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Firm Productivity, Organizational Choice and Global Value Chain*

Mariarosaria Agostino, Anna Giuntam,' Jeffrey B. Nugent, Domenico Scalera, Francesco Trivieri

Mariarosaria Agostino- Università della Calabria, Italy
Jeffrey B. Nugent- University of Southern California, USA
Domenico Scalera- Università del Sannio, Italy
Francesco Trivieri- Università della Calabria, Italy

Corresponding Author:
Anna Giuntam, Università Roma Tre- Italy agiunta@uniroma3.it

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Abstract

Based upon insights of the global value chain literature, the aim of this paper is to investigate the impact of being a supplier firm on labour productivity. The country of analysis is Italy, historically characterized by a very strong division of labour among firms. We make use of a unique database, which collects information on several organizational, structural and performance variables of a representative sample of more than 3000 Italian manufacturing firms, spanning the period 1998-2006. Our econometric investigation confirms predictions coming from the global value chain literature. By and large, our findings indicate that being a “traditional” supplier is associated with lower levels of productivity in comparison with the ones exhibit by final firms. However, supplier firms that both export a significant percentage of their production and carry out product or process innovations (i.e. the subset of suppliers that we name “advanced suppliers” against “traditional suppliers”) display productivity levels not lower (and, actually, higher) than final firms ones.

Resumen

Basado en la literatura de la cadena global de valor, el objetivo de este artículo es investigar el impacto de ser una empresa proveedora en la productividad del trabajo. El país analizado es Italia,caracterizado históricamente por una división del trabajo muy fuerte en las empresas. En este paper se utiliza una base de datos única, que recoge información sobre distintas variables organizacionales, estructurales y de desempeño para una muestra representativa de más de 3.000 empresas manufactureras italianas en el período 1998-2006. Nuestra investigación econométrica confirma las predicciones procedentes de la literatura sobre cadenas globales de valor. En general, nuestros resultados indican que operar como proveedor "tradicional" se asocia con menores niveles de productividad en comparación con los niveles presentados por las empresas finales. Sin embargo, las empresas proveedoras, que exportan un porcentaje significativo de sus producciones y llevan a cabo innovaciones de productos o procesos (es decir, el subconjunto de aquellos que llamamos "proveedores avanzados"), presentan niveles de productividad no inferiores (y, de hecho, superiores) a los de las empresas finales.

Laburpena

Balio kate globalaren literaturan oinarrituz, artikulu honek enpresa hornitzaile izateak lanaren ekoizkortasunean duen eragina du aztergai. Italiako kasua aztertu dugu, herrialde hartan historikoko enpresetan lanaren banaketa oso handia izan baita. Paper honek datu base berezi bat erabili du, 1998tik 2006ra Italiako manufakturako 3.000 enpresa baino gehiagoren lagin esanguratsu batentzat erakundeari, egiturari eta emaitzei buruzko informazioa ematen diguna. Gure ikerketa ekonometrikoak literaturak balio kate globalei buruz aurretik esandakoa berresten du. Oro har, gure emaitzek erakusten dute “ohiko” hornitzaile izatea ekoizkortasun maila txikiagoekin lotzen dela, azken enpresek dituzten ekoizkortasun mailekin alderatuta. Baina, enpresa hornitzaileen artean, ekoizpenaren ehuneko garrantzitsu bat esportatzen dutenek eta produktu edo prozesuetako berrikuntzak egiten dituztenek (alegia, "hornitzaile aurreratuak" deitutakoek), ez dira ekoizkortasunaren mailan azpitik geratzen azken enpresekiko, ekoizkortasun handiagoa dute azterlan honen arabera.

1. Introduction

In recent years the relationship between the performance and organizational features of firms has received increased attention by industrial economists and management scholars. This greater interest has been triggered by the profound changes in the world economy brought about by globalization. In particular, both considerable vertical disintegration in most industries and much reorganization of production across national borders have occurred in the last two decades. This has forced firms to search for efficient organizational options in a world of increasingly complex inter-firm relationships, rapidly growing outsourcing and off shoring and the development of global networks and value chains.

The role of sourcing strategies and the connection between the firm's organizational choice and its efficiency and productivity performance have been emphasized by the influential literature known as the "theory of firm heterogeneity" (Melitz, 2003, Antras and Helpman, 2004, Helpman et al., 2004, Helpman, 2006). Following this approach, firms may be sorted into a productivity hierarchy according to their organizational choices. Indeed, allowing for differences in the fixed costs of integration and outsourcing at home or abroad (especially in countries with low variable costs), different organizational forms can coexist. While the most productive firms carry out their activities in an integrated way in low cost countries in the form of foreign direct investments, the least productive continue to operate in the home country, and firms with intermediate levels of productivity acquire their intermediates abroad from unaffiliated suppliers.

However, while the analysis of firms' sourcing strategies (i.e. the "make-or-buy", and "where-to-make-or-buy" choices) have given rise to a large body of literature, less attention has been devoted to the behaviour of supplier firms, the "other side of the coin" of the outsourcing and offshoring phenomena. Even though the options of being a supplier rather than an assembler or a forward integrated firm, or being a supplier in local rather than international markets are recog-

nised as important and widespread choices for the firm, the literature has not yet reached clear-cut conclusions on the implications of these choices for firm's performance.

Actually, some papers (e.g., Kimura, 2002, dealing with Japanese industrial firms, and Razzolini and Vannoni, 2011, on Italian manufacturers), investigating the relative performance of suppliers, have documented a gap between the profitability of supplier firms and those selling directly to the market. Specifically, they state that there is a "subcontracting discount" which disfavours suppliers relative to other producers. This result, which has a solid root in the traditional model of the "captive supplier " at the mercy of the large and powerful monopsonist[1], while appropriately characterizing a subset of suppliers, is probably inadequate for others suppliers. In fact, there is growing evidence that, once the choice of selling to other firms has been made, some suppliers take over more and more responsibilities on the whole production process, responsibilities that go well beyond the ones associated with the profile of a marginal supplier. Such a more dynamic perspective on the current and future role of supplier firms constitute the main focus of the broad strand of literature known as the Global Value Chain Approach (GVCA henceforth).

Initially proposed by Gereffi (1994) and subsequently enhanced with important contributions by Gereffi and Korzeniewicz (1994), Gereffi (1999), Kaplinski (2000), Henderson *et al*. (2002) and Humphrey and Schmitz (2002), GVCA develops a framework which ties the vertical fragmentation of industries to the globalization of intermediate goods' markets and to the worldwide value chains forming the core of a new international division of labour. Most important, this framework also provides sound interpretations both of the functioning and governance of chains and of the role and the growth dynamics of supplier firms.

More in detail, the contributions of GVCA deal with several issues, such as: a) the type of governance of value chains, e.g., whether they are buyer or producer driven; b) the way supplier

[1] See, for example, Giunta and Scalera (2007) for Italy, Sallez (1977) for France, and Kimura (2002) for Japan. For a reappraisal of the role played by traditional suppliers, see Taymaz and Kilicaslan (2005).

firms participate in the global value chain; c) the conditions allowing supplier firms to enhance their positioning in the global value chain and trigger upgrading processes; d) the different types of upgrading; e) the contribution of external and international linkages in promoting firms' upgrading; f) the choice of governance in these chains and its determinants; and g) the coordination mechanisms operating in different global value chains.

