THE IMPORTANCE OF BEING A CAPABLE SUPPLIER: ITALIAN INDUSTRIAL FIRMS IN GLOBAL VALUE CHAINS*

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ABSTRACT

This paper investigates the effect of being a supplier (i.e., selling intermediate inputs/goods to other producers) on firm productivity. The traditional tenet that such suppliers suffer from a relative productivity disadvantage vis-à-vis final firms (i.e. the ones selling in final goods markets) is challenged by the recent literature of the Global Value Chain Approach. This stream of literature argues that the traditional view may be invalidated by virtue of the very substantial variability in supplier performance attributable to differences in the governance of value chains and the capabilities of individual firms. Our empirical investigation, focusing on Italian industrial suppliers, provides evidence supporting this view, showing that the capabilities of individual firms do matter even for small firms. To this end, we compare labour productivity and total factor productivity of supplier and final firms with the same level of ability (measured in terms of exporting and innovating). In the case of "traditional" (i.e., non-exporting and non-innovating) suppliers, the comparison with final firms confirms the relative weakness of supplier firms. However, as a firm's ability increases, the difference in performance between suppliers and final firms steadily shrinks. Indeed, the most advanced suppliers (those exporting and carrying out both product and process innovations) turn out to be even more productive than final firms.

JEL codes: D23, L22, L24, O14

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1. INTRODUCTION

The relationship between firm organization and firm performance has been receiving increasing attention by industrial economists and management scholars. This interest has been triggered by the profound changes in the world economy brought about by globalization. In particular, both the considerable decline in vertical integration in most industries and the reorganization of production across national borders have drawn attention to the organizational choices of firms in a world of increasingly complex inter-firm relationships, outsourcing, off-shoring, global networks and value chains.

However, while the analysis of the sourcing strategies of firms (i.e., the "make-or-buy" and "where-to-make-or-buy" choices) have given rise to a large body of literature (Melitz, 2003, Antras and Helpman, 2004, Helpman *et al.,* 2004, Helpman, 2006), less attention has been devoted to the behaviour of supplier firms (most of which are small relative to other firms), the "other side of the coin" from outsourcing and off-shoring. Yet, supplier firms persist and even proliferate in both developed and developing countries. A recent European survey (Unicredit, 2011) on manufacturing firms in France, Germany, Italy, Spain, United Kingdom, Austria and Hungary showed that a vast majority of firms in these countries produces for other firms, and that the value of sales to order (typical of suppliers) accounts for a high percentage of their total turnover, especially for small firms. Despite its potential relevance, the topic remains insufficiently investigated and no clear-cut conclusions have been reached on the impact of organizational choices on firm performance.

Actually, some papers (e.g., Kimura, 2002, for Japanese industrial firms, and Razzolini and Vannoni, 2011 for Italian ones) investigating the relative performance of suppliers, have documented a profitability and productivity gap in which suppliers are disadvantaged relative to other producers. This result, even though solidly rooted in the traditional model of the "captive supplier" which is seen as being at the mercy of a large and powerful monopsonist[1],is probably no longer adequate to represent the complexity of suppliers and their heterogeneity in terms of performance and behaviour.

A richer description of the features and a broader perspective on the role of suppliers is proposed by the recent Global Value Chain Approach (henceforth GVCA). GVCA develops a framework tying the vertical fragmentation of industries to the globalization of markets for intermediate goods and the global value chains (GVCs) forming the core of the new international division of labour. Most importantly, GVCA provides sound interpretations of both the functioning and governance of GVCs and the effects of belonging to such chains on the performance and growth of supplier firms.

Inspired by GVCA insights, this paper focuses on the nexus between firm's organizational structure, i.e., being a supplier or a firm selling to the final goods market, and its productivity. The research questions we address are: (1) Can suppliers still generally be characterised (as in the traditional literature) by lower productivity than final firms? (2) Alternatively, can we see that upgrading processes are occurring in at least a subset of more capable supplier firms operating in GVCs?

To answer these questions, we compare firm productivity (both labour productivity and total factor productivity TFP) between supplier and final firms and for firms of different abilities (as measured by an index based on firms' exporting and innovating capabilities).The results of our investigation show that traditional (i.e. non-exporting and non-innovating)suppliers have lower productivity than final firms. However, as firms' capabilities increase, the difference in performance between the two groups steadily shrinks to the extent that the most advanced suppliers (those which export and carry out both product and process innovations) actually have higher productivity than final firms of similar capabilities.

[1] See, for example, Sallez (1977) for France, Aoki (1988) for Japan, Innocenti and Labory (2004) for Italy.

Unlike the existing GVCA literature that has dealt mainly with experience in developing countries, our study makes use of the experience of manufacturing firms in Italy. Italy provides an interesting area of application in that Italian firms are characterized by a high division of labour among firms, a large share of firms working exclusively or primarily as suppliers (most of which are small) and are very substantially affected by globalization. We carry out an econometric investigation by employing data on a representative sample of 3904 manufacturing firms, drawn from three waves of the Unicredit survey, spanning the period 1998-2006.

The remainder of the paper is organized as follows. Section 2 reviews the most relevant insights and contributions of GVCA, which provide the theoretical background for our empirical investigation. Section 3focuses on Italian manufacturing suppliers, documenting some of their peculiar features and illustrating how they have been affected by globalization. Section 4 presents the econometric analysis, including the methods and data employed and the main results. Lastly, some concluding remarks are offered in Section 5.

