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In Times of Trouble: Innovative Drivers of External Competitiveness for Small Businesses during the Great Recession

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ABSTRACT

This paper analyzes the main drivers of external competitiveness in times of crisis for small and medium enterprises (SMEs). We focus on the Italian experience in the midst of the financial and sovereign-debt crisis, and present robust evidence based on a comprehensive survey of Italian companies in the manufacturing and production service sectors (the MET dataset).

Overall, our results confirm the high degree of heterogeneity of the Italian system and the differences between internationalized and domestic companies in terms of performance as well as structural and behavioral dimensions. In particular, data highlight not only the strict correlation between internationalization and innovative activities but also a positive change of attitude of Italian firms towards these strategies. Our analysis shows that, whilst structural factors play a key role for external competitiveness, other critical firm-level aspects trigger superior performances, especially strategic profiles, technological capabilities, and proactive behaviors such as innovativeness and R&D investment. Importantly, we document disproportionate effects of innovation for smaller and less productive companies. This points at dynamic strategies as a potential tool to fill the gap between larger/more productive companies and the set of less structured firms, a segment representing an ideal target for policy measures.

Keywords: SME, external competitiveness, Great Recession

JEL codes: M20, L23, L25

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1. INTRODUCTION

During rainy days, both policy makers and analysts focus their attention on those paying the highest price: companies kicked out from the market and workers losing their jobs accordingly. Such a focus is perfectly justified by the need of setting up policies aimed at minimizing the number of businesses going bankrupt and healing the wounds from depression, so to downsize the overall economic consequences. However, identifying companies that are resilient to the unfolding of a crisis eventually growing in both national and international markets is an equally important task. Companies successfully resisting and reacting to a negative shock are in fact those capable of adjusting their strategy (and organizational set-up) to a fast-evolving context so to cushion the effect in the short-run and enjoy a competitive advantage as soon as the economy recovers. At the macro-level, the speed of recovery is in fact crucially linked to the amount of healthy firms that can help pull the rest of the economy out of the swamp.

When a large crisis outbreaks, the collapse of aggregate demand is one of the major threaths to firms' survival, especially for companies prevalently serving domestic markets. In the aftermath of financial and sovereign debt crisis, the domestic component of aggregate demand tend to fall relatively more vis-à-vis the international one. In this regard, consolidating positions in international markets or penetrating into new ones represented not only a key way to survive in the middle of a crisis but, in some cases, a strategy to profit out of it, eventually growing at the expenses of competitors.

When crises have a global scale, firms that keep on exporting are likely to gain new market shares left by other companies in distress. Besides, the existence, emergence, and growth of resilient firms and the identification of their characteristics can eventually pave the way to the emulation of other companies which might reinforce the overall improvement in productivity and economic performance in general. Policy makers should thus pay a particular attention to the key drivers (internal and external to the firm) which might explain a positive performance during bad times, and create the conditions that are conducive to external competitiveness. From this perspective their task appears to be twofold: favouring healthy companies in undertaking their activities in foreign markets, and helping fragile firms to develop the key capabilities underlying a greater competitiveness.

When SMEs represent the dominant share of industrial structure, the attention on those displaying resilience and dynamism is even more important. Often financially constrained and lacking the necessary technological and organizational capabilities, SMEs are more likely - as compared to large companies - to fail in trying to meet markets where demand continues to be dynamic despite the crisis (Coad, 2009; Brancati et al. 2018). On the other hand, profiling (*i.e.*, identifying key characteristics and performance's determinants) and supporting those SMEs capable to adjust strategies and grow even in times of crisis represent crucial policy tasks in economies where firms are prevalently small.

In fact, due to their tight linkages with the local economy (including other SMEs operating in the same area/sector), resilient SMEs represent a critical asset to avoid the unfolding of a wider and deeper recession. In this regard, being capable to internationalize and/or to intensify their presence in foreign markets are the factors that, above all others, can explain SMEs' resilience and growth, especially when domestic demand shrinks as a consequence of a crisis (Coad, 2009; Motta, 2020). This work contributes to the empirical literature on the determinants of external competitiveness for SMEs. Our focus on the Italian economy in the 2008-2015 period allows us to identify the main drivers of resilience in times of great distress. Indeed, the aftermath of the 2008-financial crisis and the unfolding of the sovereign-debt crisis brought about structural effects on industries, markets, as well as on companies' attitudes and behavior. In Italy, the crisis was particularly severe causing a drop in aggregate production of about 25% (Lucchese et al. 2016; Cirillo et al. 2016; Dosi et al. 2019a). In this context, the ability to keep (or to gain) international market shares proved to be the main way to survive and, in some cases, to improve the performance of Italian firms. Because its industrial structure is predominantly composed of SMEs -most of which micro sized- Italy represents an instructive laboratory to investigate the drivers of SMEs' international competitiveness and growth.

Our study relies on one of the largest firm-level surveys administrated in a single European country, the MET dataset, providing a wide set of information on all Italian companies, including micro-sized companies with less than ten employees. Our sample is largely composed of SMEs with an average size of 8 employees (96% of firms below 250 employees, 85% below 20). This is an essential feature of our analysis as micro firms represent the vast majority of the Italian population and the segment of the market that is, *a priori*, more fragile in times of recession.