Building on this literature, the present paper focuses, in particular, on the nexus between a firm's organizational choice, i.e., being a supplier in a value chain, and its performance. Our starting point is that the profound transformations of recent decades have spurred radical changes in the behaviour, choices and constraints of supplier firms. Due to the different abilities of individual firms to evolve in response to external incentives, the set of suppliers has become more heterogeneous. Reflecting large differences in tasks, capabilities and productivity among firms, marginal and advanced agents coexist even in the same value chain. In the GCVA, participation in a value chain cannot guarantee by itself a positive performance for supplier firms. The factors enhancing suppliers' performance and growth are the individual firm's capabilities, the type of chains firms belong to and external linkages. These factors are crucial in identifying successful suppliers.

Unfortunately, the lack of information in our data set on the types of value chains and their governance prevents us from testing the GVCA predictions on the impact of the latter on suppliers' performance. Nevertheless, our data set does permit us to examine, in some details, two firms' features that, according to GVCA, may, as well, have an impact on suppliers productivity: the innovation capabilities and the exploitation of external linkages thanks to the ability to export, i.e. to sell intermediate goods to foreign firms. GVCA scholars have long pointed to the importance of innovation and export for a successful participation in global value chains even if their studies usually miss to quantify and test the significance of these effects with firm-level data.

To fill this gap in the literature, we perform an econometric analysis employing data on a representative sample of more than 3000 Italian manufacturing firms, drawn from three Unicredit

surveys, spanning the period 1998-2006. More specifically, our aim is to test whether supplier firms have the same productivity (measured alternatively by labour productivity and TFP, Total Factor Productivity) of final firms. We carry out this comparison for traditional suppliers (i.e. non innovating and non-exporting suppliers), for innovating only and exporting only suppliers, for advanced suppliers (both innovating and exporting). We control for physical capital, human capital, firm size, age, investments in information and communication technology, geographical location, legal form, group membership, time and industry dummies.

By and large, our findings indicate that being a traditional supplier is associated with lower levels of productivity. However, supplier firms that both export a significant percentage of their production and carry out product or process innovations (i.e. that belong to the set of suppliers that we name "advanced suppliers") display productivity levels not lower (and, actually, higher) than final firms ones.

In our analysis, we depart from most of the GVCA literature in two important respects:

i) Our study is based on an econometric investigation carried out on a representative sample of manufacturing firms, thereby permitting greater generalization, while GVCA makes use of case studies and/or anecdotal evidence;

ii) Unlike the previous literature of GVCA, dealing mainly with developing countries, our study refers to Italian manufacturing firms. Italy provides an interesting area of application since it has been historically characterized by a high division of labour among firms, with many producers selling intermediate inputs to order (i.e., serving as subcontractors to principal firms). Generally speaking, subcontracting is widely spread among European firms. One recent European survey (Unicredit, 2011) on manufacturing firms operating in France, Germany, Italy, Spain, United Kingdom, Austrian and Hungary shows that the vast majority of firms produce to order, while the turnover from subcontracting activity accounts for more than 80% of that of all suppliers. Despite its potential relevance, connected with the question of what role Italian firms are

playing now and can play in the future international division of labour, the topic is insufficiently investigated, with a few exceptions of Agostino *et al*. (2010), Accetturo *et al*. (2011), and Giunta *et al*. (forthcoming).

The remainder of the paper is organized as follows. Section 2 reviews the most interesting insights and significant contributions of GVCA and its analysis of global value chains, which provides the theoretical background for our analysis. Section 3 focuses on the subject of our empirical investigation, namely Italian suppliers, their peculiar features and the impact of globalization on them. Section 4 presents data and methods employed in the econometric investigation, as well as the main results. Lastly, some concluding remarks are offered in Section 5.

2. Global value chains and supplier firms' participation

During the last two decades, profound changes in the international division of labour among firms have led to increasingly globalized intermediates markets. Outsourcing and off shoring of the stages of production are major features of this evolution. The production of almost every good (from computers to retail trade services) now consists of a series of separate tasks, possibly located outside the "final" assembling firm, either at home or abroad. The growth of outsourcing and off shoring is so pervasive as to partially replace international trade in goods with trade in tasks (Grossman and Rossi-Hansberg, 2006). Global value chains form the core of this new international division of labour[2].

[2] Together with global value chains, a number of other terms and expressions have been coined to label the phenomenon we describe: new international division of labour (Fröbel *et al*., 1980); disintegration of production (Feenstra, 1998); fragmentation (Arndt and Kierzkowski, 2001); vertical specialization (Hummels *et al*., 2001). In its evolution, the international fragmentation of production has designed a new division of labor among firms and countries, thus putting into question the robustness of the comparative advantage notion (Beaudreau, 2011), about to be replaced by the category of "vertical comparative advantage".

The usual pattern sees firms from advanced countries taking on the role of lead firms in "producer" or "buyer"- driven global value chains (Gereffi, 1994). Buyer - driven global value chains, which have received much attention by GVCA scholars[3], are led by global buyers and are common in labour-intensive industries such as textiles and shoes. The retailers mainly control downstream activities such as distribution, marketing and sales, while manufacturing is outsourced to networks of suppliers (Gereffi *et al*., 2001). Conversely, producer-driven value chains, mainly led by large manufacturers, are typical of capital-intensive industries such as automotive, electronics and civil aviation. In this latter type of value chain, final firms keep control of the manufacturing process by sourcing customized intermediate products from selected suppliers, located both in the home countries and abroad.

A key argument of GVCA is that the involvement of supplier firms into the global value chain is a valuable opportunity for growth of these actors, since the external linkages can supply managerial expertise, technical knowledge, innovation channels, and new markets, and above all, they can foster the firm's upgrading in the value chain. GVCA scholars envision at least four distinct channels of upgrading: a) product innovation, i.e. the ability of supplier firms to satisfy the demand for higher value added, more sophisticated products (Dolan and Humphrey, 2000; Bair and Gereffi, 2001; Bazan and Navas-Aleman, 2004; Giuliani *et al*., 2005) or enlargement of the products portfolio; b) process innovation, i.e. increase of technical efficiency of the production process; c) functional upgrading, i.e. improving the quality of supplier's function along the chain, or

[3]As documented by Ivarsson and Alvstam (2010), a brief look at the publications compiled by the Global Value Chains Initiative shows that, among some 400 works that have been published during the last 25 years, buyer-driven industries are the subject of around two-thirds of the published articles, especially dominant in textile/apparel and agricultural products (e.g. horticulture, coffee, cocoa).

moving to higher quality functions (e.g. from production to design); and d) inter-chain upgrading, i.e. applying the competence acquired in a particular function to move into a new chain[4].

