Wage Inequality», *Quarterly Journal of Economics*, vol. 128, no. 3, pp. 967-1015.

Carta F. - D'Amuri F. (2016), *The Short-Term Employment Consequences of Delaying the Legal Retirement Age*, mimeo.

Castellani D. (2002), «Export Behavior and Productivity Growth: Evidence from Italian Manufacturing Firms», *Weltwirtshaftliches Archiv*, vol. 138, pp. 605-628.

Ciapanna E. (2015), *La struttura dimensionale del sistema produttivo italiano nel confronto europeo*, mimeo.

Ciapanna E. - Genito E. (2014), *The Service Sector in the Euro Area: Structure and Dynamics in Germany, France and Italy*, mimeo.

Clerides S.K. - Lach S. - Tybout J.R. (1998), «Is Learning by Exporting Important? Micro-Dynamic Evidence from Colombia, Mexico, and Morocco», *The Quarterly Journal of Economics*, vol. 113, no. 3, pp. 903-947.

Coucke K. - Sleuwaegen L. (2008), «Offshoring as a Survival Strategy: Evidence from Manufacturing Firms in Belgium», *Journal of International Business Studies*, vol. 39, no. 8, pp. 1261-1277.

Crespi G. - Criscuolo C. - Haskel J. (2008), «Productivity, Exporting, and the Learning-by-Exporting Hypothesis: Direct Evidence from UK Firms», *Canadian Journal of Economics*, vol. 41, no. 2, pp. 619-638.

De Loecker J. (2007), «Do Exports Generate Higher Productivity? Evidence from Slovenia», *Journal of International Economics*, vol. 73, no. 1, pp. 69-98.

-.- (2011), «Product Differentiation, Multiproduct Firms, and Estimating the Impact of Trade Liberalization on Productivity», *Econometrica,* vol. 79, no. 5, pp. 1407-1451.

De Loecker J. - Goldberg P. (2014), «Firm Performance in a Global Market», *Annual Review of Economics,* vol. 6, pp. 201-227.

De Loecker J. - Goldberg P.K. - Khandelwalt A. - Pavcnik N. (2016), «Prices, Markups and Trade Reform», *Econometrica*, vol. 84, no. 2, pp. 445-510.

De Loecker J. - Warzynski F. (2012), «Markups and Firm-Level Export Status», *American Economic Review*, vol. 102, no. 6, pp. 2437-2471.

Dixit A. (1989), «Hysteresis, Import Penetration, and Exchange Rate Pass-Through», *Quarterly Journal of Economics*, vol. 104, no. 2, pp. 205-228.

Federico S. (2014), «Industry Dynamics and Competition from Low-Wage Countries: Evidence on Italy», *Oxford Bulletin of Economics and Statistics*, vol. 76, no. 3, pp. 389-410.

Forlani E. - Martin F. - Mion G. - Muûls M. (2016). «Unraveling Firms: Demand, Productivity and Markups Heterogeneity», London, *Centre for Economic Policy Research*, DP, 11058.

Girma S. - Greenaway D. - Kneller R. (2004), «Does Exporting Increase Productivity? A Microeconometric Analysis of Matched Firms», *Review of International Economics*, vol. 12, no. 5, pp. 855-866.

Gordon R. (2012), «Is U.S. Economic Growth Over? Faltering Innovation Confronts the Six Headwinds», Cambridge (Mass.), *NBER Working Papers*, no. 18315.

Halpern L. - Koren M. - Szeidl A. (2015), «Imported Inputs and Productivity», *American Economic Review*, vol. 105, no. 12, pp. 3660-3703.

Hsieh C.T. - Klenow P.J. (2009), «Misallocation and Manufacturing TFP in China and India», *Quarterly Journal of Economics*, vol. 124, no. 4, pp. 1403-1448.

Isgep (2008), «Understanding Cross-Country Differences in Exporter Premia: Comparable Evidence for 14 Countries», *Technical Report*, International Study Group on Exports and Productivity (ISGEP), Kiel Institute.