2 THE NEW INTERNATIONAL DIVISION OF LABOUR AND THE GVCA: A REVIEW

During the last two decades, profound changes in the international division of labour among firms have occurred, with explosive growth in outsourcing, off-shoring of some stages of production and the globalization of intermediates goods markets. The production process of almost every good (from computers to retail trade services) has been disaggregated into a coordinated series of separate "tasks", located outside the final assembling firm, either in the home country or abroad. International trade in tasks has increased sufficiently so as to partially replace international trade in goods (Grossman and Rossi-Hansberg, 2006). This new model of the international division of labour has both initiated an increasing variety of relationships among producers and spurred the development of GVCs.

One stream of literature, initiated by Gereffi (1994)and subsequently enhanced by contributions of Gereffi and Korzeniewicz (1994), Gereffi (1999), Kaplinski (2000), Henderson *et al.*

(2002) and Humphrey and Schmitz (2002), has focused on the evolution of GVCs. A distinctive feature of GVCA is its interest in two issues relevant to our investigation[2], namely, (1) the functioning of GVCs, representing not merely the sum of bilateral connections but rather a complex set of relationships coordinated by key agents based on some form of hierarchy and/or cooperation among participants, and (2) the behaviour and performance of supplier firms.

Concerning (1), GVCA usually sees large firms from advanced countries (often multinational enterprises) taking on the role of lead firms in both "buyer" and "producer" driven GVCs (Gereffi, 1994). Buyer-driven GVCs are led by global buyers and are common in labour-intensive industries such as textiles and shoes. Retailers usually control downstream activities such as distribution, marketing and sales, while manufacturing is outsourced to networks of suppliers (Gereffi *et al*., 2001). Conversely, producer-driven GVCs, usually led by large manufacturers, are typical of capital-intensive industries such as automotive, electronics and civil aviation. In this type of GVC, final firms keep control of the manufacturing process by obtaining customized intermediate products from selected suppliers located both at home and abroad.

Participation in GVCs can affect the behaviour and the performance of firms in several ways. A key argument of GVCA is that the involvement of supplier firms in GVCs provides a valuable opportunity for these actors, since the external linkages provided can supply managerial expertise, technical knowledge, innovation channels, and new markets, thereby enhancing productivity, efficiency and growth. In particular, GVCA scholars focus on factors contributing to the improved firm performance or "upgrading" of firms in the GVCs. At least four distinct channels

[2] A large number of other authors use different approaches in dealing with the phenomenon we describe. For example, for studies on the new international division of labour (see Fröbel *et al*., 1980); disintegration of production (Feenstra, 1998); fragmentation (Arndt and Kierzkowski, 2001); vertical specialization (Hummels *et al*., 2001).The evolving new division of labour among firms and countries has called into question the appropriateness of the traditional concept of comparative advantage (Beaudreau, 2011), possibly to be replaced by the concept of "vertical comparative advantage".

of upgrading are envisioned: (a) product innovation (increasing the ability of supplier firms to satisfy higher value added, more sophisticated products – Dolan and Humphrey, 2000; Bair and Gereffi, 2001; Bazan and Navas-Aleman, 2004; Giuliani *et al*., 2005 – or enlarging product lines); (b) process innovation (increasing the technical efficiency of the production process); (c) functional upgrading (improving the quality of supplier's operations along the GVCs, or moving to higher quality functions, e.g., from production to design); and (d) inter-chain upgrading (applying the competence acquired in a particular function so as to move into a new chain)[3].

However, the mere participation in a GVC cannot guarantee success and upgrading, since suppliers' performance can be affected by several factors, especially the type of governance adopted by chain leaders and the individual capabilities of firms.

GVCA scholars attach importance to the type of chain governance adopted by lead firms. Three distinct types of governance (i.e. relational, modular and captive) have been singled out[4] by Gereffi *et al*. (2005) and many others (e.g., 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). *Relational* value chains are characterized by close relationships between suppliers and lead firms wherein the former become directly involved in strategic stages of production, such as design and product development. In *modular* value chains, lead firms provide design specifications to supplier firms that manufacture components, modules and/or subsystems (Sturgeon and Lester, 2004; Gereffi *et*

[3]Ponte and Ewert (2011, p.1647) have recently argued that long-established terms in such literature such as 'process, product, functional and inter-sectorial 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, it may be appropriate to apply upgrading to firms involved in GVCs, even if they thereby manage to "reach a better deal", or a better balance between risks and rewards.

[4]In their study of the value chain led by IKEA, Ivarsson and Alstam (2010)add one more type, "*developmental*" governance structure.

al., 2005). Finally, in *captive* value chains, several suppliers can source the same intermediate good and the competition among them is fierce, mainly based on price.

The type of value chain governance is generally related to the complexity of inter-firm transactions and the capabilities of suppliers to codify specifications for complex transactions and to assure that all the requirements needed for such transactions are satisfied (Gereffi *et al*., 2005). Suppliers with low capabilities usually participate in *captive* GVCs, gain only thin margins and are exposed to the risks of being crowded out. Conversely, suppliers with high capabilities take part in *relational* GVCs where transactions are complex and cannot be fully specified. Finally, those with intermediate capabilities usually operate in *modular* GVCs, characterized by codified specifications of standardized modular goods. Thus, according to the GVCA, firms' technical and relational abilities can be important determinants of supplier performance. In particular, the propensity to penetrate foreign markets, on the one hand, and the ability to introduce process and product innovations, on the other, are often viewed as important determinants of a firm's ability to exploit the opportunities offered by participation in GVCs.

