ITALIAN FIRMS' INTER-REGIONAL TRADE ACTIVITIES DURING THE CRISIS

A TALE ABOUT LEARNING AND INNOVATION

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Abstract: in this paper we study Italian firms' behaviour in terms of international and inter-regional trade activities during recent years. In particular, our aim is to detect similarities and differences in trade patterns in order to shed some light on the determinants of these two types of firm strategies. Our analysis is carried out within the framework of probability panel models and makes use of a very rich micro-level dataset. Main results, while confirming the relevant role played by firms' productivity, provide new evidence on the relevance of innovation activity and learning processes in enhancing the probability of entering both international and interregional markets. Our findings also show that the determinants of the firms' propensity to trade exhibit varying effects across the macro-regions of the country.

Keywords: international trade, interregional trade, innovation, regional/industrial spillovers, dynamic binary models

JEL classification: F14, O3, D22, C23, C25, R12

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1. Introduction

The ability of firms to sell their products and services beyond the boundaries of neighbouring markets is a standard measure to evaluate their competitiveness. This concept has been usually applied to international borders. As a result, a large amount of trade studies, theoretical and empirical, have provided both conceptual reasoning and statistical evidence to corroborate it (see the reviews by Wagner, 2007, 2012, 2014, Greenaway and Kneller, 2007 and Bernard et al. 2012).

Generally speaking we can say that the more competitive a firm is, the farther can sell its products and larger its potential markets can be.

This paper suggests that competitiveness depends also on firms' performance in other regions within national borders, besides in other countries beyond national borders. More specifically, we suggest that international and interregional trade are complementary and potentially related phenomena, which can, and need to, be studied together in order to analyse similarities, as well as differences.

We move along the research avenue pioneered by Bernard and Jensen (1995), according to which firms' openness depends on their capacity to overcome the sunk costs for selling abroad. Openness is, therefore, related to specific firms' characteristics, such as productivity, innovativeness and previous experience and learning.

In particular, regarding the experience and learning phenomena, we refer to Penrose (1959) by suggesting that firm's management draw on previous trade involvements to increase its knowledge and, thus, ultimately, its ability to overcome trade barriers. In other words, firms have a higher probability to enter and to survive in international and interregional markets if they are already accustomed to such environments. On the one hand, firms' ability to export abroad may be enhanced if such firm has already tackled the difficulties related to accessing an unfamiliar market. Therefore, enterprises active in interregional markets may face lower sunk costs when approaching foreign markets. Although the institutional environment is the same all over the home country, regional markets could be highly differentiated in terms of local demand or distribution networks. On the other hand and a fortiori, firms already involved in international markets are facilitated in selling in other regional markets because sunk costs are relatively minor.

The aim of this paper is therefore to assess the importance of the usual set of potential internal and external firms' features, which have proved influential on international trade, in affecting interregional trade. The comparative analysis of a common model will inform us on the parallel features of these phenomena. At the same time we will be able to assess how much interregional trade may affect international openness and viceversa. This analysis is applied to the Italian case in the period 2007-2013 by using data from an updated new database from the MET surveys. These surveys are specifically designed to study Italian firms' characteristics and strategies, with particular focus on inter and intra national relationships and networks.

The paper is structured as follows. The second section briefly presents the rich theoretical and empirical background of the present analysis in order to highlight its original contents. The third section presents the empirical model and discuss some methodological issues. Section four offers an account of the characteristics of the MET-database and describes the main features of the phenomena under examination. In section five the main results are discussed. Section six concludes.

2. Literature review

The economic literature regards firm's decision to sell products on distant markets as the outcome of a cost-benefit analysis: as long as this activity turns out to be profitable the firm will decide to carry it out. Therefore, all those elements affecting either costs or revenues influence this decision by increasing or reducing potential marginal profits stemming from this activity.

One of the first models tackling this issue is represented by the Heckscher-Ohlin-Samuelson model (henceforth HOS), which identifies comparative advantages generated by different factor endowments across sectors and countries as the main force underpinning the export activity. In order to obtain this result, however, the model needs to assume a population of firms made of homogenous agents acting within a competitive framework. The first attempt to overcome this unrealistic assumption has been put forward by Krugman (1979). Nevertheless, whilst allowing for the presence of imperfect competition, this theory remains firmly rooted in the HOS tradition by representing enterprises as a unique entity facing trade costs mainly made of homogeneous transport expenses and tariffs.

Starting from the mid-90s many empirical works have challenged this 'homogeneity' assumption by providing systematic micro-level evidence of structural differences occurring between exporters and non-exporters (Bernard and Jensen, 2004, 1999, 1995; Bernard et al. 2012; Clerides et al., 1998; Greenaway and Kneller, 2007; Wagner, 2007, 2012, 2014).

The first theoretical contribution introducing agents' heterogeneity within an international trade framework is represented by the pioneering work of Melitz (2003). According to this model, export decisions are brought about by the combination of export sunk and variable costs, on the one hand, and firm-level productivity, on the other hand. Sunk costs are mainly due to informal barriers and include incomplete information about international markets, uncertainty about contract enforcements, unfamiliarity with market characteristics abroad, difficulties in the establishment of distribution channels and the costs of complying with new or more developed product standards. Firm-level productivity, on the other side, are assumed to differ across enterprises according to a given population distribution.[2]

In so doing Melitz(2003) reinterprets the exporters-domestic firms differences as a productivity issue: exporters are able to afford export costs for their productivities outstrip the required threshold whereas domestic firms act on national markets only for their productivities fall short of the threshold. This is an important shift for it provides a framework to analyse trade activities in general. Indeed, according to this perspective trade activities are carried out as long as firm-level productivity overcomes trade costs, which, in turn, are market specific. Thus, the only difference occurring between foreign and interregional markets is represented by the extent of these costs.

The ultimate outcome of this process is an intra-industry reallocation where less efficient enterprises are forced out of the industry due to the high level of competition.

Despite these fundamental insights, Melitz (2003) model is based on a restrictive assumption. As a matter of fact, it regards both costs and productivity as exogenously given: enterprises are unable to act on either of them by means of any strategy. Thus, Costantini and Melitz (2008) and Aw et al. (2007) add on this framework by building two models which incorporate firm's attempts to improve its own efficiency levels by means of innovation activities. The key idea of these works is that there exists a virtuous circle linking together innovation and export activities. As a

[2] Yeaple (2005) attempts at endogenizing them by setting up a model where enterprises may decide to undertake certain strategies leading, at first, to productivity improvements and, subsequently, to an export flows' increment.

matter of fact, R&D returns increase along with the openness to trade, making investments in research and development more attractive when there are higher market opportunities. In particular Aw et al. (2007) account for the dynamic nature of this relationship. In their model R&D activities increase future export profits via productivity improvements. At the same time, a greater participation to the export market enhances returns from research and development investments.

Despite the different approach to this issue, evolutionary economics tradition provides a similar explanation for the innovation-export link. In particular Dosi et al. (1990) and Barletta et al. (2014) point out that whenever an exporting firm introduces either a product or a process innovation, it gains a temporary quasi-rent along its technological trajectory.

