INNOVATION ACTIVITIES AND FIRMS' FUTURE EXPORTS DECISIONS

A multi-treatment analysis

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Abstract: This study aims at estimating the effect of innovation on export growth. The empirical investigation is challenged by the fact the export strategy itself may induce innovation. In presence of this reverse causality, it is difficult to disentangle the effect of innovation on export. In this study we define two classes of innovation, namely technological and non-technological (which, in turn can be broken down respectively in *product and process innovation* and *marketing and organization changes*). For each class of innovation, we use a propensity score matching strategy to assess if innovating in period *t-1* lead to an increase in firms' probability of seeking for new exporting markets in period *t+1*. Moreover, we assess the combined effect of both classes of innovation upon the probability of seeking for new markets, as we believe that highly productive firms often undertake technological and non-technological innovating activities simultaneously. We use data from the 2004 Tagliacarne survey, which contains detailed information on about 2600 small and medium size manufacturing Italian firms. We found that a technological innovation increases the probability that a firm will plan to look for new markets abroad by 6.6 to 8.8 percentage points. The effect of a non-technological innovation is even larger, at 12.5 to 13.4 percentage points. Finally, the estimated effect of both forms of innovation is about 19 percentage points on average.

Keywords: exports, innovation, technological innovation, non-technological innovation, propensity score matching

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1. Introduction

Whether innovation causes exports (i.e. *self-selection*) or exports stimulate innovation (i.e. *learning by exporting*) is a longstanding question which does not have a univocal theoretical and empirical answer yet. In fact, from a theoretical point of view, both causal relations are plausible. The first hypothesis states that innovative firms self-select to operate in international markets whereas less innovative firms are unable/unwilling to penetrate foreign markets. This hypothesis typically goes through productivity gaps and sunk-costs theory: only those firms who are efficient enough to bear entry costs and intense competition of the export market will start exporting. In turn, the underlying mechanism for the selection of most efficient firms into foreign markets relates to firms' investment decisions (Cassiman et al., 2010: 372) and specifically to investments in innovative activities. The idea is that a firm that wants to export works hard to satisfy international buyers. Firms then make investments' decisions just for that purpose, intentionally increasing their "technological" effort (Razzak, 2008).

The second hypothesis (learning by exporting) rests on the idea that intended and unintended international knowledge flows stimulate the post-entry innovative performance of firms. In other words, firms operating in foreign markets gain access to technical expertise from international buyers and competitors (World Bank, 1993; Evenson and Westphal, 1995), which fuel their innovative performances.

Both hypotheses are plausible; hence, the presence of reverse causality undermines the possibility to conduct sound empirical tests to disentangle the direction of causality between innovation and exports employing conventional parametric techniques. Typically, endogeneity is solved using instrumental variable (IV) procedures. One computational method which can be used to calculate IV estimates is two-stage least-squares (2SLS). However, the 2SLS is not without shortcomings. First, it is difficult to find instruments that are both strong and valid. Second, the 2SLS can only provide an estimate of the local average treatment effect, and as such the results cannot be generalized to the entire population unless one is willing to make some strong behavioural assumptions. An alternative to the 2SLS is the propensity score matching (PSM), a methodology which has gained momentum over the last years.

In this study we address the self-selection hypothesis explicitly taking into account the endogenous nature of innovation when explaining exports. Specifically, we look at the effect of alternative forms of innovation on the probability that a firm will seek for new markets to export. The novelty of our contribution rests both on the empiric methodology used and on the attention we pay in defining innovation activities when assessing their impact on exports behaviours. Specifically, we define two classes of innovation strategies, which are technological and non-technological innovations.[1] For each class of innovation activity, we use a propensity score matching strategy to assess if innovating in period *t-1* leads to an increase in the probability of seeking for new exporting markets in period *t+1*. Moreover, we assess the combined effect of both classes of innovation upon the probability of seeking for new markets, as we believe that technological and non-

[1] These, in turn, are subdivided into four innovation activities (product and process innovations and organization and marketing innovations, respectively).

technological innovating activities are often undertaken simultaneously by highly productive firms.

The main findings we obtained for a representative sample of Italian small and medium enterprises can be summarised as follows: non-technological innovations increase the probability of looking for new markets abroad by 12.5 percentage points while technological innovations increase such probability by 8.7 percentage points. However, a firm that incurs both forms of innovation at the same time will increase the odd of reporting plans to increase its export by 18.2 percentage points.