The empirical strategy, employs random-effect probit models (with Mundlak correction) and within estimator (with firm and time fixed effects) to correct for unobserved heterogeneity and dig deeper into what drives gains in external competitiveness. As expected, we confirm a self-selection mechanism of more productive companies into international markets. However, once accounted for persistent components of heterogeneity, underlying long-lasting differences in the efficiency of firms, the residual role of productivity is found to be significantly reduced in explaining the change in the exporting status. Gains in external competitiveness are found to be strictly linked to firms' strategic behaviour and investment in dynamic strategies. In particular, firms' innovativeness and involvement in R&D projects are found to induce a significant positive effect on export strategies and performance. We explore several dimensions of heterogeneity by showing the existence of compounding (cumulative) impact of dynamic strategies and emphasizing the role of upgrading/downgrading paths

(i.e., whether the behavior in the recent past consisted in an increase or decrease in the array of strategies adopted, see Section 5.2 for a detailed discussion).

Among the different forms of innovations, new products dominate other forms of innovativeness (process or organizational-managerial), especially in case of previously non-exporting companies. However, we find process and organizational innovations to have an additional effect on export by boosting firms' long-run productivity, which represents an additive indirect effect of innovation on external competitiveness.

Importantly, although our results are all based on a sample mainly composed of SMEs, we further shed light on significant heterogeneities across firms according to their size and characteristics. In particular, innovative strategies are found to have disproportionate effects (3-to-4 times larger) for the international performance of (originally) smaller and less productive companies. This is an important result as it points at innovativeness as a potential tool to fill the gap between larger and more productive companies and the set of less structured firms, a segment that represents an ideal target for policy measures.

The remainder of the paper is the following. Section 2 provides a brief review of the literature dealing with SMEs' external competitiveness and its drivers. Section 3 illustrates the data and some descriptive evidence concerning the key variables at stake. Section 4 presents the econometric strategy while section 5 discusses the results. Finally, section 6 concludes the paper and provides some policy remarks.

2. BACKGROUND LITERATURE

This section reviews the empirical literature on the drivers of external competitiveness. First, we briefly go through the literature investigating firm-level determinants of external competitiveness. We then provide a synthetic review of the studies specifically studying SMEs and, finally, we offer an ad-hoc focus on the Italian case.

Firm level determinants of external competitiveness

A vast empirical literature attempted to identify the determinants of companies' external competitiveness. However, univocally identifying drivers (and companies' characteristics) laying behind successful performances on international markets is all but an easy task. Three laregely interdependent elements are on the forefront: cost, technology, and firm-level heterogeneities (Laursen and Meliciani, 2010; Dosi et al., 1990, 2015; Bogliacino et al. 2017). A classical path that firms follow in order to penetrate international markets (or to increase their market shares) is to reduce costs and increase the attractiveness of their goods and services in terms of relative prices. This can

clearly be done by either resorting to cheaper inputs or making production more efficient via process innovation (Pianta and Vivarelli, 2000). Nevertheless, consistent with a schumpeterian view of innovation-based competition, a large bulk of literature reported that technological and product quality-related factors are substantially more relevant in explaining export performances than costrelated ones. Since the seminal contribution of Vernon (1966), product innovation has been identified as a fundamental key to enter foreign markets. Young innovative firms rely on exports to: i) increase their market shares; ii) enjoy demand-pull effects (Deschryvere, 2014); and iii) accumulate the capital needed to further develop their products (Antras, 2005). Reversing the perspective, technological competitiveness strategies based on product innovation are more likely to characterize exporting firms rather than those prevalently serving the domestic market. In fact, a superior technology is likely to be needed to access foreign markets characterised by a wider and variegated spectrum of consumer preferences, together with a fiercer competition based on quality and technology. Cassiman et al. (2010) suggest that the introduction of new products might induce a positive productivity shock allowing firms to get into and increase their position in international markets. As emphasized by Foster et al. (2008), successful new products are likely to stimulate firm-specific positive demand shock activating a 'virtuous circle' going from innovation to productivity and resulting in greater export market shares (Cantwell and Sanna Randaccio 1990). This mechanism matches with the 'learning-by-exporting' hypothesis (De Loecker, 2007; 2013). The latter, again, is linked to the larger and more variegated number of customers and competitors that companies might face but, also, to the greater opportunities in terms of imitation and networking they are likely to seize. In all these cases, firm-specific capabilities are expected to increase with positive effects on productivity and export performance. Empirical evidence confirming this hypothesis abounds.¹

If new products are widely recognized as a key driver of export success (Coad, 2009), the recipe should not be thought to work indiscriminately for all firms (Guarascio and Tamagni, 2019). An extensive literature has in fact reported the presence of substantial and persistent heterogeneity along virtually every dimension of firm performance (Bartelsman and Doms, 2000, Castellani and Zanfei, 2007). This heterogeneity characterizing also the restricted cluster of exporting firms, as confirmed by Bernard and Jensen (2004), Greenaway and Kneller (2007), and Mayer et al. (2014), among others. Contrasting with the hypothesis of a 'healthy cleansing' role of recessions (Foster et al. 2016), the 2008 crisis has further increased such firm-level heterogeneity. On the one hand, a cluster of dynamic (mostly exporting) companies displayed resilience and manage to grow out of the crisis. On the other, an even larger group of low-productivity firms managed to survive, despite a persistently sluggish performance, pushing the overall economy productivity downwards (Dosi et al. 2019a). The survival

I See, among others, De Loecker (2007), Lileeva and Trefler (2010), Bustos (2011), Mayer et al. (2014, 2016)..

of those 'zombie firms' (Adalet McGowan et al. 2017a and 2017b), might partly explain the dynamics of low productivity observed in several countries after the post-2008 recession.