Most applications of GVCA are to developing countries. In this environment, the effects on economic growth of a developing country can be analysed through the creation and the development of GVCs and the international relocation of stages of production processes to which they may give rise.. Nevertheless, we believe that GVCA may also help explain some microeconomic consequences of globalization in mature industrial systems, especially ones characterized by a high division of labour among firms and a strong presence of suppliers (especially among small firms). In particular, GVCA seems to be suitable to explain why, even in advanced economies, the impact of globalization may be very different for suppliers with different technical and relational abilities.

In this vein, the insights of GVCA seem to provide useful explanations for the differences in productivity among Italian industrial suppliers with different characteristics and capabilities. Indeed, as in GVCA, our explanation for the observed heterogeneity in productivity is mainly based on differences in the endowments of abilities among firms to innovate and export.

The contributions of this paper to GVCA are several. First, it provides evidence on firm level determinants of performance of (mostly small) supplier firms. As some authors have underscored (Dunford 2006; Kalarantidis et al. 2011), while the GVC setting in which firms operate has been extensively explored at the cluster level, the enterprise itself and, in particular, the effects of its organizational choices remain quite obscure. The reason for this undoubtedly lies in the absence of good quality firm level data (Sturgeon and Gereffi, 2009). This may also explain why most empirical analyses of GVCA have been based on well-crafted, insightful and detailed case-studies, surveys and anecdotal evidence rather than on statistical investigations. Second, our study is based on an econometric investigation carried out on a representative sample of manufacturing firms, thereby permitting greater generalization. Third, unlike the previous applications of GVCA that have largely been limited to developing countries, our study refers to Italian manufacturing firms which, as noted both above and in the next section, would seem both interesting and appropriate because of its historically high division of labour among firms, often of small size, with many producers selling intermediate inputs to order.

3. THE ECONOMIC CONTEXT: ITALIAN SUPPLIERS IN GVCs

Being characterized as a country with an unusually high division of labour among firms, Italy is an ideal focus for an empirical study on the performance of supplier firms. Along with Japan, since the 1960's average firm size in Italy has been smaller than in other industrialised countries. The fragmentation of production by stage during the subsequent decades has further reduced the degree of vertical integration among Italian firms. The prevalence of suppliers and small and medium sized firms (SMEs) is partly explained by a well-known peculiarity of Italian industry, namely, the prevalence of firm clustering in Marshallian districts (especially in the North-Eastern and Central Italy regions). For quite a while, industrial districts contributed to the strength of Italian industry generally attributed to the externalities of information, labour pool specialization and division of labour that these districts afford, especially for SMEs.

However, more recently 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 many producers to search outside these districts for lower cost suppliers (in Central and Eastern Europe, the Balkans, the Mediterranean basin and Asia). As a result, district borders have begun to crumble (Rullani, 1997), local producers have been caught off guard by risk (Brusco *et al*., 1997; Corò and Grandinetti, 1999) and some of the factors lying behind the success of such districts, such as their local crafts and skills, technological spill-overs and other externalities, would seem to have been lost forever[5]. In Italy's South, the least developed area of the country, where its industrial structure has long been polarized, consisting of a few large firms and several small and relatively less productive firms, globalization effects have been even more devastating (especially for supplier firms) as demonstrated by Giunta and Scalera, 2007; Giunta *et al.,* forthcoming.

Thus, the establishment and enhancement of GVCs, while offering producers in developing countries an invaluable chance to participate in global networks and to survive and grow, has constituted a severe threat to suppliers from Italy and other more highly developed countries. In order to survive, or beyond that to take advantage of opportunities for consolidation and growth, these changing market conditions compel supplying firms in these countries not only to reduce costs and gain efficiency but also to develop their technical and relational capabilities which, according to GVCA, are essential to connect them with the large buyers and assemblers operating in GVCs.

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

The difficult and only partial adjustment of Italian suppliers to globalization is documented in a number of studies (e.g., Corò and Grandinetti, 1999; Amighini and Rabellotti, 2006; De Arcangelis and Ferri, 2005; Met, 2009; Agostino *et al*., 2010; Accetturo *et al*., 2011), showing that some of the most capable suppliers have managed to adapt to changes whereas many others have been unable to do so, becoming increasingly marginalized or doomed to exit the market.

As described in detail in the managerial literature (e.g,, Camuffo *et al.*, 2007), innovation and market expansion abroad are crucial features of this evolution. Capable suppliers extend their own markets, serving a larger number of local, national and international clients. They develop relations with buyers or assemblers on an even footing, no longer characterised by technological and economic subordination in which they merely carry out clients' orders. Instead, by collaboration and complementarity, they participate in the decisions relevant to production and propose innovative models and solutions to address their clients' problems. This kind of supplier is often itself a client to a group of other suppliers, normally operating on a smaller scale, with less advanced characteristics[6], sometimes located abroad. The need to extend the range of clients (in particular international buyers and assemblers) implies an ability to reach levels of productivity sufficient to cover the fixed costs of gaining access to foreign 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.

Some relevant features of Italian industrial suppliers are displayed in Table 1 which is based on a sample of 3904 firms drawn from the 8th (1998-2000), 9th (2001-2003) and 10th (2004-

[6]For example in the fashion complex of Italy consisting of textiles, clothing and leather "a proportion of subcontracting firms ranging between 45% and 55%(…) in turn makes use of external manufacturers" (Osservatorio Subfornitura, 2008).