Another branch of the literature focuses the attention on learning abilities, rather than on innovation activities, by investigating which factors may alter export cost processes. For example, a large number of works have put to test the so called *learning-by-exporting* hypothesis (Aitken et al., 1997; Bernard and Jensen, 1999; Clerides et al.,1998; Greenaway and Kneller, 2004; Roberts and Tybout, 1997). According to this hypothesis an enterprise adjusts its export strategies in accordance with its past experiences on foreign markets, proxied by lagged export status or performance. Quite often previous experience explains most of the variation in the data, even though these estimates may be the outcome of a self-selection process *à la* Melitz (2003).[3] Bugamelli and Infante (2003), by studying Italian data, find that past experience in foreign markets increases the probability of exporting by about 70%.[4]

Another phenomenon connected to firms' learning abilities and widely analysed since Krugman (1992) and Aitken et al. (1997) contributions is represented by *export spillover effects*.This approach supports the idea that the local host environment may create important technological and pecuniary spillovers, which affect firms' performance and, thus, their potential to export.

The way the geographical location may influence the overall efficiency of firms is twofold. The first channel has to do with the so-called 'first nature geography' which is bound to the exogenous attributes of a territory (such as latitude, natural resource endowment, climate, proximity to the coast). The second one is tied to the 'second nature geography' following from economic agents interactions (thus endogenous) occurring within a certain territory (e.g. specialisation and urbanization economies, local knowledge spillovers and other regional endowments).

This second type of externalities may also be related to those sectors where technological progress displays high levels of opportunity and cumulativeness (Nelson and Winter, 1982; Malerba and Orsenigo, 1997). In such sense, firms develop and improve their capabilities not only by exerting internal innovative efforts, but by absorbing knowledge and ideas from other geographically and/or technologically proximate firms (Cohen and Levinthal, 1990).

Recent literature has provided a large set of potential determinants of local advantages, among others we refer to Andersson and Weiss (2012) for Sweden, Koenig et al. (2010) for France, Greenaway and Kneller (2004) for UK, López-Bazo and Motellón (2013) for Spain. As for Italy, Becchetti and Rossi (2000) and Antonietti and Cainelli (2011) have investigated the existence of local externalities affecting export activity of Italian firms in 1989-91 and in 1998-2003, respectively. Results turn out to be non-homogenous due to the different empirical settings and, most importantly, to the different sets of indicators measuring local advantages. Nonetheless, there is a general agreement that local features may play a significant role in firms productivity and export performance.

[3] See for example Aw et al. (2000), Bernard and Jensen (1999) and Greenaway and Kneller (2004).
[4] This measure is remarkably high if compared with the percentage proposed by Bernard and Jensen (2004) for US plants amounting to 39%.

3. Empirical strategy

In order to make a comparison between export and interregional trade attitudes, we model them as two distinct functions hinging on the same set of regressors. By following the export propensity literature reviewed in section 2, and in particular Robert and Tybout (1997) and Bernard and Jensen (2004) works, we assume a firm decides to sell its products/services on a specific market as long as its current and expected profits are positive, i.e. as long as the difference between current and expected revenues, on the one hand, and current and sunk costs to get the access on a particular market, on the other hand, is positive. Yet, as highlighted in the previous section, costs and revenues may depend upon several internal and external factors. Therefore, we account for this heterogeneity by allowing export and interregional trade decisions to depend on three different aspects: firm's structural characteristics, the innovation activity and the ability to learn both from past experiences and from the surrounding environment.

The starting point of our analysis is represented by the following index function model (Cameron and Trivedi, 2005, p. 475)

$$(1) \qquad y^*_{isrt} = S_{exp}(1 - export_{isr,t-1}) + S_{intreg}(1 - interregional_{isr,t-1}) + \boldsymbol{X}'_{isr,t-1}\boldsymbol{\beta} + \alpha_i + \mu_s + \delta_r + \gamma_t + \varepsilon_{isrt}$$

where *i* denotes the firm, *s* denotes the sector, *r* denotes the region and *t* denotes the time period. The dependent variable y^*_{isrt} is a latent variable standing for firm *i*'s trade propensity at time *t*. S_{exp} and S_{intreg} represent the sunk costs that the firm has to face at time *t* if it was not an exporter or a trader in the interregional market in the previous period. Depending on the focus of the analysis, y^*_{isrt} refers either to the propensity to export or to the propensity to sell products/services within national markets outside regional boundaries.

Therefore, model (1) expresses firm's tendency to look for distant markets as a function of a set of factors affecting current and expected economic performances. Yet, it is reasonable to assume that the relevance of some of these factors differs between foreign and national markets due to the differing institutional and economic frameworks as well as to the geographical location of the firm. As a consequence, export and interregional trade activities can't be regarded as two symmetric phenomena. In order to highlight this difference, in our empirical analysis we estimate model (1) for both the propensity to export and for the propensity to trade in interregional markets.

As for the set of explanatory variables, we follow Bernard and Jensen (2004) to deal with sunk costs by linking their existence to firm's past trade activity. As a matter of fact, S_{exp} and S_{intreg} exert an effect on y^*_{isrt} only in case the firm has not previously sold its products on foreign and interregional markets. Therefore model (1) may be rewritten as

$$(2) \qquad y^*_{isrt} = \theta_1 export_{isr,t-1} + \theta_2 interregional_{isr,t-1} + \boldsymbol{X}'_{isr,t-1}\boldsymbol{\beta} + \alpha_i + \mu_s + \delta_r + \gamma_t + \varepsilon_{isrt}$$

where θ_1 and θ_2 are the coefficients denoting the contribution of firm's past trade experiences on current trade propensity. Alternatively θ_1 and θ_2 may be interpreted as the extent to which the company learns how to sell its products on a specific market from its past trade experiences. Hence, both coefficients are expected to be positive. It is important to highlight that our specification is different from the models present in the literature for we include both lagged *export* and *interregional trade* terms, thus implying that a firm may learn from past experiences on both foreign and interregional markets.

The matrix $\boldsymbol{X}'_{isrt}$ includes a constant term and a further set of explanatory variables influencing expected profits. In addition to past *export* and *interregional trade* propensities, we allow a company to improve its ability to sell products on markets by learning from its surrounding environment. Thus, $\boldsymbol{X}'_{isrt}$ comprises the export spillover variable, public

and private R&D expenditures at the regional level as well as two dummies denoting the group and local network memberships.

As highlighted by many theoretical and empirical works in the international trade literature (Antonietti and Cainelli, 2011; Aw et al., 2007; Barletta et al., 2014; Bernard and Jensen, 2004 Costantini and Melitz, 2008 and Dosi et al,. 1990 among others), innovation activity at the firm level is another key aspect affecting the propensity to sell products on distant markets. In our study, it is proxied both by R&D expenditure and by the innovation dummy. In so doing we try to capture both formal and informal R&D, as it has been shown Italian firms' innovative activity is to a large extent informal (Santarelli and Sterlacchini, 1990). Finally, in terms of firm's characteristics, we control for productivity (value added per worker), size (employees), age and financial leverage.

A possible problem arising from our specification refers to the direction of the estimated relationships. Indeed some of the explanatory variables we employ in our analysis may be regarded as being both influential for and influenced by firm's trade activity. In order to attenuate this reverse causality problems arising between firm's trade propensity and some of the explanatory variables, the matrix $\boldsymbol{X}'_{isrt}$ enters the specification with lagged values. Finally, equation (2) incorporates specific effects at firm, macro-sector and macro-region level as well as time dummies. In particular α_i accounts for firm heterogeneity stemming from unobservable factors affecting y^*_{isrt}, such as management ability or propensity to export.