Explaining SMEs' export performance

In a large number of countries, SMEs represent the dominant segment of the market. This is particularly true in Europe, with Italy and Spain registering values close to or greater than the 90% of total enterprises. In these economies, SMEs provide a substantial contribution to aggregate growth, in both value added and employment terms (Ayyagari et al. 2007, 2014). As it is well documented, however, information asymmetries, financial constraints, as well as scarcity of (physical and human) capital might hinder SMEs from expanding their business operations (Berger and Udell, 2006). Being relatively less capital intensive, SMEs may face difficulties in accessing bank financing (Beck and Demirguc-Kunt 2006). Such a combination of low capitalization and difficulties in accessing external funds might result in a lower investment propensity of SMEs as compared to larger companies (Chavis et al. 2011).

If, on the one hand, SMEs might be relatively more vulnerable in midst of a crisis, on the other, their size and flexibility may allow them to be comparatively faster and effective in adapting to changing economic contexts. In other words, SMEs are characterized by an even higher degree of heterogeneity than relatively larger companies. In times of crisis, especially if the growth of demand in domestic markets is significantly lower than in international markets, SMEs displaying a low propensity towards change and diversification are more likely to face insolvency and bankruptcy. Conversely, export-oriented SMEs relying on technological competitiveness strategies are more likely to be endowed with the technological, organizational, and managerial capabilities that might guarantee resilience and growth (Salavou et al. 2004; Coad, 2009). In this regard, idiosyncratic characteristics such as 'proactivity' and attitudes towards changes in business strategies are of paramount importance in explaining SMEs' external competitiveness. This is, once again, especially true in times of crisis, when opportunities shrink and competition becomes harsher.

The Italian case

In Italy, SMEs represent the backbone of the industrial structure contributing, on both national and international markets, to the overall economy's performance. Having access to unique data covering the whole Italian industrial structure including micro-firms (a large but often empirically neglected component of the universe of Italian SMEs), we are thus in the condition of investigating SMEs' competitiveness determinants at a high-level of detail as compared to the previous literature. In Italy, the heterogeneity characterizing this segment of the market is, however, substiantial. Coexisting with

a dynamic, innovative, and export-oriented bulk of SMEs, there is an even larger cluster (in terms of size and employment weight) characterized by low-productivity and weak growth performance (Bogliacino et al. 2018). After the 2008 crisis, the width of inter-firm productivity distributions has expanded further (see, for instance, Dosi et al., 2019b).

One of the key elements laying at the roots of such persistent heterogeneity is the distinction between domestic and export-oriented firms (on this point, see, among the others, Castellani and Zanfei, 2007; D'Aurizio and Cristadoro, 2015). Focusing on the determinants of export success, Basile (2001) finds that a pivotal role is played by innovation (new products, in particular) while cost factors - as labor costs per unit of product - seem to play a more marginal role. In a similar vein, Barba Navaretti and Castellani (2004) compare productivity dynamics across different firm categories, and find that internationalized companies substantially outperform the control group. These results are futher confirmed by Serti, Tomasi and Zanfei (2010), and Castellani and Giovannetti (2010), among others. Adopting an evolutionary approach, other studies (Dosi and Nelson, 2010) link the persistent heterogeneity characterizing Italian companies international performance to their idiosyncratic features concerning knowledge base, organizational routines, and business strategies. On the other hand, a large set of contributions puts emphasis on Foreign Direct Investments (FDIs), multinational companies (MNCs), and offshoring strategies (Barba Navaretti and Castellani, 2004; Cozza and Zanfei, 2014).²

We contribute to this broad literature by presenting novel evidence on the drivers of firms' export performance in times of crisis with a special focus on SMEs. We explore several dimensions of external competitiveness, ranging from extensive margins of export, to intensive margins, as well as entry/exit in/from international markets. We emphasize the importance of behavioral and strategic factors by looking at both their direct and indirect effects on export, and specifically model several dimensions of heterogeneity showing disproportionate effects for (*ex ante*) smaller and less productive companies. More specifically, we add to three distinct strands of literature: i) the one focusing on the determinants of firm-level performance (for a review, see Audretsch et al. 2014) ii) the one dealing with the heterogeneous distribution of performance indicators and exploring the company-level idiosyncratic characteristics wich may lay behind such heterogeneity (Dosi et al. 2012) iii) the empirical one investigating the peculiar characteristics of the Italian economy with an emphasis on the role of SMEs (Brancati et al. 2018).

3. DATA

² A parallel strand of the Italian literature focused on the effect on external competitiveness of resource misallocation (Calligaris et al. 2016), ownership characteristics (Corbetta 1995; Montemerlo 2005; Cerrato and Piva 2012; Bianco et al. 2013), and managers' education (Cucculelli and Micucci 2008).