2006) waves of the Unicredit three-year "Survey on manufacturing firms". This is the same sample of Italian firms that will be examined in the empirical analysis presented in Section 4. The Unicredit survey collects data on a large number of variables from a stratified representative sample of some 3000 to 4000Italian manufacturing firms with at least 11 employees in each wave. The sample contains the whole population of firms with at least 500 employees, but only 12% (in terms of employment) of the total population of firms with 11-499 employees. Each surveyed firm is asked to provide a 10-year time series for a selected number of balance sheet variables and, more importantly, the values of a large number of organizational, structural and performance variables for the current year and, in some cases, for the previous year or two. We use the information provided by each firm on their sales- to- order as an indicator of their supplier firm status. Selling to order is the most common channel of sales among suppliers of intermediates (Unicredit, 2011) since most intermediate inputs are customized for specific productive processes and client firms.

The data presented in Table 1 show that in Italy the relative weight of supplier firms is high. Indeed, the last two columns of Panel B show that on average suppliers account for about 70% of the total number of industrial producers[7], with only relatively small differences among industries[8]and over time. The share of suppliers is about 4 percentage points above the average in

[7] In Table 1 the total number of firms is divided into suppliers (i.e. firms selling only to order to other firms) and non-suppliers (i.e. selling only to the market). Firms selling both to order and on the market are omitted. This choice permits us to avoid the puzzling problem of determining a threshold of the ratio sales to order over total turnover to distinguish suppliers from other firms. Since the number of firms selling only to order or only to the market is relatively large (accounting for more than 80% of the overall sample size), we do not lose much information by omitting the intermediate category.

[8]For conciseness of presentation, in Table 1 we classify industries into the four groups of the Pavitt taxonomy, i.e. traditional, scale intensive, specialized and science- based. In the econometric investigation of Section 4 we make use of the more detailed two-digit ATECO classification.

“specialized sectors”[9], but very close to the mean value in “traditional industries” (in 2006) and “science based industries” (in 1998-2006).On the other hand, these differences are somewhat larger across different size groups, as expected with the share of suppliers being higher among SMEs than among large firms. Suppliers account for 71-72% of the firms in the smallest size class (11-49 employees) but still well over 50% of those with over 250 employees.

The first four pair of columns of Panel A of Table 1 report the distribution of all firms across the four different values of our ability index (ABIN) overall and by industry group and size class. The figures in the first column for each of the four ABIN classes represents the average over the entire 2000-6 period, while that in the second column in each case represents the average for 2006 alone. The entries in Panel B of Table 1 represent the percentages of supplier firms in each such category. The four ABIN categories (0-3) represent different levels of “ability”. A value of 3 is assigned to ABIN if the firm exports (the dummy variable EXP =1) and also carries out both product and process innovations (i.e., with the dummies PROD and PROC= 1)[10]; a value of 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; a value of 1 if the firm is either a non-innovating exporter or a non-exporter carrying out only one kind of innovation, and a value of 0 if the firm neither exports nor innovates.

From Panel A it can be seen that a relatively large share (almost 75%) of producers export and/or innovate (the sum of the percentages of firms in ABIN categories 1-3)and about 45%

[9]An especially high share of suppliers occurs in industries typically characterized by producer-driven chains, that is machinery and mechanical apparatus, electric appliances and electronics.

[10]Here and in the following regressions, we consider a firm to be an exporter whenever the share of its sales exported out of total sales exceeds 15%, the sample median value of the ratio of total exports to total sales. Concerning the ability to innovate, information on the values of the binary variables PROD (product innovation) and PROC (process innovation) are supplied by firms responses “yes” or “no” to the questions: “Have you made product (process) innovation during the last three years?” included in the Unicredit questionnaire.

export *and* innovate or make *both* product *and* process innovations (the sum of the ABIN categories 2 and 3). These percentages vary considerably, however, over industries and firm size. Firms in traditional and scale- intensive industries have somewhat higher shares of firms in ABIN = 0 because they neither export nor innovate, while firms in specialized and science based sectors have larger shares in ABIN=3 because they export and undertake both product and process innovations. The distribution of firms across these ability classes varies more sharply by size of firm group. 30% or more of the smallest producers are *neither* exporters *nor* innovators, whereas among large firms (more than 250 employees) that share was less than 7% in 2006. Conversely, the share of large firms in the highest ability category ABIN=3 was almost 45%in 2006 and averaged over 40% over the 2000-2006 period. Trends over time are noticeable from comparisons between the entries for the whole 2000-6 period and that for 2006 alone. For each size class and industry group, the entries for highest ability (ABIN=3) group are larger for 2006 than for the 2000-6 average. While the increases in the shares of firms in the ABIN=3 category are larger for firms with 50 or more employees, the shares of both ABIN=2 and ABIN=3 categories in the smallest 11-49 size class also reveal upward trends.

Finally, Panel B shows that the percentage of suppliers in all firms is some 7% higher among non-exporters and non-innovators than in the groups of higher ability producers (in ABIN categories 2 or 3). Note also that this difference is greater among firms in traditional and specialized industries. With regard to size, the data show that suppliers are relatively more numerous (constituting about 75%) among non-exporting and non-innovating SMEs (up to 250 employees), while in the group of firms with over 250 employees that same share is considerably below 60%. While this evidence seems to point out a relative disadvantage of suppliers in terms of abilities, especially with respect to the ability to export and innovate, note that of the smallest firms (11-49 employees) with ABIN=3 ability almost 70% of all firms are supplier firms.