The remainder of the paper proceeds as follows. In section 2 we provide an overview of earlier theoretical and empirical studies on innovation and exports. Section 3 describes the methodology and the data used in the study. Section 4 provides results and section 5 concludes.

2. Innovation and Exports: an Overview of the Literature

As mentioned in the introduction, the relation between exports and innovation runs in both directions: i.e. innovation causes exports through self-selection and exports cause innovation through learning by exporting. Our empirical analysis focuses only on the former hypothesis. In this section we provide a concise review of the literature on the causal relation between innovation and exports, as well as on the classification of innovation into technological and non-technological activities.

2.1 On the innovation and exports linkage: the self-selection hypothesis

The theoretical foundation of the self-selection hypothesis rests on early macro trade theory models and specifically on the North-South product-cycle proposition (see, for instance, Vernon, 1966; Krugman, 1979; and Dollar, 1986). The basic prediction of these models is that developed countries specialise in the production and export of innovative goods, which are later imitated by developing countries as product characteristics get more standardized and a dominant design develops. At this stage of the product cycle, competition shifts to manufacturing efficiency rather than developing new product characteristics, and low wage regions exploit their relative advantage. Eventually, Southern countries will export these goods back to the North and push developed countries to introduce new innovations to keep up their exports (Lachenmaier and Wößmann, 2006). In short, developed countries (whose comparative advantage rests on the production of new and technologically advanced products) must innovate continuously to penetrate international markets and oppose the tough competition of developing countries.

The outcome of these early macro trade models has been recently taken up by "new" new trade theory models. Building on firms' heterogeneity, Melitz (2003) and Bernard et al. (2003) constructed two models in which only highly productive firms are engaged in exporting. The underlying idea of Melitz (2003) is that firms have heterogeneous level of productivity and only highly productive firms are able to make sufficient profits to cover the large fixed costs required for exports. In this regard, being present on international markets becomes a task closely related with productivity levels. Bernard et al. (2003)

assume heterogeneity of plants introducing Ricardian differences in technological efficiency across producers and countries. In a Bertrand competition framework between heterogeneous firms, only the most productive enterprises can cover the transportation costs associated with international trade. Therefore, both models find that more productive firms self-select into export markets and display considerable persistence in doing so (Cassiman and Martínez-Ros, 2007).

Although very relevant, these models fall short of explaining why some firms are more productive than others and select into international markets[2] – i.e. the missing link is what determines productivity gaps across firms operating in the same country and in the same industry. And here is where innovation decisions come about. Only those firms who decide to invest in innovation activities gain in productivity and succeed to self-select into international markets. Hence, it becomes crucial to provide a fine-grained definition of various innovation activities undertaken by entrepreneurs, and establish their link with firms' productivity.

2.2 Technological and non-technological innovation activities

Starting from the early '90s, many firms operating in Northern countries (remarkably in the US) experienced a notable increase in their productivity levels. While attempting to explain such trend, analysts and economists focused their attention on the emergence of a 'new economy' characterised by firms increasing their capital investments, especially in information technology (IT) software and hardware (Black and Lynch, 2004).

However, a heated debate has also surrounded the question as to the extent to which investments in IT have indeed contributed to the so-called productivity miracle. For instances, Gordon (2003) among others argues that the role of computers for the late 1990s boom in the US was greatly exaggerated, while Oliner and Sichel (2002) conclude that notwithstanding the financial break down of the high tech sector, the link between IT and productivity remains vital (Black and Lynch, 2004: F98).

Moving along this controversial line of investigation, several authors explain the importance of IT by investigating its combined effect with organizational innovation (see e.g. Brynjolfsson and Hitt, 2000; Black and Lynch, 2001 and Bresnahan et al., 2002). Case studies reveal that the introduction of information technology has often been combined with a transformation of the firm, investment in intangible assets, and a change in the relation with suppliers and customers. IT offers the possibility for flexible production (e.g. just-in-time inventory management, integration of sales with production planning, etc.); however, such new production strategies need to be combined with adequate managerial and workplace reorganisation strategies to be effective. In one of the few empirical studies of investments in information technologies and organisational change, Bresnahan et al. (2002) find evidence for complementarities between technology, organisational changes and workforce skills. Mostly, the available econometric evidence at the firm level shows that a combination of investment in IT and changes in

[2] As put by Cassiman and Martínez-Ros "there is not a causal theory about the relation between firm decisions and entry into the export market" (2007: 4).

organizations and work practices facilitated by these technologies contributes to firms' productivity growth (see Polder, et al., 2010).