Our main source of information is 2008-2015 MET database on the Italian industry, one of the widest surveys administrated in a single European country. The dataset is made of roughly 25,000 observations per wave (6 in total) and provides information on a rich set of firms' strategic profiles such as innovation, R&D, and networking relationships. This survey is specifically conceived to study a massive amount of firms' characteristics and strategies, with a particular focus on their internationalization and innovative patterns. The sample is representative of Italy's universe of firms along three levels: 2-digit sectors (manufacturing and production services only), region, and size class.³

Importantly, unlike most other firm-level databases, the MET survey also accounts for micro-sized firms with less than ten employees representing the vast majority of companies within the Italian industrial system. This characteristic is essential to our purpose of analyzing the role of innovative strategies in affecting external competitiveness and overcoming ex ante fragilities such as size and productivity disadvantages. In particular, the availability of a large amount of information on SMEs and on micro firms allows us to explore in depth the determinants of their competitive performances as well as the heterogeneity detectable among them.

Survey data are then matched with official balance-sheet information from CRIF-Cribis D&B, with a final estimation sample that ranges between 50,000 and 13,000 observations.

Descriptive statistics are presented in Table 1. Roughly 29% of the companies declare to sell their products to international markets, accounting for an average of 9% of total revenues from exported products. As for firms' innovativeness, 31% of the firms introduced at least one type of innovation in the previous year (18% product innovations, 15% process innovations, and 17% organizational-managerial innovations) while 16% of the companies invested in R&D programs, with an average expenditure of 5% of total sales. Conditional averages show a strong positive correlation between firm innovative activities and export status. Innovators have twice the probability of exporting with respect to non-innovators (22% vs 44%) and three-times the share of sales from exported products (6% vs 17% of total sales). Similarly, firms involved in R&D projects are significantly more exposed to international markets both in terms of extensive (23% vs 63%) and intensive margin of export (5% vs 26%).

4. ECONOMETRIC STRATEGY

The econometric strategy aims at analyzing several dimensions of firms' external competitiveness, ranging from probabilities of export, entrance, or exit, to international performance and productivity dynamics. The baseline equation tests the effect of different drivers of external competitiveness on

³ Additional details are provided in the Online Appendix.

the extensive margins of export (i.e., probability of exporting) according to the following specification:

$$\Pr(Y_{it} = 1) = \Phi(\beta' Z_{it-1} + \lambda_t + c_i + \varepsilon_{it}).$$
(1)

where Y_{it} is either a dummy dependent variable identifying export activity (*Export*), or other dimensions of firms' internationalization. A continuous dependent variable will be utilised when intensive margins are considered. Equation 1 is a standard reduced form including a rich set of regressors (Z_{it-1}) to capture structural characteristics (productivity, size, age, capitalization, group belonging, degree of vertical integration, cost of labor), financial characteristics (leverage, trade credit, bank debt, ROA, sales, cash flow), and especially firms' strategic behavior (innovativeness, R&D, investments, networking, import propensity, and human capital intensity). We also include time effects (λ_t) to capture common shocks and cyclical components that vary over time. Finally, c_i is a factor controlling for firms' unobserved heterogeneity, also accounting for permanent industrial/geographical effects (12 controls for firms' industry belonging and 107 for geographical provinces).⁴

There are two main issues we need to take into account in order to assess the effect of different drivers on firms' external competitiveness. The first one has to do with reverse causality, whereby characteristics and behaviors do not foster export performance but instead result from the (*a priori*) successful penetration into new markets. The second interrelated point is the self-selection of more productive and dynamic companies into international environments. Because of the lack of a natural experiment allowing to define a strictly exogenous set of instruments, we address these issues in several alternative ways.

First of all, we rule out simultaneity bias by matching current export status with lagged regressors to alleviate problems of reverse causality. Furthermore, we account for unobserved heterogeneity in a binary-response framework by employing random-effect probit models augmented with the time average of each regressor (*i.e.*, Mundlak-type controls). As suggested by Wooldridge (2010), we relax the unrealistic assumptions of random-effect models (the orthogonality of c_i with respect to the full set of regressors) by focusing on the effect of each variable in terms of deviations from its time average. This allows us to purge the model from persistent heterogeneity across firms that may lead to biased estimates. Moreover, to further control for persistence of Y_{it} , we also provide results for the subset of firms with $Y_{it-1} = 0$.

⁴ More details on the definition of all the variables employed can be found in Appendix.

In the unlikely case that residual heterogeneity is still affecting our findings, we run several additional robustness checks. We account for the introduction of unrestricted firm fixed effects through linear probability (within estimators) models taking into account all the firms' characteristics that are stable over time. Finally, we further take care of self-selection by employing matching techniques (Coarsened Exact Matching) and control for correlated shocks in the Great Recession by enriching our baseline specifications with an extensive set of time-fixed effects specific for firm belonging industry (12 macro-industries \times 5 periods) and geographical province (110 \times 5).

5. RESULTS

This section presents the results of the analysis. The estimates are divided in two part. The first one reports the result for the whole sample of Italian companies included in the analysis. The second one provides the focus on micro-sized companies and 'fragile' firms. In both cases, we start exploring direct and indirect effects of dynamic strategies on the firms' probability of export (i.e., extensive margins). We then analyze heterogeneities in the effect and present results on the intensive margins and emphasize the role of innovative strategies as an instrument for overcoming size and productivity disadvantages.

5.1 ENTIRE ECONOMY

Extensive margin: baseline

Columns 1 and 2 of Table 2 present some preliminary evidence based on the pooled probit estimators (marginal effects with robust standard errors are reported). Even though this approach neglects firms' unobserved heterogeneity and reverse causality issues, it may still provide useful guidance in the establishment of clean correlations between exporting status and firms' characteristics and behaviors. There are several issues that is worth mentioning. First, more productive companies are found to be largely associated to higher probabilities of export: a one-standard deviation increase in productivity is associated to a 2-2.8% higher probability of export. This evidence is broadly in line with the dominant literature on firms' internationalization. However, given the type of econometric analysis performed, that neglects persistent heterogeneity across firms, little can be said on whether this effect is linked to reverse causality, the ex-ante self-selection of more productive companies into international markets, or learning by exporting phenomena. The role of productivity on firms' probability of export will be further discussed in the following analyses.