Yet y^*_{isrt} it is not observed in the data, being a latent variable representing the propensity to trade. To overcome this obstacle, we make use of the actual behaviour of the firm, $e_{isrt} \in \{0,1\}$, which is related to y^*_{isrt} according to

$$y_{isrt} = \begin{cases} 1 \text{ if } y^*_{isrt} > 0 \\ 0 \text{ if } y^*_{isrt} \leq 0. \end{cases} \tag{3}$$

Therefore, y_{isrt} becomes $export_{isrt}$ when propensity to export is modelled, while it equals $interregional_{isrt}$ when interregional trade is studied. By further assuming ε_{isrt} follows a logistic distribution, the conditional distribution of y_{isrt} may be expressed as

$$\begin{aligned} &\Pr(y_{isrt} = 1 \,|\, export_{isr,t-2}, interregional_{isr,t-2}, \boldsymbol{x}'_{isr,t-2},\ \alpha_i,\ \mu_s,\ \delta_r,\ \gamma_t) = \\ &\Lambda(\theta_1 export_{isr,t-2} + \theta_2 interregional_{isr,t-2} + \boldsymbol{x}'_{isr,t-2}\boldsymbol{\beta} + \alpha_i + \mu_s + \delta_r + \gamma_t) \end{aligned} \tag{4}$$

and we can estimate model (4) via a maximum-likelihood logit model. It is worth noting that we take a two-years lag (t-2) instead of a one-year lag (t-1) because of the design of the MET survey.

To cope with firm-specific effects, we treat α_i as random effects. Nevertheless, this is not sufficient to obtain consistent estimates for the presence of $export_{isr,t-2}$ and $interregional_{isr,t-2}$ variables among the regressors makes (4) a dynamic model. As a consequence either of them is correlated with firm's unobserved heterogeneity. To tackle this issue we follow Chamberlain (1982), Mundlak (1978) and Wooldridge (2005, 2010) contributions by modelling firm's unobserved heterogeneity as a function both of the exogenous variables' within mean ($\bar{x}_i$) and of the of the dependent variable's initial value (y_{i1}):

$$\alpha_i = a_0 + a_1 \bar{x}_i + a_2 y_{i1} + u_i \tag{5}$$

where the error term u_i is assumed of being independent of the exogenous variables (x_i), the initial conditions (y_{i1}) and eq.(2) unobserved heterogeneity (ε_{isrt}). This approach has two main advantages: on the one hand, it controls for possible correlation between α_i and $\bar{x}_i$ and, on the other hand, it enables the estimation of the time-invariant

variables' coefficients. In our case, $\bar{x}_i$ is represented by the average firm's age, which is deemed to be an exogenous variable, while y_{i1} is either $export_{isr1}$ or $interregional_{isr1}$ according to the dependent variable of the model.

We are aware this is not the only way to cope with the initial conditions problem. For instance, alternative techniques based on different assumptions about unobserved heterogeneity distributions have been put forward by Heckman (1981) and Orme (1997, 2001). Yet, Arulapalam and Stewart (2009) have shown that none of the three approaches strictly dominates the other two as far as the small sample performance is concerned. Thus we have chosen to apply the most straightforward method among the three.

Finally, we want to emphasize the importance of our methodological approach with respect to the export propensity literature. Indeed, to the best of our knowledge, those works in the field dealing with dynamic binary choice models very often have overlooked initial conditions issues. Other works (Bernard and Jensen, 2004) have tackled the unobserved heterogeneity problem by turning the nonlinear model into a linear one in order to be able to estimate a linear probability models via Arellano and Bond (1991) GMM methodology.

4. Data and summary statistics

4.1. The database

Our analysis is carried out by exploiting a very rich micro-dataset drawing on three different sources of information. The first one is represented by a firm-level database obtained from the MET survey on Italian manufacturing (ISIC Rev.4 C) and production services (ISIC Rev. 4 H and J) sectors. This is a vast survey realised by the MET Research Centre[5], which gathers a wide range of data on Italian firms strategies in terms of trade activities, R&D and innovation, investments and network participation. Hitherto it has been carried out in 2008, 2009, 2011 and 2013 and it covers a period of time starting a year ahead of Lehman collapse (wave 2008) and extending to the recent 'sovereign debt crisis' (wave 2013). Each wave contains more than 22,000 observations amounting to an overall number of 97,324 (see the first column in Table 1). Furthermore, the sample design allows for longitudinal analyses by devoting about 50% of each wave to a two period panel, as shown in column 2 of Table 1. Since we are interested in comparing firms' international and interregional trade decisions according to their previous characteristics and strategies, we only work through this subsample.

It is worth highlighting that, unlike many other firm-level databases, the MET dataset also encompasses family and micro-firms with less than 10 employees. We believe this is an important aspect of our work for micro-firms represent the outnumbering size class within Italian enterprises' population. Indeed, the representativeness of MET survey results is warranted by a sample design stratified along three dimensions: size class, sector and geographical region.[6]

[5] http://www.met-economia.it/

[6] In terms of firm size, four classes are accounted for: micro-firms (<10 employees), small firms (>= 10 and <50 employees), medium firms (>=50 and <250 employees) and large firms (>= 250 employees). In terms of sectors, the MET survey is representative for the following ISIC Rev4 sectors: Food products, beverages and tobacco (C10-12), Textiles, textile products, leather and footwear (C13-15), Wood, products of wood, cork and furniture (C16 and 31), Pulp, paper, paper products, printing and publishing (C 17-18), Chemical, rubber, plastics and fuel products (C19-22), Basic metals and fabricated metal products (C 24-25), Transport equipment (C29-30), Machinery and equipment n.e.c. (C28), Electrical and optical equipment (C 26-27), Other manufacturing sectors(C 32-33), Transport and storage (H), Information and communication (J). The former ten sectors (ISIC Rev4 section C sectors) represent the manufacturing sectors, while the latter ones (ISIC Rev4 H and J) represent the production services sectors. Finally, the dataset is also representative for the 20 NUTS2 Italian regions, which can be clustered in five NUTS1 macro-areas: North West (Valle d'Aosta, Piemonte, Liguria, Lombardia), North-East (Veneto, Trentino Alto Adige,

The second source of information is represented by companies' financial statements provided by CRIBIS D&B[7]. By merging balance sheet data with MET database we are able to match performance and financial indices with strategic activities at the firm level. Nevertheless, this operation leads to a sensitive sample size reduction (Table 1, third column). Finally, information on regional R&D public and private expenditures are drawn from the website of the Italian national institute for statistics (ISTAT).[8]

After the merging procedure, we end up with an unbalanced panel made of 16,541 observations (Table 1, third column). Likewise Italian firms' population, the sample size is skewed towards the smallest dimensions. Indeed, 76% of observations refer to micro and small firms while large enterprises with more than 250 employees account only for the residual 5% (Table 2). By looking at the geographical distribution, over 70% of observations refer to firms located in the northern-central regions, while only 25.1% refer to firms located in the so called Mezzogiorno area, embracing South of Italy and the two islands (Sicilia and Sardegna).

In macro-sectoral terms, the overwhelming majority of companies in our sample belong to manufacturing sectors. Manufacturing enterprises appear to be more concentrated around the SME's size classes and tend to be more often located in the North of Italy (especially in the North East) than the production services firms. On the other hand, production services sectors show higher shares of both micro and large firms and appear to be more concentrated within the central and Mezzogiorno regions.