4. THE EMPIRICAL INVESTIGATION

In this section, we seek to determine whether or not the gap in "capabilities" between supplier firms and firms selling to the market observed in the previous section carries over to productivity. To that end we use the same unbalanced panel of 3904 firms from the Unicredit Survey utilized in the previous section to estimate the impact of organizational choice and capability (being a supplier; being an exporter and innovator supplier; and so on) on firm productivity (both labour productivity and TFP), after controlling for a number of other plausible determinants. Among the controls we use are: firm size, age, tangible and non-tangible assets, raw materials, a proxy for human capital, investments on ICT, geographical location, legal form, group membership, time and industry dummies. We use two different measures to differentiate between firms selling to other firms on order and those selling directly to the market. First, we use a dichotomous variable (DSUP) to discriminate between firms selling *only* to order (DSUP=1) and firms producing *only* for the market (DSUP=0). Then, as an alternative, we employ the percentage of sales to order in total sales (RSUP) so as to include in the sample even firms selling both to order and to the market.

As previously stated, our primary objective is to assess the predictions of GVCA on the determinants of supplier performance. As noted above, in contrast to the traditional view of suppliers being generally less productive than firms selling to the market, GVCA scholars suggest that, under certain conditions, supplier firms can benefit considerably from participation in GVCs. In particular, by taking advantage of GVCs, they may be able to carry out those tasks that are most suitable to their abilities, benefit from more intensive specialization, and exploit the external linkages to gain access to managerial expertise, technical knowledge, innovation channels and new markets. In this way, suppliers may be able to attain productivity even higher than that of final firms. However, as suggested above, these favourable effects of involvement in GVCs depend crucially on two factors: the type of governance adopted by chain leaders and the capabilities of the firms themselves.

While we can control for a number of other factors (indicated by CTRL in the estimating equation below) some of which could be correlated with GVC governance as well as productivity, unfortunately, the available data does not allow us to detect the specific type of governance employed in the relevant GVC (relational, modular or captive)[11]. On the other hand, we make use of two measures of firm capabilities: (1) ABIN, an index coded 0-3 as defined in the previous section, and (2) ABIN2, another index, which assumes a value of 0 when the firm is neither an innovator nor an exporter; a value of 1 if the firm implements one upgrading activity (innovates or exports), and a value of 2 if the firm is both a (product and/or process) innovator and an exporter. Very importantly, we also include an interaction term between the supplier and firm capabilities measures to allow being a supplier to have different effects according to capabilities.

The estimating equation takes the following form:

$$LAPR_{it} = \beta_0 + \beta_1 LAPR_{it-1} + \beta_2 SUP_{it} + \beta_3 ABIN_{it} + \beta_4 SUP_{it} * ABIN_{it} + \sum \beta_k \, CTRL_{kit} + \varepsilon_{it} \tag{1}$$

where indexes i and t respectively represent firm and time; LAPR is our first measure of productivity (labour productivity defined as the ratio of total sales to the number of employees,

[11]Pietrobelli and Saliola (2008) test the empirical relevance of the kind of value chains and the type of governance adopted by lead firms for the case of Thailand. To the extent that the productivity-promoting governance structures would vary with the sector in Italy as these authors found for Thailand „ our use of sector dummies as controls would imply that the effects of governance are at least controlled for, if not explained and quantified, in our analysis.

in logarithmic terms), SUP represents either DSUP or RSUP (as defined above)[12], ABIN represents either ABIN or ABIN2 (again as defined above) and SUP*ABIN represents the aforementioned interaction term. The use of the ABIN indexes rather than individual dummies (for exporter and/or innovator status) facilitates interpretation of our findings, and mitigates the multicollinearity problems that would arise from the inclusion of several interaction terms in our specification. Nevertheless, as a robustness check, we also estimate (1) with individual dummies in place of the ABIN indexes. Finally, the vector CTRL is a set of *k* control variables including: capital, i.e., the (log of) tangible plus intangible assets (KAP); raw materials, (the log of) raw material costs(RAW); a measure of human capital, i.e., the percentage of employees with high school or university degree(HEDU); (the log of) the firm's age (AGE); (the log of) investment per employee in Information and Communication Technologies (ICT); a dummy (GROUP) if the firm is a member of a corporate group; a dummy for the cooperative legal form (COOP); a dummy for the relatively favourable geographical location in the central and northern regions of Italy (CENTH); and finally dummies for each of the two-digit industry codes (ATECO_1991, 2-digits), and time effects[13]. As another robustness check, we also run a regression using as the dependent variable TFP instead of LAPR[14]. A more detailed description of the variables used in the estimations and their summary statistics (variables not in log terms) are reported in Table 2.

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[12] Since RSUP includes in the sample even firms selling both to order and to the market, when it is used, the sample size increases by over 25%.

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

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

From a methodological standpoint, we face the well-known problems of endogeneity and non-random selection. In our case, the latter problem is mitigated by the use of an unbalanced panel. To tackle the issue of simultaneity, we employ the estimator proposed by Blundell and Bond (1998)[15]. This estimator, also known as the System GMM (or SYS-GMM) estimator, is based on a GMM (Generalized Method of Moments) procedure which makes use, on one hand, of lagged explanatory variables as instruments for the model in first differences (under the assumption of white noise errors, as in the GMM-difference approach of Arellano and Bond, 1991) and, on the other hand, of lagged first differences (of 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.

Table 3 summarizes the results of our estimations where the parameter estimates (and their p-values immediately below them) in the different columns pertain to different specifications, different estimation procedures and different measures of key variables.