Several case studies show that firms' upgrading cannot be treated as "granted" because the outcome is dependent not only on firms' individual capabilities but also on the type of governance adopted by lead firms. In this respect, three distinct types of governance (i.e. modular, relational and captive) have been singled out[5], primary by Gereffi *et al*. (2005) and subsequently refined by empirical findings coming from field work in several industries of developing countries (Gereffi, 1999; Schmitz, 1999; Bair and Gereffi, 2001; Dolan and Humphrey, 2000; Galvin and Morkel, 2001; Sturgeon, 2002; Humphrey, 2003; Sturgeon and Florida, 2004; Pietrobelli and Rabellotti, 2007). In modular value chains lead firms provide design specifications to supplier firms that will manufacture components, modules and/or subsystems (Sturgeon and Lester, 2004; Gereffi *et al*., 2005). Relational value chains are, instead, characterized by close relationships between suppliers and lead firms, as suppliers are involved in strategic stages of production, such as design and product development. Finally, in captive value chains, several suppliers can source the same intermediate good and the competition among them is fierce, mainly based on price.

Gereffi *et al.* (2005) have also associated the types of value chain governance, outlined above, with combinations of three peculiar dimensions: the complexity of inter-firm transactions, the ability to codify specifications for complex transactions and the capabilities of suppliers in relation to the requirements of the transactions. Suppliers with low capabilities participate in captive

[4]Ponte and Ewert (2011, p.1647) have recently argued that established terms in such literature such as 'process, product, functional and inter-sectoral upgrading' "should be used only as partial guides to arrive at a more complex and fine-tuned picture of supplier firms' upgrading". For example, in the case of South African wine producers, upgrading may appropriately apply to firms involved in the global value chain, which simply manage to "reach a better deal", or a better balance between risks and rewards.

[5]Ivarsson and Alstam(2010), in their study on the value chain led by IKEA, add one more type, defined as "developmental" governance structure.

global value chains, gain only thin margins and are exposed to the risks of being crowded out. Conversely, suppliers with high capabilities take part in relational value chains where transactions are complex and cannot be fully specified. Finally, those with intermediate capabilities are required to supply in modular value chains, characterized by codified specifications of standardized modular goods.

As this brief review has shown, GVCA provides useful insights, based on empirical evidence supplied by several case studies on particular aspects of producers' participation in the global value chain that may either hinder or foster the role, performance and growth of supplier firms. In addition to the importance of product, process, functional and inter-sectoral innovation as the main channels for firms' upgrading, more recently the nexus between the different types of governance chains and suppliers' prospects for upgrading have been underlined and proved.

Although the final objective of the whole analytical apparatus of GVCA is to emphasize the relevance of inter-firm linkages to the overall determination of firm performances within the value chain, an important part of the story has been neglected, namely, evidence from firm level analysis. As some authors have underscored (Dunford 2006; Kalarantidis *et al.* 2011), while the value chain setting in which firms operate has been extensively explored, the enterprise itself and its organizational choice remain somewhat in the shadows. The reason for this undoubtedly lies in the absence of good quality micro data (Sturgeon and Gereffi, 2009), which may also explain why most of the empirical results of GVCA are based on rich, insightful and detailed case-studies, surveys and anecdotal evidence rather than on statistical investigations.

In our exploration of the link between firm performance, capabilities and position in the global value chain, this paper is based instead on a firm-level analysis. According to GVCA, regardless of the type of value chain to which they belong, lead firms always enjoy high levels of productivity. But for suppliers the picture drawn by GCVA is more complex since both their individual capabilities and the type of value chain (relational, modular or captive) they feed into, are crucial in

determining their success, profitability and growth. In our investigation, therefore, consistent with the insights of GVCA we will consider: 1) the supplier's ability to innovate as an indicator of supplier capability and a determinant of better performance; 2) the supplier's export propensity as a determinant of firms' productivity[6]. The latter would seem especially relevant in developed countries, where firms mainly operate inside producer-driven global value chains and the access to foreign markets enhances their participation in the global organisational structures and their business relationships with the largest assemblers. Also, the link between firm export capacity and performance is well known in the literature as the "learning by exporting hypothesis" (Bernard and Jensen, 1999). According to this, exports increase firms' productivity thanks to the flow of knowledge firms are exposed to by operating in foreign markets. Possible channels for such learning are analysed for example by Baldwin and Gu (2004) and Lilleeva and Treer (2010).

3. Value chains and Italian suppliers

Being characterized as a country with an unusually high division of labour among firms, Italy is an ideal focus for an empirical study on supplier firms. Together with Japan, since the 1960's Italy has shown the smallest average firm size among industrialised countries. The fragmentation of production during the subsequent decades has further reduced firms' vertical integration.

Table 1 shows some interesting evidence based on Unicredit data. In the first two groups of columns [A] and [B], the distribution (by industrial sectors and employees classes) of industrial producers among "final market" firms and suppliers is displayed. As shown in third set of columns, figures clearly confirm that in Italy suppliers account for a large share (between 57% in the 2001- 2003 wave and 71% in 2004-2006 wave) of the total number of manufacturing firms with

[6]As already stated, the lack of suitable information prevents us from testing the empirical relevance of the kind of value chains and the type of governance adopted by lead firms as a determinant of suppliers' productivity. This is made, for the case of Thailand, by Pietrobelli and Saliola (2008).

at least 11 employees. A particularly strong presence of suppliers turns out to concern the industries typically characterized by producer-driven chains, that is machinery and mechanical apparatus, electric appliances and electronics. With regard to firm size, suppliers are relatively more numerous among small and medium sized firms (below 150 employees) but their share is never below 48% of the total number of firms in any size group and year.

The prevalence of suppliers and small size firms is partly explained by an important peculiarity of Italian industry, namely the strong presence of Marshallian districts (especially in the North-Eastern and Central Italy regions). Indeed, for several years, industrial districts have been a strength for Italian industry, with a competitive advantage founded on a territorially bounded, efficient and deep division of labour among small and medium-sized specialised firms.

The globalization of intermediate goods markets has had severe repercussions on Italian suppliers, particularly on those operating in industrial districts and in the South. In fact, resort to off shoring has driven several producers to search outside the districts for lower cost suppliers in Central-Eastern Europe, the Balkans, the Mediterranean basin and Southeast Asia. Thus, district borders have begun to crumble (Rullani, 1997), while local producers were caught off guard by risk (Brusco *et al*., 1997; Corò and Grandinetti, 1999) and the major factors behind the success of such districts – local crafts and skills, technological spillovers and other forms of externalities – got lost forever[7]. In the South, the least developed area of the country, whose industrial structure has long been polarized by few large firms and several small and relatively less productive firms, the global dispersion of production beyond the country's borders and increasing competition from developing country suppliers, has had even more serious consequences, particularly for subcontracting firms (Giunta and Scalera, 2007; Giunta *et al.*,2011).

[7] See for example the interesting case study of Crestanello and Tattara (2008) on the effects of changes in the sourcing strategy of the Benetton group on Treviso apparel district.