Hence, productivity gains appear to be determined by innovation activities, but it is not just a question of introducing new IT-based processes and/or new products; it is rather the combination of both technological and non-technological innovation activities, which determines productivity gains.

As it was observed by Schmidt and Rammer "with respect to organizational innovation, a close link to process innovation is likely, since introducing new technologies in production or distribution may demand reorganizing business routines, which may trigger the introduction of new business practices or new organizational models. Organizational innovation may also occur in the course of product innovations. For instance, new products often induce the establishment of new production or sales divisions and call for re-organization of workflows, knowledge management or external relations. Marketing innovations may be closely connected to product innovation, too. New products may demand new ways of marketing and urge for introducing new marketing methods. In practice, new marketing concepts for product innovations may represent an integral part of the innovative effort, both types of innovation constituting one single innovation project. There is also a case for marketing innovation interacting with process innovation. New production technologies may result in increased production capacities or in improved quality characteristics of products. In order to market this increased capacity or improved quality, new marketing approaches may be required" (2007: 6). Hence, technological and non-technological innovations should not be conceived as alternative activities; these are rather complementary strategies, which are more effective when combined. We will attempt to test this complementarity hypothesis in our empirical investigation.

3. Methodology and data description

This study looks at the effect of alternative forms of innovation on the probability that a firm will seek for new markets to export. To that regard, this study belongs to a larger literature on the Average effect of the Treatment on the Treated group (ATT), where the treatment is the innovation undertaken by the firm. The usual problem associated with the estimation of the ATT is that the natural counterfactual for a treated observation, i.e. the outcome associated with the treated firm if it were not treated, is not available. For this reason, an OLS estimation of the ATT is likely to be biased if treated and untreated firms differ systematically and this unobserved heterogeneity is correlated with the outcome of the treatment.[3] The Propensity Score Matching (PSM) draws on the idea that ATT can be retrieved by comparing a treated observation with a non-treated observation with a similar distribution of observed variables before the treatment. The assumption underlying PSM is that firm with similar observable covariates will be similar also on the

[3] Note that a 2SLS could also be used to control for this unobserved heterogeneity, but it can only provide a measure of the Local Average Treatment Effect (LATE) unless one is willing to make strong behavioural assumption about the effect of the instrumental variable on the treated and untreated observations (Heckman et al, 1997).

unobservables. The PSM is a way to reduce the dimension of all observable covariates to just a scalar (Rosenbaum and Rubin, 1983).

The data used for this study is taken from the Indagine Tagliacarne, 2004. This dataset contains detailed information about 2603 small and medium size manufacturing Italian firms. In particular, question about the innovation strategy adopted in the three year before the survey was administrated was broken down in four possible categories: product innovation, process innovation, organizational innovation, and marketing innovation. Since each firm faces multiple innovation choices, the propensity score is better estimated using a multinomial logit (Lechner, 2001). Becker and Egger (2009) use a similar approach to analyse the relative impact of product and process innovation on the propensity to export. We build upon their model and we add two more forms of innovation: organizational and marketing innovation. Since each firm can undertake more than one treatment but categories in the multinomial logit cannot be overlapping, we collapse the first two forms of innovation (product and process) into one category that we call *technological innovation*, and the organizational and marketing innovation into *non-technological innovation*. We then group firms according to one of the four possible mutually exclusive treatments: firms that do not engage in any form of innovation (1224 firms), firms that engage only in non-technological innovation (188 firms), firms that engage only in technological innovations (752 firms), and firms that engage in both technological and non-technological innovations (439 firms). We use a kernel based matching algorithm, i.e. each firm in the treatment group is matched to a weighted sum of individuals who have similar propensity scores with greatest weight given to people with closer scores. The fact that the non-treatment group is always larger than any treated group is important to insure that the common support requirement between treated and non-treated observations will be respected.