The final dataset encompasses a wide range of information concerning structural characteristics, strategies and linkages at the firm level, together with some selected phenomena at the regional level. In particular, among the former we account for company's activities on foreign and interregional markets, innovative activity, participation to groups and/or local networks, size, age, productivity levels and financial structure. Among the latter we include the share of exporters within each region-sector combination and the regional public and private R&D expenditures.[9]

Export and interregional trade activities are measured through two dummy variables computed according MET information on geographical distribution of firm's total sales. The export dummy variable takes on value 1 whenever the firm has sold (part of) its products/services on foreign markets, while the interregional trade dummy takes on value 1 whenever the firm has sold (part of) its products/services on domestic markets outside the NUTS2 region where it is located.

The innovation activity is proxied by two variables drawn from the MET survey and representing inputs and outputs within the innovative process. Inputs are measured through the logarithm of the ratio between R&D expenditure and firm's total sales. Indeed, the larger the amount of resources devoted to research and development with respect to total sales, the more the firm is committed to innovation. Yet, the industrial economics literature has pointed out that Italian firms' innovation is often carried out through informal ways (Santarelli and Sterlacchini, 1990). R&D expenditure alone is thus insufficient to measure the innovative activity for it is unable to capture both the whole extent of firm's efforts and whether these efforts have produced an actual outcome. To cope with these issues we have decided to use a dummy indicating the actual introduction of at least one type of innovation. It is worth

Friuli Venezia-Giulia, Emilia-Romagna), Centre (Toscana, Umbria, Marche, Lazio), South (Abruzzo, Molise, Campania, Puglia, Basilicata, Calabria) and the Islands (Sicilia and Sardegna). Given the main task of the survey is to study innovative firms' characteristics, the sample design seeks to oversample them by looking for the cells with a greater probability of containing innovative enterprises. This identification procedure is performed according to a Bayesian technique which updates each wave's information with the innovative firms' frequencies observed in the preceding wave. Interviews are performed either via phone call or via web (with phone call assistance). For further information about the sampling technique and the methodology see Brancati et al. (2015).

[7] http://dbitaly.dnb.com/English/Main/default.asp

[8] http://dati.istat.it/ .

[9] For a full list of the variables employed in our study look at Table A in the Appendix.

pointing out that even this dummy alone would be insufficient to measure the innovative activity for it detects the outcome of a process but it is uninformative as to company's commitment to that process. We therefore regard the R&D expenditure and the innovation dummy as two complementary elements, necessary to properly account for the firm's innovative activity.

Group membership and local network participation are measured by two dummies coming from the MET survey. Local network participation is identified through any stable and persistent relationship occurring between the enterprise and other firms/institutions settled in a "local" area around it. Thus local networks do not necessarily fall within regional boundaries, but they can also cross borders whenever they remain in a local dimension. This aspect has to be taken into account when interpreting the interregional trade patterns.

Firm's structural characteristics are measured in the usual way. Size is represented by the total number of employees; age is computed as the difference between the year of MET wave under consideration and firm's establishing year; productivity is measured as value added per employee and firm's financial structure is proxied by its financial leverage. All these variables are log-transformed when included in the empirical model.

Finally, as to the three variables at the regional level, R&D expenditures enter our econometric specifications in logarithms, while the share of exporters in each sector-region combination are estimated by means of MET survey results. Since we want to measure the spillover effects exerted by exporters surrounding the firm under consideration we have computed this index in the following way

$$Export\ spillover_{isrt} = \begin{cases} \dfrac{\#\ \text{exporters}_{srt}}{\#\ \text{firms}_{srt} - 1} & \text{if} \quad export_{isrt} = 0 \\ \dfrac{\#\ \text{exporters}_{srt} - 1}{\#\ \text{firms}_{srt} - 1} & \text{if} \quad export_{isrt} = 1 \end{cases}$$

where *i* denotes the firm, *s* denotes the macro-sector, *r* denotes the macro-region and *t* denotes the time period.

4.2. Descriptive statistics

Before analysing the econometric results, we look through some descriptive statistics concerning firms' trade patterns, characteristics and strategies. Table 3 reports the summary statistics for the whole sample as well as for a number of subsets referring to international and interregional exporters. Overall, the former account for 39% of observations while the latter add to 64%. In line with the literature (Bernard et al., 2012; Greenaway and Kneller, 2007; Wagner, 2007, 2012, 2014), domestic firms are on average less innovative, less productive and devote a smaller share of resources to R&D activities than international exporters. Furthermore, they also show higher financial leverages due to the deep fall of the Italian aggregate demand hampering their ability to pay the debts back. As to international exporters, it is interesting to point out that the overwhelming majority of these companies (5,563) sell products both on foreign and on national markets. Such behaviour does not seem to be transitory for 74% of them already used to trade on foreign markets in the preceding wave, suggesting many enterprises adopt a stable market diversification strategy.

In Table 4 we present the correlation coefficients between export decisions and lagged regressors in order to identify co-movements between these series. First of all we find that export activities are quite persistent through time. In particular firms selling products abroad in t are very likely to continue with the same strategy during the following years. In addition to that, we also detect positive and significant cross-correlations between international and interregional trade activities. As a matter of fact, the correlation coefficient between past export on foreign markets

and current export on interregional markets amounts to 0.2503, while the one between past interregional trade activities and current international export equals 0.3208. We interpret these evidences as the outcome of knowledge flows stemming from firm experiences on different markets.

Innovative activity, export spillover and regional private R&D expenditure are all positively correlated with export decisions, whereas public R&D expenditure displays negative coefficients. As we will argue in the econometric section these coefficients may be driven by the type of R&D expenditure rather than by the amount of expenditure itself.

Finally, Table 5 reports descriptive statistics at the regional level in order to highlight the extent of firm heterogeneity across the Italian territory. In terms of openness to trade, Northern regions stand out by displaying the best performance: the average shares of international and interregional exporters within this area outstrip 45 and 67% respectively. On the contrary, the Mezzogiorno area performs poorly with slightly more than 50% of firms reaching interregional markets and less than 30% of companies exporting products abroad. Central regions are placed in-between these two extremes by exhibiting about 36% of enterprises engaged in international export activities and 64% of companies exporting products on interregional markets.

Along with trade propensities, regional statistics highlight other aspects differing across Italian regions. Indeed, enterprises located in the northern and central areas are, on average, larger and more innovative than those located in the Mezzogiorno area. In the next section we are going to employ econometric analysis to investigate the relationship between these factors and trade behaviours.

5. Results

5.1. Export and Interregional trade propensities

We begin the econometric analysis by investigating the factors affecting export and interregional trade propensities. Table 6 presents the results for three different specifications of eq.(1). Columns (1) and (2) report linear probability model (LPM) coefficients. Given the intrinsic nonlinear nature of the phenomenon, we regard these estimates only as a benchmark. In columns (3) and (4) we introduce nonlinearity by means of two pooled logit models estimated via maximum likelihood techniques. It is important to remind that, differently from LPM, logit coefficients can't be immediately interpreted as regressors' marginal effects. Furthermore, both linear probability and pooled logit estimates do not deal with the potential presence of unobserved heterogeneity at the firm level. Indeed, whilst dealing with the presence of more than one observation referring to the same company via clustered standard errors, models in columns (1)-(4) do not exploit the longitudinal dimension of our dataset. Thus, in columns (5) and (6) we control for firm-specific effects by means of random effects. As described in the econometric strategy section, the presence of these unobserved effects combined with the lagged values of the dependent variable among the regressors brings about endogeneity. To cope with it we model the company fixed effects following Chamberlain (1983), Mundlak (1978) and Wooldridge (2005, 2010) approaches. This correction is carried out both for pooled and for random effects' estimates. Finally, we control for macroeconomic influences by introducing macro-sector and time dummies in all our estimates.