As explained below, the results 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-

[15] Several studies apply this method to the estimation of production functions (e.g., Blundell and Bond, 2000; Van Biesebroeck, 2003; Van Beveren, 2007; Gebreeyesus, 2008). Alternatively, Olley and Pakes(1996) and Levinsohn and Petrin (2003) propose a 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). In our case the Olley and Pakes (1996) approach does not seem suitable since we do not know whether the firms which exit the panel exit the market or simply are no longer included in the survey panel.

identifying restrictions. Furthermore, the *difference-in-Hansen-test* outcomes are almost always not significant at the 5% level, supporting the validity of the extra instruments used by the SYS-GMM estimator compared to the difference GMM estimator of Arellano and Bond (1991). When this is not the case, i.e., in columns 6 and 11, where TFP is dependent variable, we employ the Arellano and Bond (1991) estimator. We also explicitly verify the endogeneity of our key variable SUP by running a *difference-in-Hansen-test*, reported in the last rows of Table 3, which verifies the null hypothesis of exogeneity.

Not unexpectedly, beginning in column 1 but continuing through column 11, the results in Table 3 reveal persistence in productivity, in that the coefficients of the lagged dependent variable (DEP_1) are positive and highly significant and that this finding is quite robust to the differences in specifications, estimation procedures and measures used. Two of the control variables, capital (KAP) and the favourable regional location (CENTH) also have rather consistently positive and statistically significant effects on each of the measures of the dependent variable. While few of the remaining control variables have consistently statistically significant effects, at least the signs of coefficients are almost always consistent both across specifications and with our a priori expectations.

Moving on to our main research hypotheses concerning suppliers and firm capabilities, from the estimates reported in column 1 of Table 3 where the supplier dummy DSUP appears separately without its interaction with ABIN, the negative and significant parameter estimate supports the traditional view that, on average, supplier firms have significantly lower productivity than firms selling directly to the market. Columns 2 and 3[16] report estimates of specifications in which the interaction term DSUP*ABIN is also included. Since the model we adopt has a semi-

[16] In column 3, as a first check of robustness, we estimate the two-step variant of the SYS-GMM, adopting the Windmeijer's (2005) correction of the covariance matrix. The results are clearly very close to the ones reported in column 2.

logarithmic form, the estimated percentage impact of being a supplier can be calculated as $100 * [exp(\hat{\beta}_2 + \hat{\beta}_4 ABIN) - 1]$ (Halvorsen and Palmquist, 1980). Thus, applying this formula to the point estimates from column 2, when ABIN =0 (representing a firm that neither exports nor innovates), supplier productivity is about 18.4 percentage points lower than that of other firms with the same level of abilities. With ABIN taking on intermediate values (1 or 2), the impact of being a supplier remains negative but the absolute value of the supplier productivity gap is reduced to 12.1 and 5.4 percentage points, respectively. Finally, when the ability measure rises to ABIN=3, i.e., when the firm is able to both export and implement product and process innovations, being a supplier implies labour productivity 1.9% above that of non-supplier firms[17]. Notably, while the positive coefficient of the DSUP*ABIN interaction term is not individually significant, it is jointly significant with the SUP variable when implementing an F-test, as reported in that column under "Observations" in the lower part of Table 3[18].

Summarizing, we can conclude that within the subset of the least advanced (not exporting and/or not innovating) firms, suppliers suffer a productivity disadvantage relative to other firms as suggested by the traditional literature. Yet, within the group of firms with the highest abilities to export and innovate, suppliers are on average somewhat more productive than other firms. Specifically, the positive coefficients of the interaction terms in columns 2 and 3 show that in-

[17]Since the effect of the ability index is not statistically significant, neither individually nor jointly with the interaction term SUP*ABIN (from the relevant F-test reported in Table 3), the upgrading activities do not seem to have significant impacts on final market firms.

[18]The inconsistency between individual and joint significance may signal the presence of multicollinearity (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''.

dividual abilities are more important for suppliers than for firms in general, reflecting the importance of these characteristics for suppliers to take advantage of GVCs.

While the results of columns 1, 2 and 3 are obtained by using all internal available instruments, as a 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 checks are not tabulated, but are available upon request.

What is more important is that these results remain substantially unaltered when we change our measure of firms' ability as in columns 4 and 5. In column 4, where we adopt the ability index ABIN2, from the coefficients reported we find that the productivity of suppliers that neither export nor innovate is about 18.6% lower than non-suppliers with the same level of abilities. The gap shrinks to 8.7% when either export or innovation activities are undertaken and turns into a relative advantage of about 2.4% for suppliers which both export and innovate.

In column 5, rather than the indexes ABIN or ABIN2, we employ the individual dummy variables on which the previous indexes are based upon: EXP is a dummy variable coded 1 if the firm is an exporter (as defined in footnote 10), 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 the additional interactions between DSUP, EXP and INNO, and as a result the formula for calculating the marginal impact of being an advanced supplier becomes $100 * [exp(\hat{\beta}_2 + \hat{\gamma}_2 EXP + \hat{\gamma}_4 INNO) - 1]$ where $\hat{\gamma}_2$ and $\hat{\gamma}_4$ are respectively the coefficients of the interaction terms DSUP* EXP and DSUP*INNO. Again, according to the results of the regressions displayed in column 5, being a supplier (DSUP) tends to imply lower productivity for non-exporters and non-innovators, although in this case it is significant only at the 12.2% level. This negative impact of DSUP on productivity tends to be partly offset when considering innovating-only suppliers (EXP=0 and INNO=1), as $\hat{\gamma}_4$ is positive but lower (in absolute value) than

$\hat{\beta}_2$. 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 being a supplier is reversed to be positive as $\hat{\gamma}_2 > \hat{\beta}_2$ and more so when $\hat{\gamma}_2 + \hat{\gamma}_4 > \hat{\beta}_2$ According to the F-test reported in the lower part of Table 3, while again not individually significant, the interaction terms are statistically significant when considered jointly with the DSUP variable.