Khandelwal A. (2010), «The Long and Short (of) Quality Ladders», *Review of Economic Studies*, vol. 77, no. 4, pp. 1450-1476.

Krugman P.R. (1989), *Exchange Rate Stability*, Cambridge, MIT Press.

Lamorgese A.R. - Linarello A. - Warzynsky F. (2016), *Free Trade Agreements and Firm-Product Markups in Chilean Manufacturing*, mimeo.

Lileeva A. - Trefler D. (2010), «Improved Access to Foreign Markets Raises Plant-Level Productivity … for Some Plants», *The Quarterly Journal of Economics*, vol. 125, no. 3, pp. 1051-1099.

Linarello A. - Petrella A. (2016), «Productivity and Reallocation: Evidence from the Universe of Italian Firms», Banca d'Italia, *Questioni di Economia e Finanza*, no. 353.

Lotti F. - Marin G. (2016), *Productivity Effects of Eco-Innovations Using Data on Eco-Patents*, *Industrial and Corporate Change*, on line doi: 10.1093/icc/dtw014

Macis M. - Schivardi F. (2016), «Exports and Wages: Rent Sharing, Workforce Composition, or Returns to Skills?», *Journal of Labor Economics*, vol. 34, no. 4, pp. 945-978.

Maestas N. - Mullen K.J. - Powell D. (2016), «The Effect of Population Aging on Economic Growth, the Labor Force and Productivity», Cambridge (Mass.), *NBER Working Papers*, no. 22452.

Martin J. - Mejean I. (2014), «Low-Wage Countries' Competition, Reallocation Across Firms and the Quality Content of Exports», *Journal of International Economics*, vol. 93, no. 1, pp. 140-152.

Mayer T. - Melitz M.J. - Ottaviano G.I.P. (2014), «Market Size, Competition and the Product Mix of Exporters», *American Economic Review*, vol. 104, no. 2, pp. 495-536.

-.-,-.-,-.- (2016), «Product Mix and Firm Productivity Responses to Trade Competition», Cambridge (Mass.), *NBER Working Paper*, no. 22433.

Melitz M. (2003), «The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity», *Econometrica*, vol. 71, no. 6, pp. 1695-1725.

Melitz M. - Ottaviano G.I.P. (2008), «Market Size, Trade and Productivity», *Review of Economic Studies*, vol. 75, no. 1, pp. 295-316.

Mion G. - Zhu L. (2013), «Import Competition from and Offshoring to China: A Curse or Blessing for Firms?», *Journal of International Economics*, vol. 89, no. 1, pp. 202-215.

Pagano P. - Schivardi F. (2003), «Firm Size Distribution and Growth», *The Scandinavian Journal of Economics*, vol. 105, no. 2, pp. 225-274.

Pavcnik N. (2002), «Trade Liberalization, Exit, and Productivity Improvements: Evidence from Chilean Plants», *Review of Economic Studies*, vol. 69, no. 1, pp. 245-276.

Pellegrino B. - Zingales L. (2014), «Diagnosing the Italian Disease», University of Chicago, Chicago Booth, *Working Paper*.

Poddar T. (2004), «Domestic Competition Spurs Exports: The Indian Example», *IMF Working Paper*, no. 173.

Roberts M.J. - Tybout J.R. (1997), «The Decision to Export in Colombia: An Empirical Model of Entry with Sunk Costs», *American Economic Review*, vol. 87, no. 4, pp. 545-564.

Serti F. - Tomasi C. (2008), «Self-Selection and Post-Entry Effects of Export: Evidence from Italian Manufacturing Firms», *Review of World Economics*, vol. 144, no. 4, pp. 660-694.

Trefler D. (2004), «The Long and Short of the Canada-U.S. Free Trade Agreement», *The American Economic Review*, vol. 94, no. 4, pp. 870-895.

Wagner J. (2007), «Exports and Productivity: A Survey of the Evidence from Firm-level Data», *The World Economy*, vol. 30, no. 1, pp. 60-82.

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