Thus, the establishment and enhancement of global value chains, while offering the producers of developing countries an invaluable chance to participate in the global network and to survive and grow, is for Italian and, more generally, for advanced countries' suppliers primarily a threat. In order to survive, or even to find in on-going changes an opportunity for consolidation and growth, these firms are required to follow a virtuous path of evolution suitable to their characteristics and functions. The changing market conditions compel them to behave like the "advanced suppliers" of GVCA, and to strive to connect their activity with global value chains and the large buyers operating in them.

The difficult and partial reaction of Italian suppliers is documented by a quite large literature (i.e.: Corò and Grandinetti, 1999; Amighini and Rabellotti, 2003; De Arcangelis and Ferri, 2005; Met, 2009), showing how the most capable suppliers make significant efforts to adapt to changes, and those unable to evolve are bound to become marginal and doomed to exit the market.

Innovation and market expansion are crucial features of this evolution. As described in details by the managerial literature (for example Camuffo *et al.*, 2007), any capable supplier firm first extends its own market, serving a relatively large number of clients, not only local nor only national. It develops relations with buyers or assemblers on an even footing, no longer characterised by technological and economic subordination, merely carrying out the clients' orders. Instead, by collaboration and complementarity, it participates in the decisions relevant to production and proposes innovative models and solutions to address the clients' problems. This kind of supplier is often itself a client to a group of other suppliers, normally operating on a smaller scale and with less advanced characteristics[8]. The need to extend the range of clients (in particular abroad) implies an effort to reach levels of productivity sufficient to cover the fixed costs of access to for-

[8]Taking the example of the fashion system (textiles, clothing and leather) in Italy, "a proportion of subcontracting firms ranging from year to year between 45% and 55% … in turn make use of external manufacturers" (Osservatorio Subfornitura, 2008).

eign markets. On the other hand, the need to serve clients whose demand is differentiated and more technologically complex call for significant steps forward in project and design skills. Moreover, active pursuit of market outlets implies the appropriate development of marketing functions in terms of product promotion and positioning, research and the defence of profitable market niches.

The data collected in Table 1 (in particular, the last two sets of columns) give a rough picture of the efforts of Italian suppliers. Indeed, according to this evidence, the number of industrial supplier firms carrying out innovation activities and exporting a significant share of their turnover is relatively high. Those able to both innovate and export (the ones that we name "advanced suppliers") are between 37% and 56% of total number of suppliers. This share climbs up to 78% in the case of electric and electronic appliances in 2001-2003 wave. These virtuous suppliers are the ones on which we focus our attention in the following investigation.

4. The empirical investigation

In this section, we estimate the impact of being either a traditional supplier or an advanced supplier on labour productivity and TFP, after controlling for a number of other plausible determinants (firm size, age, tangible and non-tangible assets, raw material, a proxy for human capital, investments on ICT, geographical location, legal form, group membership, and time and industry dummies). As a proxy for the condition of being a supplier of intermediate inputs, we consider whether the firm sells for the market or to order. This approximation, due to the features of our database is acceptable, as subcontracting is widespread among intermediates' suppliers (Unicredit, 2011), since most of these inputs are customized for a specific productive process and their sale (and manufacturing) takes typically place to order rather than on the market[9]. More in

[9] Firms selling to final markets are usually integrated firms or assemblers. As a matter of fact, and in our sample as well, in a few cases subcontractors produce also for the final market (for example, a group-affiliated firm selling the

detail, in the first part of our analysis, we specify a dichotomous variable to distinguish firms producing for market from those producing to order. We then deepen our investigation by employing the "subcontracting intensity", defined as the ratio between sales to order and total sales as our key variable.

To some extent, this is a way to test the empirical relevance of GVCA predictions, which, in contrast with the traditional view considering suppliers as less productive firms, support the idea that, on some conditions, supplier firms can demonstrate productivity performance not lower and possibly superior to the ones exhibited by other firms. As seen before, GVCA highlights the suppliers chance to perform better than others by carrying out the tasks most suitable to their abilities, benefitting from more intensive specialization, moving up along the value chain. This, in particular, may happen provided that the qualifications of suppliers evolve in terms of the governance of their network of relationships, their positioning and upgrading along the value chain and their ability to innovate and export. Accordingly, in the following econometric investigation, we identify as "advanced suppliers" the supplier firms which are both exporters and innovators[10] and compare their productivity with that of other firms (traditional suppliers neither innovating nor exporting; only innovating and only exporting suppliers; firms selling on the market). In agreement with the idea that suppliers are a heterogeneous group (i.e. they have different levels of individual productivity according to their capabilities), we expect that the characteristics of being an innovator and/or exporter turn out to be decisive in determining supplier productivity.

The data we employ are drawn from the unique dataset based on the 8th, 9th and 10th waves for the years 2000, 2003 and 2006 of the Unicredit "Survey on manufacturing firms", carried out every three years. This survey collects data on a large number of variables from a stratified repre-

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final product to the market and an intermediate input to another firm of the group or a producer selling an input to an assembler and also to the market as spare parts).

[10] The precise meaning of the terms "innovator" and "exporter" in the econometric estimation is given later.

sentative sample of more than 3,000 Italian manufacturing firms with at least 11 employees. The sample includes the whole population of large firms (at least 500 employees), while for the 11-499 employees class the firms included in the sample represent, in terms of employment, about 12% of the whole population. The detailed questionnaire asks firms about the values of a large number of organizational, structural and performance variables for the current year and, in some cases, for the previous one or two years. In particular, there is a question about subcontracting intensity (measured as sales to order sales over total turnover) in the current year. Also, each firm surveyed is asked to provide a 10-year time series for a selected number of balance sheet variables.

The model we estimate is:

$$Prod_{it} = \beta_0 + \beta_1 Prod_{it-1} + \beta_2 SF_{it} + \beta_3 INDEX\_ABI_{it} + \beta_4 SF_{it} * INDEX\_ABI_{it} + \\ + \sum \beta_k CRTL_{kit} + \varepsilon_{it} \qquad (1)$$

where: indexes *i* and *t* respectively represent firm and time; *Prod* is a measure of labour productivity (the ratio of total sales to the number of employees, in logarithmic terms); SF is first a dummy variable (SFD) coded 1 if the firm is a subcontractor (selling *only* to order) and 0 otherwise (i.e. if the firm sells *only* to the market). By using this dummy in the first part of the analysis, we compare subcontractors with final market firms, leaving apart those firms producing for both the market and to order (these latter represent a minority of our sample). In the second part of our empirical investigation, we replace the dummy SFD, with the subcontracting intensity (SFR), thus including in our analysis even the firms producing for both the market and to order. To capture the influence of individual firms' abilities, we specify an index of ability (INDEX_ ABI), a categorical variable coded: 3 if the firm is an exporter[11] (EXP) carrying out both product

[11] By exporters we mean the firms whose share of sales exported out of total sales exceeds the sample median value of the ratio of total exports to total sales (15%).

(INNO_PROD) and process (INNO_PROC) innovation; 2 if the firm is either an exporter carrying out only one kind of innovation or a non-exporter carrying out both kinds of innovation; 1 if the firm is either a non-innovating exporter or a non-exporter carrying only one kind of innovation; 0 if the firm does not export nor innovate.