Overall, results suggest that export and interregional trade activities are only to some extent alike.

In terms of innovative efforts, all our specifications are in line with the main theoretical and empirical results proposed by the international trade literature (see section two) by detecting a positive correlation between these activities and firm's ability to reach distant markets. However, while R&D coefficients are always strongly significant,

the innovation dummy estimates turn out to be significant in export models only. Therefore, our findings highlight two important aspects concerning firm innovative activity. On the one hand, they point out R&D intensity is bound to long term commitments and high quality innovations, thus providing the firm with strong competitive advantages both on national and on international markets. On the other hand, the innovation dummy outcome underlines the knightian uncertainty (Knight, 1921) characterising this type of strategy. As a matter of fact it is very difficult for the firm to foresee whether or not its innovation will be successful. This impossibility is even stronger during aggregate demand downturns, which explains why our dummy variable turns out to be uncorrelated with firm's probability to sell its outputs on domestic markets outside regional boundaries.

As to learning processes variables, we find out that past trade experiences are fundamental for future probability to trade. Indeed, in Table 6, lagged export and interregional trade coefficients show highly significant coefficients, by implying that these activities are to a certain extent persistent through time. Thus, this persistency confirms the existence of sunk costs, as well as the ability to learn from past experiences to overcome them. Differently from the literature (Aitken et al., 1997; Bernard and Jensen, 1999; Bugamelli and Infante, 2003; Clerides et al.,1998; Greenaway and Kneller, 2004; Roberts and Tybout, 1997), though, our model accounts for the possibility that firms learn how to dampen these costs by taking advantage of past experiences both on international and on domestic markets. Despite past experiences on the same type of market stand out as a more important channel for trade, we find strong evidence of cross effects. As a consequence, firm's today investments and strategies set up to sell on domestic distant markets may be helpful tomorrow to export on foreign markets. Conversely, today investment and strategies set up for foreign markets may help firm's future activities on regional markets. This is also consistent with Table 3 summary statistics where enterprises selling products both internationally and inter-regionally outperform simple interregional traders and exporters.

By looking at firm's abilities to learn from the surrounding environment, Table 6 shows industry and regional characteristics most of the time boost trade activities. First of all, both trade propensities are positively correlated with the share of surrounding firms belonging to the same sector and exporting abroad their products. This effect may follow from a set of beneficial interactions occurring between companies located within the same area. These interactions turn out to be especially helpful for the interregional trade probability.

Similarly, regional private R&D expenditure is positively correlated with both probabilities to trade: the higher the amount of knowledge produced around the firm, the lower the overhead costs burdening the company. Therefore a high level of R&D expenditure implies higher chances for the firm to obtain strictly positive profits by selling its products on distant markets. Differently from what happens for the export spillover's variable, though, regional private R&D expenditure is slightly more important for export propensity than for interregional trade propensity.

On the contrary, we do not find any clear-cut evidence as to the role played by regional public R&D expenditures. Estimates in Table 6 suggest, on the one hand, a poorly negative correlation with firm's propensity to export and, on the other hand, a positive but not significant correlation with the propensity to sell products on domestic markets outside regional boundaries. However, as we will see in the next section, this coefficient varies among Italian macroregions, thus suggesting that Table 6 results are partially driven by both the type and the quality of the R&D expenditure carried out by regional administrations.

In addition to these sectoral and regional dimensions, we allow our specification to account for learning processes stemming from enterprises' environmental linkages. Group membership is positively correlated with both probabilities to trade. However, its coefficient turns out to be statistically significant at the 10% significance level for the interregional trade propensity only. Therefore companies belonging to a group are slightly more likely than the others to sell their outputs outside the region where they are located but they don't show any comparative advantage in terms of export activities. It is worth pointing out that we are not able to distinguish between national and

international groups for our data don't report the group's nationality. As to local network's membership, the signs of the correlations are in line with our expectations in that firms taking part into local networks are less likely to export but more likely to sell products on interregional markets. Yet, these coefficients are never statistically significant.

By turning the attention to the relationship between firm's structural characteristics and trade activities, we find evidence in line with most of the literature (see among others, Bernard and Jensen, 2004; Melitz, 2003) that higher productivity levels are correlated with higher chances to sell products on distant markets. Firm's size, measured in terms of employees, is positively correlated with both trade propensities, while firm's age is strongly negatively correlated with both our dependent variables. This result suggests that young firms are more likely than the old ones to overcome regional boundaries, once controlling for size. It is worth emphasizing that the younger the enterprise, the smaller (on average) its size.

Finally, it is worth pointing out that company's indebtedness plays a detrimental role only for the export activity. As a matter of fact, leverage coefficients within interregional trade specifications are never significant. We interpret this result by taking into account that, on average, exporting abroad requires bigger investments than selling on domestic markets. Furthermore, as underlined by the lagged dependent variables coefficients, trade activities are persistent through time, thus making internationalised enterprises more likely to show higher leverages than the other firms.

5.2. Learning processes across Italian macro-regions

As underlined in the econometric strategy section, our approach assumes firm's decision to sell on a specific market depends upon a cost-revenue analysis. In particular, we account for the possibility that the outcome of this analysis is influenced both by company's structural characteristics as well as by its behaviours. As to the latter we distinguish between innovation activity and learning processes, for we regard firm's capability to improve its strategies by learning from past experiences and from its relationships with other economic agents as much important as its ability to improve economic performances through innovative activities.

Now, we want to go a step further by testing whether these learning abilities vary to a certain extent according to the location of the enterprise. To do so, we have run new estimates introducing a set of interaction terms between our learning processes variables and the macro-regional dummies. Table 7 reports the learning variables coefficients for each one of the five macroregions estimated through a dynamic random effect logit technique with Mundlak-Chamberlain-Wooldridge correction similar to the one employed for the estimates in columns (5) and (6) of Table 6.

First of all, our results point out that firms located in the northern regions have to cope with smaller sunk costs than the ones located either in the Centre of Italy or in the Mezzogiorno area. This implies that trade activities are more persistent outside northern regions: once a company located either in the Centre or in the Mezzogiorno area is able to sell its products on distant markets, it is more likely it will persist with the same behaviour in future periods.

As before, past experiences on the same type of market are more important than past experiences on the other type of market. Therefore today's export activities are more important than today's interregional trade activities for tomorrow's probability to export, whereas today's interregional trade activities are more important than today's export activities for tomorrow's probability to sell products on domestic markets outside regional boundaries.

In terms of export spillovers, we detect a sharp difference across Italian macro-regions. Indeed, the correlation between the share of exporters belonging to the same sector and located in the same region and firm's export propensity is statistically significant in the North of Italy only (Table 7). This may follow from the fact that exporters gather for the most part within these areas, as shown in Table 5.

When we look at interregional trade propensities, we find significant export spillovers phenomena within the North East, the Centre of Italy and, to a lesser extent, within the North West regions.