As the estimates reported in column 6 indicate, our results are again basically confirmed when as a further robustness check we replace our first productivity measure LAPR with TFP[19]. This latter variable is retrieved from a preliminary estimation of a Cobb-Douglas production function, which in log-linear terms is given by:

$$ADVA_{it} = \alpha_0 + \alpha_k KAP_{it} + \alpha_l LAB_{it} + \alpha_H HEDU_{it} + e_{it} \tag{2}$$

where ADVA represents the firm's added value, LAB is the number of employees and the other symbols have the same meaning as above[20]. After having estimated coefficients of (2) through the Arellano and Bond (1991) estimator[21], a measure of firm-specific TFP is obtained as the difference between the actual value of ADVA and $\hat{\alpha}_k KAP_{it} + \hat{\alpha}_l LAB_{it} + \hat{\alpha}_H HEDU_{it}$.

Finally, in columns 7 to 11 of Table 3, are results obtained when the dummy variable DSUP is replaced by the continuous variable RSUP, the percentage of sales- to- order in the firm's total sales. Even with this change, the results are substantially unaltered so that our previous conclusions still hold. Indeed, across all the estimations performed, the coefficient of the variable

[19] The only substantial difference is that the estimates are now slightly less significant (p-values slightly above 0.05).

[20] Variables ADVA and KAP 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_1991, 2-digits) dummies.

[21] Here 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.

RSUP is negative and statistically significant, showing that for the least able firms, i.e., the ones which neither export nor innovate, the effect of being a supplier is negative, since productivity decreases as the share of sales- to- order increases. Once again, however, this negative impact of supplier status declines when considering intermediate values of the ability index (ABIN=1 or ABIN=2) and turns slightly positive when ABIN=3[22] .

5. CONCLUDING REMARKS

In the traditional view, the firm's organizational choice of being a supplier, i.e., selling to other firms, rather than to the market for final goods, implies lower efficiency and lower productivity.

However, the profound changes that have occurred in the world economy in recent decades, with increasing globalization of markets for intermediate goods, seem to have triggered a substantial evolution among 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 GVCs have allowed developing country producers to compete indirectly with them in internationally integrated markets. In the face of this challenge, some (but certainly not all) Italian sup-

[22]The estimates obtained with RSUP are similar to the ones obtained with DSUP, qualitatively and also quantitatively. To see this, consider the figures in column 7 of Table 3. Since RSUP is measured in percentage points, the coefficient $\hat{\beta}_2 = -0.0017$evaluates the proportional effect of a unit increase in RSUP on predicted productivity (-0.17%). This impact falls in magnitude to -0.09% and -0.01% when ABIN equals respectively 1 and 2, and turns to +0.07% when ABIN=3. Conversely, when DSUP is used, the estimated coefficients are a measure of the impact on productivity of a much more substantial change in organizational structure (i.e., from non-supplier to supplier), which, for firms that are not suppliers is a 100 times as large as a unit change in RSUP. Therefore the fact that coefficients $\hat{\beta}_2$ and $\hat{\beta}_4$ in columns 2-4 are approximately 100 times larger than in columns 7-9 shows that our estimates are (even quantitatively) quite robust to changes in the definition of the key variable SUP.

pliers (including even small ones) have succeeded in increasing their ability to export and innovate and thereby achieve greater efficiency and productivity.

In accordance with the theoretical insights of GVCA, in this paper we have considered some individual capabilities or upgrading indicators of the firm, specifically its propensity to innovate and export. In our working hypothesis, the subset of suppliers able to both innovate and export (more than the sample median value) seems to have been successful in adapting to the changes brought about by globalization.

The results of the empirical investigation support our hypotheses. In all the different specifications of our regression model, the most capable suppliers (i.e., the ones exporting and carrying out both product and process innovation) show both labour productivity and total factor productivity that are not lower (and actually are higher) than other firms with a comparable level of capabilities. Instead, when firms with lower abilities are considered, a negative productivity gap emerges for supplier firms relative to non-supplier firms. This gap is larger when firms are neither innovators nor exporters, and smaller when producers either innovate or export but not both. Our results are consistent with insights of the GVCA pointing to the importance of upgrading by supplier firms in GVCs through innovation and penetration on international markets. Since the lack of suitable data has prevented us from investigating the effect of chain governance on supplier performance, this task is left to future research.

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TABLE 1 (*Panel A*) - Firms distribution for level of abilities, industry and size

	ABIN = 0		ABIN = 1		ABIN = 2		ABIN = 3		TOTAL	
	2000-06	**2006**	**2000-06**	**2006**	**2000-06**	**2006**	**2000-06**	**2006**	**2000-06**	**2006**
Traditional	29.38	27.92	29.88	28.5	26.25	27.81	14.49	15.77	100	100
Scale intensive	32.18	30.96	28.09	27.85	26.76	27.85	12.97	13.34	100	100
Specialized	20.04	19.66	29.56	30.06	27.42	25.75	22.98	24.53	100	100
Science based	19.71	16.67	31.73	32.09	25	25.93	23.56	25.31	100	100
Total	**26.92**	**25.79**	**29.52**	**28.95**	**26.62**	**27.18**	**16.94**	**18.08**	**100**	**100**
11—49	32.01	29.38	30.31	30.05	26.21	27.79	11.47	12.78	100	100
50—149	18.78	17.42	30.46	28.64	28.22	27.8	22.54	26.14	100	100
150—250	14.22	14.57	29.32	25.17	29.31	29.13	27.15	31.13	100	100
>250	10.67	6.81	19.95	20.42	29.21	28.09	40.17	44.68	100	100
Total	**26.92**	**25.79**	**29.52**	**28.94**	**26.62**	**27.18**	**16.94**	**18.09**	**100**	**100**