The dependent variable is an indicator that takes the value of one if firms report that they will be looking for new markets to export in the next two years. Hence, for firms that already export, our analysis will shed light on the effect of innovation on the probability that a firm will seek new markets in the future, while for firms that do not export our analysis will define the probability that innovation will affect the decision to start exporting. Unfortunately, we do not know whether the firm in fact will export in the future. To the extent that innovative firms may over-report their propensity to export, our results should be interpreted as an upper-bound on the true effect of innovation on export strategy. However, using information on export strategy rather than export revenues may reduce the problem of reverse causality that curses much of the literature on the link between innovation and export. When using information on export revenue, it is difficult to disentangle whether innovation was the cause or the result of exporting. Since, in our case, exporting has not taken place yet, we can be sure that such reverse causal path is ruled out.

The descriptive statistics of the variable used in this analysis are reported in Table 1. The propensity score is estimated using information on the firm's size (represented by its revenue class), the age of the firm, the quality of the good produced, the sector of operation, the geographical location, and indicators for being already an exporter or serving mostly the local market. We observe a much larger percentage of firms that plan to export that have engaged in technological and/or non- technological innovation. About half of the firms that reported no plan to seek new market abroad produce for local markets, while more than 70 percent of the firms that plan to seek new markets abroad are already operating in the international market. Moreover, firms seeking for new markets tend to be more high quality product while firms that are not seeking for new markets abroad tend to be more medium to low quality product.

Table 1: descriptive statistics (I)

Variable	Will not seek new markets		Will seek new markets	
	Mean	Std. Dev.	Mean	Std. Dev.
technical innovation	0.3834977	0.486364	0.6686391	0.4710511
non-technical innovation	0.1738454	0.3790748	0.4319527	0.4957147
Type of markert served ("regional and national market" is the reference category)				
international export	0.1219512	0.3273144	0.7130178	0.4526882
local market	0.5324338	0.4990764	0.2233728	0.4168146
Quality ("high" is the reference category)				
medium high	0.2226258	0.4161171	0.4215976	0.4941805
medium	0.5936689	0.4912753	0.387574	0.4875572
medium low	0.070576	0.2561818	0.0576923	0.2333333
low	0.0337312	0.1805833	0.0177515	0.1321446
Revenues ("<300,000 euros" is the reference category)				
from 300,000 to 1 million euros	0.2682927	0.4431858	0.2766272	0.4476618
from 1 to 5 million euros	0.1805916	0.3847793	0.2544379	0.4358673
from 5 to 10 million euros	0.0306175	0.1723239	0.091716	0.2888383
>10million euros	0.0306175	0.1723239	0.1686391	0.3747101
Geography ("south" is the reference category)				
north	0.5801764	0.493658	0.637574	0.4810569
center	0.1883757	0.3911134	0.183432	0.3873068
Year of establishment ("before 1960" is the reference category)				
between 1961 and 1970	0.0949663	0.2932444	0.1420118	0.3493207
between 1971 and 1980	0.2163985	0.4118959	0.2248521	0.417794
between 1981 and 1990	0.3212247	0.4670681	0.2322485	0.4225793
between 1991 and 2000	0.2532434	0.434982	0.2307692	0.421637
after 2000	0.0508563	0.2197611	0.0399408	0.1959652
Sector ("food and beverage" is the reference category)				
clothing	0.13233	0.3389372	0.1257396	0.3318012
footweat and leather	0.035288	0.1845547	0.0473373	0.2125165
wood and funiture	0.1385573	0.3455737	0.0931953	0.2909211
chemical and plastic	0.0482615	0.214374	0.0724852	0.2594816
mineral	0.0565646	0.2310687	0.035503	0.1851843
metal	0.1800727	0.3843477	0.1908284	0.3932451
mechanical	0.0773223	0.2671714	0.1360947	0.343143
eletrical	0.0939284	0.2918048	0.0931953	0.2909211
other	0.1115724	0.3149214	0.0872781	0.2824512
N obs	1927		676	

Before conducting any matching estimation, it could be informative to look at some simple statistics about the incidence of seeking new markets among firms that innovate. Table 2, column 2 reports the average response to the question of whether the firm was planning to seek new markets abroad in the next two years by their innovation status. Only 12 percent of the firms that did not engage in any form of innovation were planning to expand their markets abroad, compared to more than 50 percent of firms that experiences both technological and non technological innovation. For firms that undertook only one form of innovation, planning to export to new markets is more prevalent among firms that took on a non-technological innovation.