Regional R&D expenditures show the most interesting results. Indeed, Table 7 estimates enrich the framework described in Table 6 by showing several differences across Italian territory. As to public R&D expenditures, they turn out to restrain export activities mainly in the South of Italy and, to a lesser extent, in the central and north-eastern regions. On the contrary, we find a positive but not significant correlation within the insular regions and a positive and slightly significant (10%) correlation within the north-western regions. A similar situation is detected for the interregional trade propensity: negative but not significant correlations are found for the Mezzogiorno and the North East areas, while positive and significant coefficients are estimated for central and north western regions. As mentioned before, we interpret these diverging coefficients as the result of different types and qualities of R&D expenditures. Unfortunately our dataset does not allow us to identify each single type of R&D expenditure, thus we are not able to further deepen this issue.

In terms of regional private R&D expenditures, our macro-regional estimates point out that the spillover effects identified in Table 6 are the result of a set of differing coefficients across the Italian territory. When looking at export propensity, Table 7 highlights positive and statistically significant coefficients within North East and South of Italy, whereas for the remaining areas correlations are not statistically significant. As to interregional trade propensity, macro-sectoral analysis reveals a positive and statistically significant correlation for the South of Italy only. On the contrary, private R&D expenditure at the regional level appears to exert a slightly negative effect for firms located within Italian central regions.

Finally, very often macroregional environmental linkages estimates are not significantly correlated with trade activities. For the group dummy variable, we just find a positive coefficient at the 5% significance level and a 10% negative correlation with respect to firm's export propensity within North West and South of Italy respectively. For local network, we only find a 10% significant negative correlation with export propensity for companies settled in north-western regions.

6. Concluding remarks

This paper investigates Italian firms' competitiveness by comparing international and interregional sales firms' decisions in current years. We believe that these parallel phenomena are intrinsically interrelated but also with different features with respect to some of their main determinants. In particular, we single out the role of sunk costs, innovative activities and learning abilities on firm's strategies for selling beyond their neighbouring markets.

Results, as expected, show that international and interregional trade activities are only to some extent alike. First of all, while R&D investments are always relevant, the innovation activity turns out to be significant in export models only. This finding suggests that R&D intensity, related to long term commitments and high quality innovations, provides a stable competitive advantages both on national and on international markets; whilst innovations, related to more uncertain and highly heterogeneous results, is effective only when firms need a competitive hedge in international markets. Secondly, we find that the possibility that firms learn how to dampen sunk costs by taking advantage of past experiences both on international and on domestic markets. Obviously past experiences on the same type of market proves always the most important channel for trade, but there is also strong evidence of cross effects. In other words, firm's current strategy to sell on domestic distant markets may be helpful tomorrow to export on foreign markets. Conversely, today strategies for foreign markets may facilitate firm's future activities on regional markets. Third, we find that, when we analyse learning from the surrounding environment, the two phenomena are very similar: industry and regional characteristics, most of the time, boost both trade activities.

Finally, we deepen the analysis at the regional level to see if firms' learning abilities vary according to the dualistic features of the Italian economy. Results show that this is the case: firms located in the northern regions have to cope with smaller sunk costs than the ones located either in the Centre of Italy or in the Mezzogiorno area. This implies that trade activities are more persistent outside northern regions. Thus, a company located either in the Centre or in the Mezzogiorno area which sells its products on international or interregional markets today, is likely to survive in the same market tomorrow. At the same time, firms currently out the market are very likely to stay out also in the future.

These results can be particularly relevant if we consider that the overall dimension of sunk costs is much lower in the case of interregional trade if compared with the international trade ones.

In conclusion, we prove that interregional and international trade strategies are interrelated and similar phenomena even though with some interesting difference with respect to the role of innovation and learning abilities. Most importantly, we have seen that these phenomena may depend on the regional location and that persistence is stronger in the Mezzogiorno rather than in the North. As a result, regional policies oriented to break this path dependence are more necessary in some areas rather than others.

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Table 1: Sample breakdown

Year	MET-firms	Two-period panel	Merge with CRIBIS
2007	24,894		
2009	22,340	11,549	6,016
2011	25,090	13,901	5,797
2013	25,000	10,537	4,728
Total	**97,324**	**35,987**	**16,541**

Table 2: Size class and geographical distributions of the final sample

	Total		Manufacturing		Production Services	
	N. of obs.	%	N. of obs.	%	N. of obs.	%
micro	5,622	34.0	3,112	30.0	2,510	40.7
small	6,953	42.0	4,795	46.2	2,158	35.0
medium	3,144	19.0	1,979	19.1	1,165	18.9
large	822	5.0	485	4.7	337	5.5
Total	**16,541**	**100.0**	**10,371**	**100.0**	**6,170**	**100.0**
North West	3,397	20.5	2,219	21.4	1,178	19.1
North East	4,226	25.6	2,943	28.4	1,283	20.8
Centre	4,770	28.8	2,678	25.8	2,092	33.9
South	2,977	18.0	1,841	17.8	1,136	18.4
Islands	1,171	7.1	690	6.7	481	7.8
Total	**16,541**	**100.0**	**10,371**	**100.0**	**6,170**	**100.0**

Table 3: Descriptive statistics

	Overall sample				*International exporters*		*Interregional exporters*		*Interregional exporters only*		*Both international and interregional*		*International exporters only*	
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
At t														
Export propensity	39%	49%	0%	100%	100%	0%	53%	50%	0%	0%	100%	0%	100%	0%
Inter-regional trade propensity	64%	48%	0%	100%	85%	35%	100%	0%	100%	0%	100%	0%	0%	0%
At t-2														
Export propensity	37%	48%	0%	100%	74%	44%	46%	50%	14%	35%	74%	44%	75%	44%
Inter-regional trade propensity	60%	49%	0%	100%	79%	40%	76%	42%	67%	47%	85%	36%	48%	50%
Innovation	38%	49%	0%	100%	45%	50%	41%	49%	35%	48%	46%	50%	38%	49%
Productivity	10.61	1.05	2.30	16.99	10.64	0.93	10.60	0.99	10.57	1.08	10.62	0.91	10.76	1.04
R&D intensity	1.39	5.90	0	100	2.2	7.1	1.7	6.6	1.1	5.7	2.3	7.2	1.4	6.0
R&D dummy	15%	35%	0%	100%	24%	43%	19%	39%	10%	30%	26%	44%	14%	34%
Leverage	12.0	100.1	0.0	9118.9	10.0	117.2	11.6	106.5	13.3	79.2	10.1	126.2	9.8	30.4
Size	68	250	1	9000	93	268	82	285	61	293	101	276	52	204
Age	19	15	0	169	21	15	20	15	19	14	21	16	18	13
Group	19%	39%	0%	100%	26%	44%	22%	42%	17%	37%	27%	45%	15%	35%
Local network	41%	49%	0%	100%	39%	49%	41%	49%	44%	50%	39%	49%	37%	48%
# Obs.	16541				6510		10594		5031		5563		947	

Note: See Appendix for definitions of variables. Time *t-2* refers to the previous survey wave. *International* and *interregional exporters* are identified according to firm's time t shares of revenue stemming from international and interregional trade activities respectively. Companies selling their products/services exclusively on markets located within the NUTS2 region of their location at time *t* are labbelled *Local firms*.