Second, structural characteristics play a critical role for firms' exporting status. In particular, firm size and the belonging to corporate groups are associated to increases in a company's probability of

exporting. On the other hand, older and more capitalized firms are found to have a lower international propensity, even though coefficients tend to be unstable across specifications.

A prominent effect is found for firms' strategic behaviors. Being an importer of intermediate products is largely associated to a higher probability of exporting (33-34% probability). This result is in line with the extant literature emphasizing how import policies may affect aggregate productivity, resource allocation, and industry export activity along both the extensive and intensive margins (see for instance Amiti and Konings, 2005; Halpern, Koren, and Szeidl, 2015; Kasahara and Lapham, 2013; Kasahara and Rodrigue, 2008, Castellani, Serti and Tomasi 2011).

Importantly, the introduction of innovations, the involvement in R&D projects, as well as undertaking new investments, are strongly correlated with export strategies. At this stage though, the estimates do not allow to make inference on the direction of causality underlying these relationships.

As expected, past performances are positively related to firms' exporting status, but, once again, this analysis does not shed light on whether the direction of causality is reversed (i.e., the access to international markets allowed firms to experience higher sales growth). Other estimates are in line with a priori expectations.

Since these results may be affected by persistent unobserved heterogeneity across firms (such as managers' attitudes and skills), Table 2 also presents RE-probit models with Mundlak correction (columns 3 and 4) and within estimators with firm and time fixed effects (columns 5 and 6).

Once purged the model from persistent heterogeneity across firms, the role of productivity in fostering export activity is found to be strongly reduced. This result is unchanged across the two estimators and is qualitatively similar if we employ TFP as an alternative measure of productivity (Levinsohn and Petrin, 2003). Notice that the comparison of column 2 and 4 (or 6), is implicitly confirming the self-selection hypothesis (largely emphasized by the literature), whereby persistentlymore-productive companies are more prone to penetrate international markets, driving the positive association in the pooled specification. However, once this persistent heterogeneity is accounted for, the effect of productivity tends to be small or even insignificant. Because columns 3 and 4 of Table 2 include the Mundlak correction, the estimates have to be interpreted as effects of changes in each measure from its time average. In other words, the model is cleaned-out from any persistent characteristic, including any high/low level of productivity that is stable over time. Once accounted for this issue, and directly controlled for other structural and strategic determinants, the variation in firms' productivity (on average) is not sufficient to explain the change in their exporting status. On the one hand, this is because productivity tends to be quite sticky over time. On the other, most of the variation of productivity in the short run are caused by the strategies undertaken by the company and its operating environment, which are added as separate regressors in our specification as they

represent the drivers of productivity (more on this in section 5.4). The insignificance of the estimates implies that the remaining component has not enough variation to induce any change in the international attitude. This result can be summarized as follows. While relatively more productive firms tend to show average superior export performance vis-à-vis other companies, the residual role of productivity is blurred when factors laying behind productivity differentials and company-level fixed effects are explicitly accounted for (i.e. controlling for persistent unobserved heterogeneity). In this regard, our estimates show how structural, behavioral, and strategic factors take the center stage as key drivers of international competitiveness in the short run.

This result is largely confirmed by the linear probability models in columns 5 and 6 (especially in the richest specification), that do not impose any restriction on the type of unobserved heterogeneity that takes place. Notice that this finding must not be interpreted as an evidence that productivity does not play any role in firms' exporting status. The significant effect documented in column 2 suggests a clear positive association between productivity and export. The insignificance portrayed in the following columns indicates that, while there exists a self-selection of persistently-more-productive companies, there is no effect of changes in productivity on export propensity, once structural and behavioural characteritics of firms are controlled for. Most importantly, the introduction of innovations and the expenditure in R&D keep their significance and prove to be a critical determinant in firms' internationalization status.⁵

Extensive margin: additional tests

There are two main issues that may still affect our results and we have to deal with. The first one has to do with the persistence of the phenomena under consideration, whereby the positive effect of firms' innovativeness on export may arise from long-lasting internationalization strategies triggering innovative processes and not the other way around. The second interrelated issue has to do with the simultaneity of innovation and export decisions.

We tackle the first identification challenge by repeating the analysis in Table 2 on the subsample of previously-non-exporting companies. Restricting the focus on firms that were not exporters in t - 1 is equivalent to modelling firms' entry on the international markets and it allows us to get rid of any export-driven effects (e.g., introduction of innovations to gain competitiveness in foreign countries). Untabulated results show that innovative strategies keep playing a critical role on the probability of (starting to) export even if the persistent heterogeneity across firms is properly accounted for (see Table A2 in the extended appendix for details).

⁵ Notice that the (apparently small) coefficient of R&D has to be interpreted as the effect of a 1%-increase in the expenditure in R&D. For instance, a firm increasing R&D expenditure up to 10% of its total sales has a 3%-higher probability of exporting.