Definition of INDEX_ABI employed in the estimations

INDEX_ABI=0	if EXP=0 and INNO_PROD=0 and INNO_PROC=0
INDEX_ABI=1	if EXP=1 or INNO_PROD=1 or INNO_PROC=1
INDEX_ABI=2	if at least TWO of the three dummies are equal to one
INDEX_ABI=3	if EXP=1 and INNO_PROD=1 and INNO_PROC=1

SFD*INDEX_ABI is an interaction term between the aforementioned two variables, through which we make the subcontracting impact conditional on the firm's level of abilities. Employing an index rather than individual dummies (to indicate the status of exporter and innovator), allows a straightforward interpretation of our findings, and can avoid the inclusion of several interactions in our specification, inclusion that, from an econometric standpoint, may also imply problems of multicollinearity. Nevertheless, as robustness checks, we carry out also estimations where individual dummies are considered. Finally, the vector CTRL is a set of control variables including: capital (K), given by the (log of) tangible plus intangible assets; raw material (RAW_MATERIAL), specified as (the log of) costs for raw materials; a measure of human capital (HIGH_EDU), given by the ratio of high-school and graduate employees to total employees; (the log of) firms' age (AGE); (the log of) investment in ICT per worker; a group membership dummy (GROUP); a dummy for the cooperative legal form (COOP); geographical location dummies (CENTRE-NORTH and regional dummies) and, finally, sectorial dummies (ATECO 1991, 2-digits) and time effects[12]. As a sensitivity check, we also use Total Factor Productivity (TFP) as

[12] The error term consists of a factor determining productivity, specific to each firm, known to the firm itself and unknown to the econometrician, and an idiosyncratic part unknown to both.

an alternative measure of the dependent variable[13]. The description of the variables used in the estimations and their summary statistics are reported in Table 2 and Table 2.1, respectively.

From a methodological standpoint, in estimating the parameters of a production function we face the usual problems of endogeneity and non-random selection[14]. The latter problem is, in our case, mitigated by the use of an unbalanced panel; while, in order to tackle the issue of simultaneity, we employ an estimator proposed by Blundell and Bond, 1998 (for studies applying this method to the estimation of production functions see, among the others, Blundell and Bond, 2000; Van Biesebroeck, 2003; Van Beveren, 2007; Gebreeyesus, 2008)[15]. This estimator, also known as the system GMM (or SYS-GMM) estimator, is based on a GMM procedure which makes use, on the one hand, of lagged explanatory variables as instruments for the model in first differences (under the assumption of white noise errors, like the GMM-difference of Arellano and Bond, 1991) and, on the other hand, of lagged first differences (of the regressors) as instruments for the model in levels. These additional conditions of orthogonality "remain informative even for persistent series, and (the system estimator) has been shown to perform well in simulations" (Bond *et al.*, 2001, p.4), thus enhancing efficiency in estimation.

[13]Given the lack of data on the prices applied by the individual firms, three of our model variables – which originally represented total sales and the costs of capital and raw material in euros – have been deflated making use of (annual) deflators of the industrial sector to which the firm belongs (base year 1995; source: EU Klems, 2008).

[14]As Ackerberg *et al.*(2005) point out, "many of the econometric problems that hampered early estimation are still an issue today". Although the problems of endogeneity and selection are the most debated, more recent works have also raised other methodological issues. For example, the use of deflators at the industrial sector level – as approximations of the prices applied by individual firms – has come into criticism from Katayama *et al.*(2009).

[15]Olley and Pakes (1996) and Levinsohn and Petrin (2003) propose alternative semi-parametric approach to solve the problem of simultaneity. Olley and Pakes (1996) introduce an explicit correction for the selection problem, considering the likelihood of survival for each firm. Some extensions of their model have recently been proposed(see for example De Loecker 2007).

Table 3 summarizes the results of our estimations, which are robust to the presence of any pattern of heteroskedasticity and autocorrelation within panels. The Arellano-Bond tests for autocorrelation in first and in second differences signal a strong first order correlation in the differenced residuals, but no higher order autocorrelation, therefore supporting the assumption of lack of autocorrelation in the errors in levels. The Hansen test cannot reject the null hypothesis of validity of the over-identifying restrictions. Further, the difference in Hansen test is almost always not significant at the 5% level, supporting the hypothesis of validity of the extra instruments used by the SYS-GMM estimator, when compared to the difference GMM estimator of Arellano and Bond (1991). When this is not the case (column 6 and 11) we employ the Arellano and Bond (1991) estimator.

Turning to the estimates, in general, the results reveal persistence in productivity, the coefficient of the lagged dependent variable (DEP_1) being always highly significant. Concerning the control variables, while not always statistically significant, the signs of coefficients are almost always consistent with our a priori expectations.

Moving on to the results more closely connected to our main issues, we carry out a preliminary estimation without including any interaction terms (column 1). The negative and statistically significant coefficient of SFD indicates that, on average, being a subcontractor is associated to a lower productivity in our sample. Column 2, reporting estimates of model 1, shows that traditional suppliers firms, i.e. the ones which do not export and do not innovate, exhibit lower productivity. As a matter of fact, when INDEX_ABI is equal to zero, the impact of being a subcontractor is reflected by the SFD coefficient, which is still negative and statistically significant at 5% level. This negative impact is progressively offset as the ability index takes on its intermediate values (one and two), turning to be positive when the index value achieves its maximum level of

three, i.e. the firm is both exporter and (product and process) innovator.[16] Indeed, the interaction term is positive and, although not individually significant, is jointly significant with the SFD variable when implementing an F-test, reported in Table 3 (continued).[17]

While the results of column 1 and 2 are obtained by using all internal available instruments, as a first sensitivity check we change the number of instruments. Our main results are not affected by reducing to different subsets the instruments used (lags of the independent variables). For the sake of conciseness, these first sensitivity checks are not tabulated, and are available upon request. Further, we estimate the two-step variant of the SYS-GMM, adopting the Windmeijer's (2005) correction of the covariance matrix. These results, reported in column 3 of Table 3, confirm the findings shown in the previous columns. What is more important is that results are still substantially unaltered, when we change our measures of firms' ability. (column 4 and 5). More precisely, in column 4 we adopt a different ability index (INDEX_ABI2), which assumes: value 0 when the firm is neither an innovator nor an exporter; 1 if the firm implements at least one upgrading activity (innovates and/or exports); 2 if the firm is both (product and process) innovator and exporter.

[16]As the ability index is not statistically significant, neither individually nor jointly considered with the interaction term SFD*INDEX_ABI (see F-test in Table 3), in our sample upgrading activities do not display a significant impact on final market firms.

[17]The inconsistency between individual and joint significance may be a signal of multicollinearity (see Wooldridge 2003 and Brambor et al. 2006) induced by the inclusion of interaction terms. As Brambor et al. (2006) highlight, ''even if there really is high multicollinearity and this leads to large standard errors on the model parameters, it is important to remember that these standard errors are never in any sense 'too' large—they are always the 'correct' standard errors. High multicollinearity simply means that there is not enough information in the data to estimate the model parameters accurately and the standard errors rightfully reflect this''.