Table 4: Correlations among the main variables

	At t		*At t-2*							
	Export propensity	Interregional trade propensity	Export propensity	Interregional trade propensity	Innovation - all types	Productivity	R&D dummy	Export spillovers	Regional public R&D	Regional private R&D
At t										
Export propensity	1									
Interregional trade propensity	0.3594	1								
	(0.0000)									
At t-2										
Export propensity	0.6322	0.2503	1							
	(0.0000)	(0.0000)								
Interregional trade propensity	0.3208	0.4491	0.3911	1						
	(0.0000)	(0.0000)	(0.0000)							
Innovation - all types	0.1182	0.0892	0.1585	0.0921	1					
	(0.0000)	(0.0000)	(0.0000)	(0.0000)						
Productivity	0.0286	-0.0076	-0.0109	-0.0654	-0.0205	1				
	(0.0002)	(0.3311)	(0.1594)	(0.0000)	(0.0084)					
R&D dummy	0.2248	0.1544	0.2883	0.2165	0.2855	-0.0141	1			
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0695)				
Export spillovers	0.1795	0.1283	0.2016	0.1308	0.0481	0.0259	0.1023	1		
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0009)	(0.0000)			
Regional public R&D	-0.1169	-0.0431	-0.1235	-0.0594	-0.0399	0.047	-0.0771	-0.169	1	
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)		
Regional private R&D	0.1603	0.1347	0.1488	0.1677	0.0581	-0.0157	0.0924	0.19	-0.0811	1
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0431)	(0.0000)	(0.0000)	(0.0000)	

Note: Productivity is measured in terms of value added per worker in logarithms. See Appendix for definitions of variables.

Table 5: The main variables across Italian regions and macroregions

		At t		*At t-2*								
	Obs	**Export propensity**	**Interregional trade pr.**	**Innovation**	**Employees**	**Productivity va per worker**	**Productivity tfp**	**Age**	**R&D intensity**	**Regional public R&D**	**Regional private R&D**	**Export spillovers**
North West	***3'397***	***50.5%***	***70.2%***	***40.7%***	***88.0***	***10.6***	***5.9***	***22.5***	***1.8%***	***35.1%***	***110.8%***	***20.2%***
Piemonte	1'277	49.8%	69.9%	43.2%	102.6	10.5	5.9	20.7	1.8%	38.3%	144.5%	19.8%
Valle D'Aosta	143	32.2%	41.3%	35.0%	23.0	10.8	5.3	19.8	0.6%	14.9%	45.2%	15.2%
Lombardia	1'563	53.7%	73.8%	39.8%	85.3	10.6	6.0	23.7	2.0%	29.1%	98.0%	20.7%
Liguria	414	46.4%	67.9%	38.6%	75.9	10.6	5.9	24.0	1.5%	54.8%	78.1%	20.7%
North East	***4'226***	***45.0%***	***67.7%***	***42.0%***	***76.1***	***10.6***	***5.9***	***21.6***	***1.5%***	***46.9%***	***71.0%***	***22.9%***
Trentino Alto Adige	629	42.3%	61.2%	36.6%	98.9	10.7	5.9	22.6	1.1%	52.5%	64.8%	17.1%
Veneto	1'910	45.0%	67.3%	44.5%	63.3	10.6	5.9	18.9	1.6%	34.5%	61.1%	22.7%
Friuli-Venezia Giulia	352	59.1%	72.4%	31.3%	113.1	10.6	5.9	22.4	0.8%	63.2%	79.6%	31.0%
Emilia Romagna	1'335	42.5%	70.0%	43.8%	74.1	10.6	5.9	24.9	1.8%	57.7%	85.7%	23.8%
Centre	***4'770***	***36.4%***	***64.3%***	***38.5%***	***62.3***	***10.7***	***5.8***	***17.8***	***1.3%***	***79.3%***	***50.6%***	***15.3%***
Toscana	1'563	42.8%	65.3%	42.2%	50.8	10.5	5.8	19.7	1.3%	63.4%	51.0%	17.1%
Umbria	506	32.8%	68.8%	40.7%	70.3	10.5	5.7	17.3	1.5%	69.2%	23.0%	17.5%
Marche	687	46.6%	70.5%	33.9%	51.6	10.5	5.7	18.2	1.4%	36.0%	34.4%	19.9%
Lazio	2'014	28.8%	60.4%	36.7%	72.9	10.9	5.9	16.5	1.2%	109.0%	62.8%	11.7%
South	***2'977***	***29.6%***	***58.8%***	***31.1%***	***54.3***	***10.5***	***5.4***	***16.1***	***1.0%***	***56.8%***	***30.4%***	***14.3%***
Abruzzo	247	44.9%	75.7%	33.6%	101.1	10.3	5.8	20.3	1.2%	55.4%	40.0%	15.9%
Molise	244	27.5%	53.7%	25.8%	18.8	10.6	5.3	15.2	0.9%	42.4%	7.0%	12.7%
Campania	1'059	30.1%	64.0%	28.5%	48.0	10.3	5.4	14.2	1.6%	71.3%	55.2%	16.7%
Puglia	568	39.3%	67.8%	43.0%	90.5	10.4	5.5	20.1	1.2%	54.1%	23.9%	10.2%
Basilicata	278	27.0%	51.4%	37.4%	34.8	10.9	5.4	16.3	0.4%	51.6%	16.9%	15.1%
Calabria	581	14.6%	39.1%	22.2%	34.9	10.8	5.1	14.4	0.3%	42.3%	3.7%	13.5%
Islands	***1'171***	***23.8%***	***45.1%***	***29.0%***	***40.0***	***10.7***	***5.4***	***16.8***	***1.0%***	***60.2%***	***18.7%***	***13.9%***
Sicilia	850	24.6%	44.4%	31.3%	40.5	10.8	5.4	16.9	1.0%	60.5%	23.2%	13.1%
Sardegna	321	21.8%	47.0%	23.1%	38.7	10.5	5.3	16.5	1.0%	59.3%	6.9%	15.9%

Note: See Appendix for definitions of variables.

Table 6: Estimates of the Italian firms' export and interregional trade propensities