TABLE 1 (*Panel B*) - Ratio Suppliers/Total number of firms for level of abilities, industry and size

	ABIN = 0		ABIN = 1		ABIN = 2		ABIN = 3		TOTAL	
	2000-06	**2006**	**2000-06**	**2006**	**2000-06**	**2006**	**2000-06**	**2006**	**2000-06**	**2006**
Traditional	71.14	74.76	67.42	69.00	65.49	68.62	63.31	65.00	67.44	69.87
Scale intensive	69.77	70.29	71.26	71.16	63.17	64.19	64.84	66.99	67.52	68.39
Specialized	78.54	80.95	74.00	74.77	71.21	71.64	69.29	70.61	73.16	74.16
Science based	72.39	70.37	68.91	71.15	65.10	69.05	67.45	63.41	69.23	68.52
Total	**72.48**	**74.88**	**69.82**	**71.15**	**66.92**	**68.52**	**66.04**	**67.28**	**69.12**	**70.70**
11—49	71.55	74.07	68.62	71.31	69.74	71.08	68.59	69.51	70.70	71.83
50—149	71.70	72.60	70.98	70.83	67.52	68.67	67.50	68.95	68.51	70.05
150—250	83.52	81.82	67.61	71.05	54.92	56.82	65.70	63.83	63.79	66.23
>250	53.58	56.25	62.65	64.58	51.76	50.00	58.33	60.00	56.46	57.87
Total	**72.48**	**74.88**	**69.82**	**71.15**	**66.92**	**68.52**	**66.04**	**67.28**	**69.12**	**70.70**

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
DSUP	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
RSUP [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
ABIN	See section 3 of the manuscript.					
KAP [b]	Tangible plus intangible assets.	6,588	33,600	0.444	1,190,000	18,392
RAW [b]	Expenditure for raw materials.	1,478	8,509	0	631,000	18,392
HEDU [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
CENTH	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 (sectorial summies, ATECO_1991, 2-digits, not reported). The variables total sales, KAP and RAW have been deflated making use of (annual) deflators of the industrial sector the firms belong to (base year 1995; source: EU Klems, [2008]).

TABLE 3 - Estimation results

		Key Variable: DSUP						Key Variable: RSUP				
		Dependent Variable (DEP): labour productivity (LAPR)					TFP	Dependent Variable (DEP): labour productivity (LAPR)				TFP
		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 ABIN (ABIN2)**	**EXP and INNO**	**TFP as DEP**	**MODEL with Interaction**	**TWO STEPS**	**Changing ABIN (ABIN2)**	**EXP and INNO**	**TFP as DEP**
DSUP	*(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*					
RSUP	*(ar)*							-0.0017	-0.0015	-0.0021	-0.004	-0.0020
								0.031	*0.053*	*0.015*	*0.034*	*0.073*
ABIN	*(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*		
DSUP (or RSUP)*ABIN	*(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*
DSUP (or RSUP)*EXP	*(e)*					0.628					0.001	
						0.394					*0.638*	
INNO	*(f)*					-0.524					-0.288	
						0.355					*0.108*	
DSUP (or RSUP)*INNO	*(g)*					0.570					0.002	
						0.302					*0.286*	
EXP*INNO	*(h)*					0.533					0.001	
						0.529					*0.764*	
DSUP (or RSUP)*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*
KAP		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		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*	
HEDU		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*

(continued)

TABLE 3 (continued) - Estimation results

	Key Variable: DSUP						Key Variable: RSUP				
	Dependent Variable (DEP): labour productivity (LAPR)					TFP	Dependent Variable (DEP): labour productivity (LAPR)				TFP
	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 ABIN (ABIN2)**	**EXP and INNO**	**TFP as DEP**	**MODEL with Interaction**	**TWO STEPS**	**Changing ABIN (ABIN2)**	**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*
CENTH	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	3062	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	54.17 #	52.97	52.97	51.05	59.94	39.45 #
	0.575	*0.053*	*0.053*	*0.088*	*0.286*	*0.001*	*0.142*	*0.142*	*0.187*	*0.210*	*0.044*
Difference-in-Hansen tests	0.56	3.15	3.15	1.09	0.37	0.58	3.51	3.51	2.01	2.19	0.02
H null: DSUP (or RSUP) is exogeneous	*0.454*	*0.076*	*0.076*	*0.296*	*0.543*	*0.446*	*0.061*	*0.061*	*0.156*	*0.139*	*0.887*

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 dummies, sectorial dummies (ATECO_1991, 2-digits) and regional dummies included but not reported. The dependent variable in columns from 1 to 5 and from 7 to 10 (LAPR) as well as the variables KAP, RAW, AGE, ICT are in natural logarithms. The TFP measure, used as dependent variable in columns 6 and 11, has been retrieved as described in section 4. AB test for AR(1) and AB test for AR(2) stand for Arellano-Bond tests for AR in first and in second differences, respectively. # As the difference-in-Hansen-Test is statistically significant at 5%, the Arellano and Bond (1991) estimator is employed in column 6 and 11.