Definition of INDEX_ABI2 employed as a robustness check

INDEX_ABI2=0	if EXP=0 and INNO_PROD=0 and INNO_PROC=0
INDEX_ABI2=1	if at least ONE of the three dummies are equal to one
INDEX_ABI2=2	if EXP=1 and INNO_PROD=1 and INNO_PROC=1

In column 5, rather than indexes ABI, we employ the individual dummy variables on which the index is based upon: EXP is a dummy variable coded 1 if the firm is an exporter (as defined in footnote 11), and zero otherwise; INNO is a dummy variable coded 1 if the firm has carried out innovation activities (process, and/or product innovations), and zero otherwise. When doing so, the specification of our model has to be modified to account for all possible interactions between the variables under scrutiny (SFD, EXP and INNO), and the marginal impact of being an advanced subcontractor is given by the sum of the SFD coefficient and the coefficients of the interaction terms including the SFD dummy. According to our estimates, for non-advanced firms, being a subcontractor tends to imply lower productivity. As a matter of fact, the coefficient of the variable SFD is negative even tough not statistically significant. This negative impact on productivity tends to be offset when considering innovating-only suppliers (EXP=0 and INNO=1), as the (SFD*EXP) interaction coefficient is positive, but lower in absolute value than the SFD coefficient. When considering exporting-only firms (EXP=1 and INNO=0)or firms that are both exporters and innovators (EXP=1 and INNO=1), the impact of subcontracting is reversed to be positive. According to the F-test reported in Table 3 (continued), while not individually significant, the interaction terms are statistically significant when considered jointly with the SFD variable.

Besides, as the estimates reported in column 6 indicate, our results tend to be confirmed when our dependent variable (SE) is replaced by TFP. This latter is retrieved from a preliminary estimation of a Cobb-Douglas production function, whose log-linear equation is:

$$VA_{it} = \alpha_0 + \alpha_k K_{it} + \alpha_l L_{it} + \alpha_H HIGH\_EDU_{it} + e_{it} \quad (2)$$

where *VA* represents the firm's value added and *K*, L and HIGH_EDU respectively physical capital, labour, and human capital[18]. After having estimated coefficients of (2) by adopting the Arellano and Bond (1991) estimator,[19] a measure of TFP is obtained as the difference between the dependent variable and the sum ($\hat{\alpha}_k K_{it} + \hat{\alpha}_l L_{it} + \hat{\alpha}_H HIGH\_EDU_{it}$).

In columns 7 to 11 of Table 3, our dummy variable SFD is replaced by an indicator of subcontracting intensity (SFR), which is the firm's share of sales to order to total sales. The pattern, above illustrated, is confirmed. Indeed, across all the estimations performed, the coefficient of the variable SFR is negative and statistically significant, showing that – for traditional supplier firms (i.e. the ones which do not export nor innovate) – as the share of sales to order increases the labour productivity decreases[20]. This negative impact declines when considering the intermediate values of the ability index (INDEX_ABI=1 or INDEX_ABI=2), turning slightly positive when taking into considerations advanced supplier firms, which are both exporters and innovators (INDEX_ABI=3).

5. Concluding remarks

In the traditional view, the firm's organizational choice of being a supplier, i.e. selling to other firms, rather than accessing the final markets, has been usually considered to mirror less effi-

[18]Variables VA and K have been deflated by using the EU Klems (2008) indexes. We also add to the regressors of equation (2) a set of time, regional and sector (ATECO 19991,2-digits) dummies.

[19]We adopt the difference GMM estimator of Arellano and Bond (1991) because the difference in Hansen test is statistically significant, rejecting the null hypothesis of the validity of the additional instruments employed by the SYS-GMM estimator.

[20]To give an example, the figures in column 7 of Table 3 indicate that a 1% increase of the ratio SFR is associated to a 0.17% decrease of predicted productivity.

ciency and lower levels of productivity of supplier firms (the so called "subcontracting discount").

However, the profound changes occurred in the world economy in the last decades, with the globalization of intermediates' markets, seems to have triggered a deep evolution in supplier firms operating in developed countries like Italy. As a matter of fact, these firms have undergone a powerful shock, as the establishment and enhancement of global value chains have allowed developing countries' producers to indirectly compete against them on internationally integrated markets. In the face of this challenge, a part of Italian suppliers have sought to move along a virtuous path, striving for greater efficiency and larger productivity.

In this paper, in accordance with the theoretical insights of GVCA, we have considered some individual capabilities of the firm, specifically its propensity to innovate and export, as firm upgrading indicators. In our working hypothesis, the subset of suppliers that we call "advanced suppliers" because of their ability to both innovate and export (more than the sample median value) is the one that has presumably successfully reacted to the changes brought about by globalization. These suppliers, emancipated from the subcontracting discount, are no longer less productive than firms producing for final markets.

The econometric analyses support our hypothesis. In all the different specifications we consider, advanced suppliers show both labour productivity and total factor productivity not lower (and actually higher) than both type of firms, the ones producing for final markets and other suppliers. For the latter, instead, a negative productivity gap emerges with respect to non-supplier firms. This gap is larger when suppliers are neither innovators nor exporters, but smaller if suppliers are only innovators or only exporters. Our results are consistent with insights of GVCA scholars on the importance of supplier firm upgrading in global value chains through innovation and penetration on international markets. The lack of suitable data prevented us from investigat-

ing the weight of chain governance in determining suppliers' performance. This task is left to future research.

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ANNEX

Table 1 - Sample firms: final market producers, supplier firms and "advanced" suppliers. Distribution by ATECO sector grouping and employees classes

Quadrant A	MARKET [A]				SUPPLIER [B]				B/(A+B)			ADV. SUPPLIERS [C]				C/B		
ATECO SECTOR GROUPING	**2000**	**2003**	**2006**	**TOT**	**2000**	**2003**	**2006**	**TOT**	**2000**	**2003**	**2006**	**2000**	**2003**	**2006**	**TOT**	**2000**	**2003**	**2006**
Foodstuffs, beverages and tobacco	29	60	171	**260**	11	11	115	**137**	*27.5*	*15.5*	*40.2*	NA	5	39	44	-	*45.5*	*33.9*
Textiles, clothing and leather	24	51	151	**226**	46	51	343	**440**	*65.7*	*50.0*	*69.4*	NA	25	139	164	-	*49.0*	*40.5*
Paper, paper products, press and publishing	8	12	65	**85**	27	28	208	**263**	*77.1*	*70.0*	*76.2*	NA	10	44	54	-	*35.7*	*21.2*
Chemicals, rubber, plastics, petro products	19	38	138	**195**	23	44	245	**312**	*54.8*	*53.7*	*64.0*	NA	28	93	121	-	*63.6*	*38.0*
Non-metal minerals, metallurgy, metal products	20	48	181	**249**	67	74	500	**641**	*77.0*	*60.7*	*73.4*	NA	29	149	178	-	*39.2*	*29.8*
Machinery and mechanical apparatus	11	33	161	**205**	67	93	593	**753**	*85.9*	*73.8*	*78.6*	NA	55	248	303	-	*59.1*	*41.8*
Electric, electronic and optic machinery	17	38	122	**177**	56	61	409	**526**	*76.7*	*61.6*	*77.0*	NA	48	188	236	-	*78.7*	*46.0*
Means of transport manufacture	5	3	30	**38**	14	13	66	**93**	*73.7*	*81.3*	*68.8*	NA	9	31	40	-	*69.2*	*47.0*
Wood, furniture, recycling and other manuf. inds.	7	27	107	**141**	23	32	239	**294**	*76.7*	*54.2*	*69.1*	NA	17	82	99	-	*53.1*	*34.3*
TOTAL	140	310	1126	**1576**	334	407	2718	**3459**	*70.5*	*56.8*	*70.7*	NA	226	1013	**1239**	-	55.5	***37.3***