To further explore the extensive margin, we model innovation and export as simultaneous decisions through a bivariate probit model (once again, augmented with time averages of each variable to control for unobserved heterogeneity, i.e. Mundlak correction). Simultaneity may generate in-built correlation between the variables if a firm chooses to invest in innovations *only* to penetrate international markets In this context, bivariate probit models account for this issue by jointly estimating export and innovation via simultaneous equations that perfectly control for (observed and unobserved) third factors that might drive both choices. Results keep showing a positive and significant effect of firms' innovative strategies on their international propensity, reassuring that our main results do not depend on simultaneity issues (for a detailed discussion of the methodology and the results see the Extended appendix, Table A3a and A3b).

Finally, our estimates are also robust to the inclusion of a rich set of controls for correlated shocks at the region and/or industry levels (through the introduction of industry-specific and province-specific time fixed effects, see Table A1 in the Extended appendix)⁶ and are consistent even we restrict our analysis to the manufacturing sector only.

We run a number of additional exercises to highlight some heterogeneities and sharpen our results. First of all, we explore differential effects of innovative strategies along the (maximum) geographical extension of the destination market. To this end, we run distinct regressions on a firm's probability of exporting within the EU area or for exporting beyond the Eurozone. Results confirm the critical role played by firms' strategy in affecting their exporting status (Table A4 of the Extended appendix). Interestingly, the effect of innovation is found to be significantly more important for farther markets, with a magnitude that is roughly twice as much as the impact for export activity within the Eurozone. On the other hand, the effect of R&D seems to be somewhat reduced. This result might be related to the relatively slow recovery that characterized, during the post-crisis phase, the European domestic market vis-à-vis the Chinese, US or the UK's one. In times of fiscal consolidation and austerity at home (Celi et al. 2018), the European companies that have grown by accessing new foreign markets have mostly benifited from the increasing demand in US and China where, in turn, expansionary policies have been in order all along the post-crisis phase.

An additional exercise aims at exploring heterogeneities along the different types of innovations and separately test the impact of product, process, and organizational-managerial improvements.⁷ As expected, product innovations dominate other forms of innovativeness (process or organizational-

⁶ This allows to capture any shock that is time varying and common to firms within a specific geographical area or industrial sector. This may be particularly relevant in the aftermath of the Great Recession in which demand shocks may be not homogeneous and hit more severely specific segments of the market.

⁷ Coherently with the Community Innovation Survey (CIS) organizational-managerial innovations comprehend new organizational methods in a firm's business practices (including knowledge management), workplace organization, or external relations that has not been previously used.

managerial innovations). This strict dominance is partly related to the fact that new products are the main form of innovation which is not reflected in the level of productivity (which we control for). Moreover, product innovation are linked to technological competitiveness strategies that tend to prevail over other factors capable to explain international performance (see, among others, Dosi et al. 2016). Importantly, product innovations are found to be especially relevant for new exporters, with a magnitude that is roughly twice the impact on the entire sample (4%-increase in the probability to start exporting, as shown in Table A5 in the Extended appendix).

Given the prominent role played by firms' strategies, we also ask whether, on top of the direct impact of firms' innovativeness on its international attitude, the upgrading or downgrading paths have additional effects. In other words, two identical companies having the same set of innovative strategies, may differ in terms of international propensity depending on the pattern undertaken in the recent past (i.e., stable, increasing, or decreasing number of innovative activities). To this end, we enrich the baseline specification with the change in the number of innovative strategies (innovation and R&D) between t - 2 and t - 1. This measure of upgrading takes positive values if the company incremented its array of innovative behaviors, is zero if the firm experienced constant strategies, and takes negative values in case of a reduction in the number of innovative activities (i.e., downgrading). Results clearly show that, on top of the positive direct effect of innovation and R&D, the path of dynamic strategies undertaken in the recent past has a significant impact. In particular, integrating more and more strategies is associated with a positive premium leading to a higher probability of export (ranging between 4% and 8%, as shown in Table A6 of the Extended appendix). On the other hand, the same coefficient suggests that a reduction in the array of dynamic behaviors tends to lower the likelihood of exporting. Notice that these results highlight disproportionate benefits for firms that in the past presented low or reduced innovativeness. For this set of companies, the introduction of one or more dynamic activities would allow to (partially) fill the gap with the group of most dynamic firms.

As a final exercise, we also test the effect of a firm's innovativeness on its probability of exiting international markets (i.e., fall back on domestic markets). Because of the substantial drop in domestic demand, a large fraction of companies entered the international environment in the aftermath of 2011 (see above). Since a significant flow of firms also exited international markets in the following years, explaining what drives success on international markets is of central importance. We find evidence that companies that withdrew from foreign markets were on average smaller, younger, and, especially, less productive. Notice that while after accounting for unobserved heterogeneity firms' productivity did not play any role in firms' entrance, it keeps having a very negative and significant effect on exit strategies. These combined results point at an outflow of companies that attempted to

succeed in the international environment despite being less structured and fragile. Importantly, the adoption of R&D and innovation strategies, especially the latter, are found to help overcome structural characteristics by significantly lowering a firm's probability of exit (-8.5%, as shown in Table A7 of the Extended appendix).

Indirect effect on productivity and intensive margin

The analysis presented in the previous sections focused on the direct effect of firms' innovativeness on export choices. However, on top of this channel, a firm's innovativeness may also have indirect effects by boosting firms' long term productivity which, as we showed in table 2 and argued in section 5.1, is conducive to better export performance.