Table 2: descriptive statistics (II)

	N obs.	% of firms reporting of looking for new markets
no innovation	1224	12.6%
technological innovation only	752	30.6%
non-technological innovation only	188	37.2%
technological and non-technological	439	50.6%

4. Propensity score analysis

A multinomial logit is used to compute the propensity score needed to match treated and control firms. The results of the multinomial logit are reported in Table 3. We observe that being an exporter does not affect the probability of adopting non-technological innovation alone but it has a positive impact on the probability of developing a technological innovation (with or without non-technological innovation). Firms that operate mainly on the local scale are less likely to incur any form of innovation. These results are consistent with the *learning by exporting* theory. Firms that offer medium-high quality product are more likely to innovate than firm producing high quality good, but this result may be driven by the small number of high quality good firms (less than 9 percent of the sample). Firms producing lower quality goods are less likely to innovate. Innovation can be a financially strenuous investment and firms that generate a larger turnover can benefit from having access to a larger cash flow. There is no evidence of any difference in the propensity to innovate between firms located in different geographical area of the country. The age of the firm does not seem to affect the probability of carrying on either form of innovation, although older firms have a higher probability of carrying both forms of innovation. Finally, while there are differences in the propensity of a technological innovation across sector (the food and beverages being the most innovative sector), we do not observe the same differences for non-technological innovation.

Table 3: Multinomial Logit (reference group: no innovation)

	Non-technical innovation		Technical innovation		Non-technical and technical innovation	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Type of market served:						
international	0.1919	0.2105	0.5063***	0.1275	0.9557***	0.1542
local market	-0.6366***	0.1965	-0.3477***	0.1126	-0.5906***	0.1515
Quality:						
medium high	0.6526**	0.3151	0.3292*	0.1967	0.3876*	0.2323
medium	-0.5554*	0.3091	-0.6616***	0.1824	-0.9592***	0.2229
medium low	-0.8325*	0.5002	-0.2938	0.2491	-0.6314*	0.3218
low	-0.7077	0.6006	-1.1759***	0.3708	-1.0043**	0.4642
Revenues:						
from 300,000 to 1 million euros	0.4988**	0.2144	0.4113***	0.1193	0.6655***	0.1720
from 1 to 5 million euros	0.5132**	0.2536	0.2033	0.1456	0.9057***	0.1872
from 5 to 10 million euros	1.0176**	0.3954	0.7589***	0.2666	1.3159***	0.3076
>10million euros	1.3062***	0.3981	0.8198***	0.2826	1.8699***	0.2950
Location						
north	0.0806	0.2133	-0.0302	0.1268	0.0367	0.1708
center	-0.3826	0.2774	-0.1161	0.1558	0.0269	0.2034
Year of establishment:						
between 1961 and 1970	-0.1347	0.3872	-0.2181	0.2456	-0.4586*	0.2697
between 1971 and 1980	0.0660	0.3346	-0.0210	0.2186	-0.4590*	0.2354
between 1981 and 1990	-0.2179	0.3351	-0.1424	0.2128	-0.5953**	0.2330
between 1991 and 2000	0.4788	0.3261	0.2704	0.2191	-0.0756	0.2367
after 2000	-0.6958	0.5511	-0.2925	0.2973	-0.8985**	0.4036
Constant	-1.5537***	0.5227	0.3285	0.3235	0.0275	0.3722

Dummy variables for sector included but not reported
Standard error robust to unobserved heteroskedasticity
*** indicates 1% significance; ** indicates 5% significance level; * indicates 10% significance level

There are several algorithms that can be use to match a treated firm to a control *alter-ego*. We use a kernel, one-to-one, and radius matching algorithms. Moreover, we evaluate the radius matching algorithms using three levels of distance (0.1, 0.05, and 0.001). It is not clear in the literature which algorithm is to be preferred. However, we can compare the relative efficiency of each algorithm with respect to how well they balance the explanatory variables. The advantage of the PSM over OLS is that with PSM one can obtain a better balancing of the observable variables. Under a perfect match, the average value of each variable in the treatment group should be the same as in the control group. In Table 4, we report the median value of the absolute standardized bias for each variable used in the multinomial probit under each algorithm. The (absolute) bias after matching is defined as the (absolute value of the) difference of the sample means of each variables for the treated and the matched comparison sub-samples (Rosenbaum and Rubin, 1985). The absolute bias is then standardized by computing the bias as a percentage of the sample standard error. There is no rule about what should be the acceptable bias after matching. However we observe a substantial reduction in the bias before and after any matching. On average the bias drops by two third, with few cases of reduction larger than four fifth. We cannot identify an algorithm that always performs better than the others. The Kernel and the radius 0.05 produce similar results. The on-to-one matching seems to perform better on the pair technological and non-technological innovation versus no innovation, while the radius 0.01 matching seems to perform better on the pair technological innovation versus no innovation.