Quadrant B	MARKET [A]				SUPPLIER [B]				B/(A+B)			ADV. SUPPLIERS [C]				C/B		
Employees	**2000**	**2003**	**2006**	**TOT**	**2000**	**2003**	**2006**	**TOT**	**2000**	**2003**	**2006**	**2000**	**2003**	**2006**	**TOT**	**2000**	**2003**	**2006**
1—9	0	0	68	**68**	0	0	214	**214**	-	-	*75.9*	NA	0	36	36	-	-	*16.8*
10—49	74	108	662	**844**	212	120	1684	**2016**	*74.1*	*52.6*	*71.8*	NA	57	545	602	-	*47.5*	*32.4*
50—149	29	126	240	**395**	79	206	581	**866**	*73.1*	*62.0*	*70.8*	NA	109	286	395	-	*52.9*	*49.2*
150—250	7	32	51	**90**	15	37	96	**148**	*68.2*	*53.6*	*65.3*	NA	24	60	84	-	*64.9*	*62.5*
>250	30	44	105	**179**	28	44	143	**215**	*48.3*	*50.0*	*57.7*	NA	36	86	122	-	*81.8*	*60.1*
TOTAL	140	310	1126	**1576**	334	407	2718	**3459**	*70.5*	*56.8*	*70.7*	NA	226	1013	**1239**		55.5	***37.3***

MARKET represents the firms whose share of sales to order stands at zero, while SUPPLIER are firms whose sales to order amounts to 100%. ADV. SUPPLIERS (advanced suppliers) are firms which export (the share of sales exported out of total sales exceeds the median value of the ratio total exports to total sales) and/or innovates (product and/or process innovation activities).

TABLE 2 - Description of variables used in the estimations and their summary statistics

VARIABLE	DESCRIPTION	Mean	Std. Dev.	Min	Max	Obs
SE [a]	Total sales per employee.	285,0	847,3	0,002	12.094	18.615
SFD	Dummy = 1 (= 0) if firm's share of sales to order to total sales is 100% (0%).	0,690	0,463	0	1	14.952
SFR [d]	Firm's share of sales to order to total sales.	66,118	43,41	0	100	18.407
EXP	Dummy = 1 if firms' exports exceed the median value of the ratio exports to sales.	0,50	0,50	0	1	16.803
INNO	Dummy =1 if firms carried out innovation activities (process, and/or product) [f]	0,603	0,489	0	1	18.739
K [b]	Tangible plus intangible assets.	6.588	33.600	0,444	1.190.000	18.392
RAW_MATERIAL [b]	Expenditure for raw materials.	1.478	8.509	0	631.000	18.392
HIGH_EDU [d]	High school and graduate employees to total employees.	51,75	29,87	0	100	11.797
AGE [e]	Current year minus firm's year of establishment.	27	23	0	256	18.479
ICT [a]	ICT expenditure to employees	404,4	948,7	0	6.507	12.330
GROUP	Dummy = 1 if firms belong to a group and zero otherwise.	0,219	0,414	0	1	18.719
COOP	Dummy = 1 if firms have the cooperative legal form and zero otherwise.	0,013	0,115	0	1	18.707
CENTRE-NORTH	Dummy = 1 if firms belong to Centre-North regions and zero otherwise.	0,886	0,318	0	1	18.848

All the variables are drawn from the 8th, 9th and 10th Capitalia's surveys (Indagini sulle Imprese Manufatturiere). [a] In Euro; [b] in thousands of Euro; [c] in unit; [d] in percentage terms; [e] in years; [f] the dummy INNO_prod=1 and/or the dummy INNO_proc=1. The other variables are dummies. The variables total sales, K and RAW_MATERIAL have been deflated making use of (annual) deflators of the industrial sector the firms belong to (base year 1995; source: EU Klems, [2008]).

TABLE 2.1 - Correlation matrix

	SE	SFR	EXP	INNO	K	RAW MATERIAL	HIGH EDU	AGE	ICT	GROUP	COOP	CENTRE NORTH
SE	1											
SFR	-0,1317	1										
EXP	0,1955	-0,0367	1									
INNO	0,1375	-0,0427	0,1548	1								
K	0,0766	-0,0465	0,11	0,0618	1							
RAW_MATERIAL	0,0972	-0,0134	0,1516	0,0689	0,7078	1						
HIGH_EDU	-0,0982	-0,0736	0,0355	0,0422	-0,0104	0,0018	1					
AGE	0,0467	-0,0604	0,0964	0,0991	0,0899	0,1351	-0,0492	1				
ICT	0,584	-0,0791	0,1227	0,1437	0,0497	0,0679	-0,0798	0,0412	1			
GROUP	0,175	-0,0234	0,1671	0,0705	0,1648	0,1981	0,0295	0,0256	0,1627	1		
COOP	0,0379	-0,0965	-0,0634	0,007	0,0521	0,0103	-0,0403	0,0397	-0,0019	-0,0478	1	
CENTRE-NORTH	0,035	0,0607	0,1379	0,0087	0,0076	0,0314	-0,0157	0,0893	0,0537	0,0076	-0,1099	1