To explore this additional phenomenon, Table 3 tests the role of innovations on firm productivity growth. Columns 1 and 2 present the results of within estimators with firm and time fixed effects. As expected, higher innovativeness is linked to more pronounced productivity growth (+4% growth rate) that may, in turn, further foster a firm's probability of export. Interestingly, this indirect effect is largely driven by process and organizational-managerial innovations (column 2), while the introduction of new products is not linked to any productivity growth.

To deal with the possible reverse causality affecting the estimates, we also take advantage of matching techniques in columns 3 and 4. We employ Coarsened Exact Matching to recover a subsample of firms with similar characteristics (size, age, geographical location, industrial features, and, especially, having the same productivity level at the beginning of the sample, 2008) that only differ for the actual introduction of innovations (the treatment variable). We then re-estimate the regressions in columns 1 and 2 on the new (balanced) sample employing matching weights. Once again, firms' innovativeness is found to have a positive and significant effect on their productivity growth, with a dominant role for process and organizational-managerial innovations (associated to a 15%-higher productivity growth).

We also show the results for the intensive margins of export, captured by the share of sales from exported products (as a percentage of total sales, in columns 1 and 2), or the growth rate of export sales (in columns 3 and 4).

Table 4 relies on within estimators with firm and time fixed effects and clearly shows that the impact of firms' innovativeness on export is not limited to the extensive margins, but extends to the performance on the international markets, leading to an 8.3%-increase in export growth. Once again,

there is a strict dominance of product innovations compared to alternative forms of improvements (columns 2 and 4).

As an additional exercise, we also exploited quantile regressions to emphasize nonlinearities in the effect of firms' innovativeness on export shares (Table A9 in the Extended appendix). Results highlight that research activities are fundamental to improve the performance on foreign markets except in case of firms that are extremely large exporters.⁸ In a similar vein, the introduction of innovations is a relevant strategy especially for marginal exporters while plays a minor role for companies that rely heavily on export. Taken together, this result points to the critical role of R&D and innovation in penetrating foreign markets. However, once the firm reaches a significant degree of dependence from the international environment, its degree of innovativeness has a reduced impact while size and productivity stand out key elements for competitive advantages.

5.2 MICRO-SIZED AND LESS PRODUCTIVE FIRMS

Having established the effect of dynamic strategies on firms' international propensity, we now turn the attention to potential additional non-linearities in the effects of interest. In particular, smaller and less productive firms may have disproportionate benefits from the introduction of innovations and the investment in R&D projects. To test for this heterogeneity, Table 5 interacts the effect of Innovation and R&D with dummy indicators for higher and lower productivity or larger and smaller size. The thresholds used to identify fragile companies are listed in the third rows (33rd or 25th percentile of the 2008 cross-sectional distribution of size and productivity). Notice that, although our results all relate to SMEs because of the composition of our dataset, this exercise allows to highlight the additional role of dynamic strategies for truly nano-sized companies, as the thresholds for smaller firms identify units with less than six and four employees, respectively.

Both the extensive (columns 1-4) and the intensive (columns 5-8) margins of export present significant non-linearities pointing at larger benefits for smaller and less productive companies (for instance, innovations of less productive companies are linked to a 5.3% increase in the probability of export and 17%-higher export sales growth, which are reduced to 1.7% and 7.1% in case of innovations undertaken by a productive firm). This is a critical finding as it identifies innovative strategies as a potential tool to fill the gap between large/productive companies and the set of less structured firms, that are ideal targets for policy measures.

6. CONCLUDING REMARKS

⁸ This is because highly internationalized firms typically lean on alternative strategies to gain/preserve the competitive advantage over their rivals (e.g. outsourcing, market power exploitation, strict connection with foreign markets).

Overall, we contribute to the debate on Italian external competitiveness by pointing out the importance of behavioral and strategic factors for SMEs in shaping firm-level competitive advantages. Whilst our results confirm the positive effect of structural characteristics, such as size and productivity, they also highlight the existence of additional factors that help boost firms' internationalization. Among these, innovation and R&D play a crucial role and affect external competitiveness both directly and via productivity improvements. Even though the positive effect of innovative activities and R&D is certainly not new, we explore several new levels of heterogeneity, as well as indirect effects that may provide a sound base for the construction of granular policy implications. In particular, the analysis allows for the identification of some key characteristics of firms that favor their external competitiveness in a phase of deep economic crisis.

First, we showed that while firms exhibiting a higher productivity do perform better, *changes* in productivity are not significantly associated to improvements in external competitiveness, once other firm level structural and behavioural chacateristics, including innovation strategies, are controlled for. In other words, temporary changes in productivity do not have an impact on export performance, while long term, persisting productivity premia do. This might signal that it is only when innovation and other firm level characteristics become less sporadic and more systematic, these translate into structural and persisting advanges (e.g. via the accumulation of complementary competencies, routines, and resources) and determine long term shifts in productivity. It is these shifts in long term productivity, and not temporary changes, that yield improvements in external competitiveness.

Second, firms expanding the span of their product, process, and organizational innovations, significantly improve their capacity to peneterate foreign markets. In a similar vein the adoption of innovative strategies are found to lower the probability of exiting foreign markets. By documenting these facts, together with the indirect impact of innovative activities – especially process and managerial innovation - on long term productivity, we provide sound evidence on the importance of favouring technological and organizational change as a source of external competitiveness, particularly in a phase of crisis.