Table 4: Median Absolute Standardized Bias

	Unconditional difference	ATT-kernel matching	ATT-1to1 matching	ATT-radius:0.10 matching	ATT-radius:0.05 matching	ATT-radius:0.01 matching
technical innovation only	18.0%	8.1%	6.6%	8.8%	8.1%	7.8%
non-technical innovation only	24.7%	12.5%	12.5%	13.4%	12.4%	12.7%
technical and non-technical innovation	38.0%	18.7%	19.4%	19.8%	18.5%	19.7%

The estimation of the ATT of innovation using the matching estimator is reported in Table 5a. As expected, the magnitudes of the ATT are much lower than the unconditional mean, and they are all significant at 1 percent confidence interval. A technological innovation increases the probability that a firm will plan to look for new markets abroad by 6.6 to 8.8 percentage points. The effect of a non-technological innovation is even larger, at 12.5 to 13.4 percentage points. Finally, the estimated effect of both forms of innovation is about 19 percentage points on average. This finding confirm our assumption that technological and non-technological innovations best exert their effect when combined together – i.e. those firms which combine product and process innovations with organizational and marketing changes will most likely plan to look for new markets abroad.

Table 5a: Effect of the innovation on export

	Unconditional difference	ATT-kernel matching	ATT-1to1 matching	ATT-radius:0.10 matching	ATT-radius:0.05 matching	ATT-radius:0.01 matching
technical innovation only	8.8%	6.7%	6.6%	7.3%	6.9%	6.1%
non-technical innovation only	19.5%	16.1%	12.4%	16.2%	15.6%	15.4%
technical and non-technical innovation	19.3%	15.9%	12.7%	16.6%	15.9%	15.0%

Next, we re-estimated our model on the sub-sample of firm that did not export at the time of the interview (see Table 5b). For this sub-set of firms, looking for a market abroad signifies that the firm is planning to start exporting. Again, we found that non-technological innovations are more important for the decision to start exporting than technological innovation. In fact, a technological innovation alone increases the probability of starting to export between 6.1 and 7.3 percentage points. However, if a firm undertakes a non-technological innovation, the probability of starting to export jumps by twice as much. In latter case, introducing a technological innovation does not improve the changes of starting exporting. These findings are quite surprising and counterintuitive as they show that introducing non-technological innovations (alone) is by far the most effective strategy in order to enhance the probability of starting exporting in the future. A possible explanation of this finding is that switching from non-exporter to the status of exporter requires profound changes in the management of a firm involving new management practices as well as new marketing strategies. In fact, as it was observed (Schienstock et al., 2009) firms are forced to initiate organizational restructuring programs or to even introduce totally new organizational models if they want to be competitive on global markets.

Table 5b: Effect of the innovation on export (sample: non exporting firms)

	Unconditional difference	ATT-kernel	ATT-1to1	ATT-radius:0.10	ATT-radius:0.05	ATT-radius:0.01
technical innovation only	8.8%	6.7%	6.6%	7.3%	6.9%	6.1%
non-technical innovation only	19.5%	16.1%	12.4%	16.2%	15.6%	15.4%
technical and non-technical innovation	19.3%	15.9%	12.7%	16.6%	15.9%	15.0%

5. Conclusions

In this paper we investigate the impact of innovating activities on exporting. Specifically, we tested for the so-called self-selection hypothesis – i.e. innovative firms self-select to operate in international markets whereas less innovative firms are unable/unwilling to penetrate foreign markets. We conducted our investigations looking at Italian small and medium enterprises operating in manufacturing sector (reference year 2004), and disentangle their innovative activities into technological (product and process innovation) and non-technological (marketing and organizational changes). We observed a strong complementarity between these two classes of innovating activities as for the decision of penetrating new foreign markets; whereas when restricting the analysis only to those firms that did not export at the time of the interview, we observe a growing relevance of non-technological innovations. The complementarity finding is in line with our expectations and confirms the general view that product and process innovations request organizational and marketing changes in order to effectively stimulate productivity and international competitiveness. Our second finding would suggest once more the relevance of organizational restructuring programs (which might evolve the introduction of totally new organizational models) when opening to international markets.

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