TABLE 3 - Estimation results

		Key Variable: SFD						Key Variable: SFR				
		Dependent Variable (DEP): Sales per employee (in logs) (SE)						Dependent Variable (DEP): Sales per employee (in logs) (SE)				
		Column 1	*Column 2*	*Column 3*	*Column 4*	*Column 5*	*Column 6*	*Column 7*	*Column 8*	*Column 9*	*Column 10*	*Column 11*
		MODEL without Interaction	**MODEL with Interaction**	**TWO STEPS**	**Changing INDEX_ABI (INDEX_ABI2)**	**EXP and INNO**	**TFP as DEP**	**MODEL with Interaction**	**TWO STEPS**	**Changing INDEX_ABI (INDEX_ABI2)**	**EXP and INNO**	**TFP as DEP**
SFD	*(a)*	-0,068	-0,203	-0,203	-0,206	-0,621	-0,198					
		0,004	*0,040*	*0,061*	*0,055*	*0,123*	*0,069*					
SFR	*(ar)*							-0,0017	-0,0015	-0,0021	-0,004	-0,0020
								0,031	*0,053*	*0,015*	*0,034*	*0,073*
INDEX_ABI	*(b)*		-0,065	-0,066	-0,125		-0,081	-0,051	-0,047	-0,102		
			0,230	*0,222*	*0,122*		*0,125*	*0,237*	*0,244*	*0,105*		
SFD (or SFR)*INDEX_ABI	*(c)*		0,074	0,073	0,115		0,068	0,0008	0,0007	0,0016		-0,0700
			0,248	*0,239*	*0,289*		*0,226*	*0,106*	*0,145*	*0,061*		*0,174*
EXP	*(d)*					-0,630					-0,171	0,001
						0,352					*0,418*	*0,201*
SFD (or SFR)*EXP	*(e)*					0,628					0,001	
						0,394					*0,638*	
INNO	*(f)*					-0,524					-0,288	
						0,355					*0,108*	
SFD (or SFR)*INNO	*(g)*					0,570					0,002	
						0,302					*0,286*	
EXP*INNO	*(h)*					0,533					0,001	
						0,529					*0,764*	
SFD (or SFR)*EXP*INNO	*(i)*					-0,508					0,001	
						0,577					*0,646*	
DEP_1		0,513	0,338	0,335	0,334	0,342	0,314	0,533	0,522	0,533	0,336	0,343
		0,000	*0,000*	*0,000*	*0,000*	*0,000*	*0,050*	*0,000*	*0,000*	*0,000*	*0,000*	*0,015*
K		0,040	0,079	0,074	0,079	0,060		0,065	0,062	0,062	0,076	
		0,186	*0,019*	*0,030*	*0,018*	*0,155*		*0,024*	*0,025*	*0,032*	*0,018*	
RAW_MATERIAL		0,004	-0,006	-0,004	-0,004	0,000		0,001	-0,001	0,002	-0,001	
		0,699	*0,609*	*0,696*	*0,676*	*0,989*		*0,922*	*0,936*	*0,805*	*0,957*	
HIGH_EDU		0,0001	-0,0004	-0,0004	-0,0004	0,000		0,001	0,001	0,001	0,001	
		0,879	*0,697*	*0,681*	*0,692*	*0,837*		*0,193*	*0,287*	*0,207*	*0,344*	
AGE		-0,021	-0,016	-0,019	-0,015	0,003	0,013	-0,038	-0,046	-0,040	-0,028	-0,020
		0,200	*0,402*	*0,379*	*0,452*	*0,899*	*0,878*	*0,016*	*0,005*	*0,013*	*0,219*	*0,750*
ICT		0,047	0,088	0,085	0,094	0,107	-0,006	0,073	0,068	0,073	0,102	-0,005
		0,277	*0,167*	*0,133*	*0,174*	*0,043*	*0,220*	*0,220*	*0,215*	*0,235*	*0,061*	*0,152*
GROUP		-0,041	-0,021	-0,021	-0,011	0,009	0,143	-0,096	-0,100	-0,105	-0,085	0,086
		0,572	*0,811*	*0,805*	*0,903*	*0,933*	*0,161*	*0,168*	*0,129*	*0,145*	*0,426*	*0,196*

TABLE 3 (continued) - Estimation results

	Key Variable: SFD						Key Variable: SFR				
	Dependent Variable (DEP): Sales per employee (in logs) (SE)						Dependent Variable (DEP): Sales per employee (in logs) (SE)				
	Column 1	*Column 2*	*Column 3*	*Column 4*	*Column 5*	*Column 6*	*Column 7*	*Column 8*	*Column 9*	*Column 10*	*Column 11*
	MODEL without Interaction	**MODEL with Interaction**	**TWO STEPS**	**Changing INDEX_ABI (INDEX_ABI2)**	**EXP and INNO**	**TFP as DEP**	**MODEL with Interaction**	**TWO STEPS**	**Changing INDEX_ABI (INDEX_ABI2)**	**EXP and INNO**	**TFP as DEP**
COOP	-0,037	-0,069	-0,025	-0,063	-0,081	-0,073	-0,021	-0,043	-0,017	-0,028	-0,016
	0,596	*0,441*	*0,821*	*0,487*	*0,425*	*0,515*	*0,765*	*0,534*	*0,803*	*0,786*	*0,844*
CENTRE-NORTH	0,142	0,179	0,106	0,184	0,178	0,201	0,155	0,123	0,154	0,195	0,197
	0,041	*0,031*	*0,227*	*0,030*	*0,092*	*0,002*	*0,022*	*0,067*	*0,027*	*0,027*	*0,003*
Observations	4.143	4.143	4.143	4.143	3.506	2.436	5.291	5.291	5.291	4.423	3.231
Test joint sig. [(a) or (ar), (c)]		7,740	5,360	8,010		2,940	3,570	2,670	4,860		2,860
		0,001	*0,005*	*0,000*		*0,053*	*0,028*	*0,070*	*0,008*		*0,058*
Test joint sig. [(b), (c)]		0,740	0,770	1,340		1,220	1,320	1,070	1,820		0,930
		0,477	*0,465*	*0,261*		*0,296*	*0,268*	*0,345*	*0,162*		*0,396*
Test joint sig. [(a) or (ar), (e), (g), (i)]					4,060					4,520	
					0,003					*0,001*	
Test joint sig. [(d),(e),(h),(i)]					0,640					0,970	
					0,632					*0,424*	
Test joint sig. [(f),(g),(h),(i)]					0,720					1,570	
					0,577					*0,180*	
Model test	4325	2560	2990	2540	1738	9,100	6408	6337	6338	2677	47,70
	0,000	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*	*0,000*
AB test for AR(1)	-3,260	-3,310	-3,180	-3,260	-3,900	-2,510	-2,670	-3,150	-2,650	-3,030	-3,060
	0,001	*0,001*	*0,001*	*0,001*	*0,000*	*0,012*	*0,007*	*0,002*	*0,008*	*0,002*	*0,002*
AB test for AR(2)	1,620	1,130	1,080	1,100	0,970	1,500	1,950	2,040	1,920	0,390	0,990
	0,106	*0,259*	*0,279*	*0,271*	*0,330*	*0,129*	*0,051*	*0,042*	*0,055*	*0,695*	*0,323*
Hansen test	219,4	277,0	277,0	273,3	317,2	82,40	285,0	285,0	283,4	354,8	79,8
	0,461	*0,590*	*0,590*	*0,650*	*0,684*	*0,097*	*0,390*	*0,390*	*0,415*	*0,306*	*0,137*
Difference-in-Hansen tests	35,73	60,21	60,21	57,19	56,20	56.62 #	52,97	52,97	51,05	59,94	41.12 #
	0,575	*0,053*	*0,053*	*0,088*	*0,286*	*0,000*	*0,142*	*0,142*	*0,187*	*0,210*	*0,040*

In italics are reported the p-values of the tests. The standard errors (not reported) are consistent in the presence of any pattern of heteroskedasticity and autocorrelation within panels. For the description of the variables see Table 2. Constant, time d

Orkestra-Basque Institute of Competitiveness

Mundaiz, 50
20012 Donostia – San Sebastián
t.(+34) 943297327
f. (+34) 943279323

Orkestra
BASQUE INSTITUTE
OF COMPETITIVENESS
DEUSTO FOUNDATION