	Linear Probability Model		*Pooled Logit*		*Random Effects Logit model*	
Dependent variable	**Export propensity**	**Interregional trade propensity**	**Export propensity**	**Interregional trade propensity**	**Export propensity**	**Interregional trade propensity**
Innovative efforts						
Innovation	0.013 **	0.001	0.110 **	0.025	0.129 **	0.026
	(0.007)	*(0.007)*	*(0.048)*	*(0.042)*	*(0.056)*	*(0.047)*
R&D intensity	0.001 **	0.001 *	0.009 **	0.010 **	0.011 **	0.011 **
	(0.0005)	*(0.0001)*	*(0.004)*	*(0.004)*	*(0.005)*	*(0.005)*
Learning processes						
Past export	0.558 ***	0.044 ***	2.312 ***	0.248 ***	1.973 ***	0.263 ***
	(0.008)	*(0.008)*	*(0.074)*	*(0.046)*	*(0.105)*	*(0.051)*
Past inter-regional trade	0.055 ***	0.372 ***	0.378 ***	1.291 ***	0.440 ***	1.057 ***
	(0.007)	*(0.009)*	*(0.048)*	*(0.060)*	*(0.057)*	*(0.086)*
Export spillovers	0.001 ***	0.001 ***	0.005 **	0.008 ***	0.006 **	0.009 ***
	(0.0003)	*(0.0003)*	*(0.002)*	*(0.002)*	*(0.003)*	*(0.002)*
Regional public R&D	-0.025 **	0.010	-0.160 *	0.067	-0.195 *	0.071
	(0.011)	*(0.013)*	*(0.084)*	*(0.073)*	*(0.102)*	*(0.084)*
Regional private R&D	0.022 ***	0.019 ***	0.174 ***	0.073 *	0.214 ***	0.086 **
	(0.006)	*(0.007)*	*(0.047)*	*(0.039)*	*(0.060)*	*(0.045)*
Group	0.006	0.014 *	0.017	0.100 *	0.022	0.114 *
	(0.008)	*(0.009)*	*(0.060)*	*(0.056)*	*(0.072)*	*(0.062)*
Local network	-0.007	0.004	-0.035	0.016	-0.051	0.024
	(0.006)	*(0.007)*	*(0.045)*	*(0.040)*	*(0.053)*	*(0.044)*
Firm characteristics						
Productivity - va per worker	0.026 ***	0.021 ***	0.196 ***	0.123 ***	0.236 ***	0.140 ***
	(0.003)	*(0.003)*	*(0.023)*	*(0.019)*	*(0.028)*	*(0.021)*
Size	0.026 ***	0.032 ***	0.174 ***	0.174 ***	0.215 ***	0.205 ***
	(0.002)	*(0.003)*	*(0.018)*	*(0.017)*	*(0.025)*	*(0.021)*
Age	-0.004	0.011 **	-0.856 ***	-0.469 **	-0.956 ***	-0.551 ***
	(0.004)	*(0.005)*	*(0.211)*	*(0.193)*	*(0.245)*	*(0.212)*
Leverage	-0.007 ***	0.003	-0.045 **	0.014	-0.055 **	0.013
	(0.003)	*(0.003)*	*(0.022)*	*(0.019)*	*(0.026)*	*(0.020)*
Constant	-0.186 ***	0.128 ***	-4.452 ***	-2.138 ***	-5.301 ***	-2.409 ***
	(0.039)	*(0.046)*	*(0.307)*	*(0.262)*	*(0.401)*	*(0.301)*
Log-likelihood	-6'978.51	-9'135.55	-7'177.59	-8'733.25	-7'159.15	-8'724.15
Number of observations	16'541	16'541	16'541	16'541	16'541	16'541

Note: All explanatory variables are two-year lagged (previous MET survey wave). R&D intensity, productivity, leverage, size, age and regional R&D variables are log-transformed. All models include fixed effects for macro-sectors (manufacturing, services), macro-regions (North-West, North-East, Centre, Islands) and time. Pooled and Random Effect model contain the terms required to account for initial conditions and for the endogeneity of the lagged dependent variable. Clustered Standard Errors in parenthesis.

Table 7: Macro-regional differences in learning variables' coefficients

	Export propensity				
	North West	**North East**	**Centre**	**South**	**Islands**
Past export	1.929 ***	1.631 ***	2.264 ***	2.310 ***	2.335 ***
	(0.147)	(0.135)	(0.134)	(0.160)	(0.233)
Past interregional trade	0.362 ***	0.332 ***	0.361 ***	0.765 ***	0.591 ***
	(0.123)	(0.103)	(0.105)	(0.139)	(0.218)
Export spillovers	0.010 **	0.009 **	0.004	-0.010	0.010
	(0.004)	(0.004)	(0.006)	(0.007)	(0.007)
Regional public R&D	0.358 *	-0.408 *	-0.304 *	-2.774 ***	2.584
	(0.212)	(0.235)	(0.169)	(0.732)	(2.617)
Regional private R&D	-0.268	0.568 **	0.296	0.724 ***	0.018
	(0.201)	(0.281)	(0.192)	(0.156)	(0.194)
Group	0.303 **	-0.019	-0.020	-0.352 *	0.141
	(0.146)	(0.116)	(0.122)	(0.202)	(0.331)
Local network	-0.201 *	-0.071	0.096	-0.134	0.008
	(0.110)	(0.095)	(0.097)	(0.129)	(0.219)
	Interregional trade propensity				
	North West	**North East**	**Centre**	**South**	**Islands**
Past export	0.372 ***	0.480 ***	0.004	0.265 **	0.356 *
	(0.106)	(0.096)	(0.096)	(0.124)	(0.184)
Past interregional trade	0.774 ***	0.832 ***	1.337 ***	1.216 ***	1.027 ***
	(0.127)	(0.116)	(0.108)	(0.123)	(0.174)
Export spillovers	0.007 *	0.016 ***	0.013 ***	-0.005	0.007
	(0.004)	(0.004)	(0.005)	(0.005)	(0.006)
Regional public R&D	0.391 **	-0.286	0.234 *	-0.459	-0.717
	(0.182)	(0.207)	(0.139)	(0.575)	(1.830)
Regional private R&D	0.058	0.257	-0.261 *	0.248 **	-0.079
	(0.169)	(0.241)	(0.158)	(0.119)	(0.140)
Group	0.037	0.110	0.061	0.232	0.404
	(0.128)	(0.107)	(0.105)	(0.171)	(0.256)
Local network	0.025	0.021	0.050	-0.064	0.088
	(0.095)	(0.085)	(0.080)	(0.100)	(0.157)

Note: Reported coefficients have been estimated through two Random Effects dynamic logit models equivalent to those reported in columns (5) and (6) of Table 6, except for the presence of a set of interaction terms between learning processes variables and macro-regional dummies. Standard errors are reported in parentheses.

Appendix

Table A - Appendix

Variable name	Definition	Source
International and interregional trade		
export propensity	dummy = 1 if the firm sells at least part of its products/services abroad	MET database
export share	share of revenues stemming from export activities	MET database
inter-regional trade propensity	dummy = 1 if the firm sells part of its products/services outside the region where it is located but within the national boundaries	MET database
Innovation activity		
Innovation - all types	dummy = 1 if the firm has introduced one or more innovations	MET database
Innovation - main product	dummy = 1 if the firm has either introduced a new product on the market or radically changed an old one	MET database
Innovation - process	dummy=1 if the firm has changed its production process	MET database
Innovation - organization	dummy=1 if the firm has changed the organisation of its activity	MET database
R&D intensity	natuarl logarithm of the R&D expenditure at time t, normalised by total turnover at time t *	MET database
R&D dummy	dummy=1 if the firm carries out R&D activity	MET database
Productivity measures		
Productivity - va per worker	value added per employee at time t *	MET database, CRIBIS D&B
Productivity - tfp	firm's Total Factor Productivity *	own calculations
Financial and structural chacteristics		
Leverage	financial leverage of the firm *	CRIBIS D&B
Age	age of the firm computed as the difference between time t and the date of its establishment *	MET database
Employees	number of employees	MET database
Group	dummy=1 if the firm belongs to a group of enterprises at time t	MET database
Local network	dummy=1 if the firm belongs to a local network of firms at time t	MET database
Regional and sectoral exogenous factors		
Export spillovers	share of exporting firms, at time t, operating in the same sector and located in the same region of the focal firm	MET database
Regional public R&D	public expenditure in R&D at the regional level, normalised by the regional GDP at time t *	ISTAT
Regional private R&D	private expenditure in R&D at the regional level, normalised by the regional GDP at time t *	ISTAT

* This variable is log-transformed when included in regression models