Third, the most fragile firms, including the least productive and smaller companies, are the ones that appear to gain the greatest benefits from innovation strategies in terms of external competitiveness, especially in terms of export growth. In troubled times, as the ones that we are living in the aftermath of the big financial crisis worsened by the effects of COVID-19 outbreak, our results provide a strong argument in favour of comprehensive recovery strategies based on multiple strategies and multiple actors. In times of dramatic crises there seems to be no easy recipe and "cherry picking" is not likely to be the way out. As shown, on the one hand pulling the economy out of crisis calls for the ability

of firms to combine different competencies and innovative behaviours; on the other hand recovery cannot rely only on the best performers, but also on the spread of innovation capacity to strengthen the less structured and weaker segments of the production system.

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8. TABLES

Table 1: Descriptive statistics.

	Mean	Stdev	Min	Max
Export	0.287	0.453	0	1
Export share	9.893	21.46	0	100
Export sales growth	0.005	0.491	-1	2.553
Export sales	18.51	2.161	1.609	26.88
Productivity	10.63	1.308	-16.13	26.38
Innovation	0.314	0.464	0	1
Product inn.	0.188	0.391	0	1
Process inn.	0.148	0.355	0	1
Organiz. inn.	0.168	0.374	0	1
R&D	0.162	0.369	0	1
R&D share	1.035	5.217	0	250
Size	2.272	1.742	-11.51	10.72
Age	2.544	2.113	-13.81	6.405
Capitalization	9.451	3.941	-21.06	27.51
Group	0.129	0.335	0	1
Import	0.113	0.316	0	1
Investment	0.445	0.497	0	1
ROA	-0.001	0.104	-0.619	0.266
Vertical int.	0.363	0.225	0.026	1.197
Cost of labor	0.251	0.229	-22.42	62.44
Sales	1.162	6.722	0	3675
Sales growth	-0.031	0.563	-14.17	10.78
Leverage	1.649	1.089	-1.822	12.19
Net acc. payable	-0.101	0.338	-2.385	86.71
Bank debt	0.252	0.402	-2.307	73.33

Y:			Expor	t		
Estimator:	Poole	d probit	RE-Probit w	vith Mundlak	Linear proba	ability model
	(1)	(2)	(3)	(4)	(5)	(6)
Productivity	0.0281***	0.0208***	-0.001	0.0011	0.006*	0.008
110000011109	(0.0022)	(0.0046)	(0.002)	(0.002)	(0.003)	(0.011)
Size	0.058***	0.056***	0.0168***	0.0305***	0.023***	0.054***
	(0.001)	(0.003)	(0.003)	(0.004)	(0.004)	(0.012)
Age	-0.003	-0.009**	-0.0012	-0.002	-0.000	-0.002
8-	(0.002)	(0.004)	(0.002)	(0.002)	(0.003)	(0.006)
Capitalization	0.001	-0.006***	0.001	0.002	0.000	0.007*
Cuphunzuton	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0,004)
Group	0.019***	0.006	0.0119*	0.0202**	0.019**	0.040***
Group	(0.005)	(0.008)	(0.006)	(0.008)	(0.008)	(0.015)
Import	0 346***	0.336***	0.084***	0.073***	0.250***	0.178***
mport	(0.006)	(0.011)	(0.004)	(0.005)	(0.006)	(0.012)
Innovation	0.0531***	0.0516***	0.011**	0.0131***	0.016***	0.012
mnovation	(0.004)	(0.007)	(0.0045)	(0.005)	(0.005)	(0,009)
P&D share	0.004	0.00/***	0.0021***	0.0021***	0.003***	0.003***
R&D Share	(0,000)	(0.004	(0.001)	(0.001)	(0,000)	(0.003
Investment	0.0132***	(0.000)	0.01/3***	0.0157***	0.025***	(0.001)
nivestinent	(0.004)	(0.007)	(0.0045)	(0.005)	(0.005)	(0.010)
ROA	(0.004)	(0.007)	(0.0043)	(0.003)	(0.003)	(0.010)
KUA	-0.019	-0.011	-0.007	-0.007	-0.001	0.034
Vention 1 int	(0.005)	(0.003)	(0.043)	(0.043)	(0.011)	(0.088)
vertical int.	0.0108**	0.01/**	0.0122	0.0116	-0.019	-0.017
Coot of lob or	(0.004)	(0.009)	(0.017)	(0.029)	(0.017)	(0.054)
Cost of labor	0.028	-0.041	0.0112	0.0257	0.001	0.090
C 1	(0.019)	(0.056)	(0.029)	(0.045)	(0.004)	(0.089)
Sales	-0.253***	-0.222***		-0.005		-0.001
<u>.</u>	(0.011)	(0.0325)		(0.007)		(0.012)
Sales growth	-0.004	-0.074*		-0.0027		-0.009
-	(0.004)	(0.0404)		(0.005)		(0.009)
Leverage		-0.0272***		-0.0020		0.003
		(0.004)		(0.0044)		(0.008)
Net acc. payable		0.112***		0.0105		0.008
		(0.0211)		(0.022)		(0.040)
Bank debt		0.102***		-0.043*		-0.126**
		(0.024)		(0.024)		(0.048)
Constant	-1.588***	-0.825***	-2.55***	-2.88***	0.18***	0.09
	(0.092)	(0.193)	(0.244)	(0.368)	(0.047)	(0.150)
			Controls			
Region		yes	yes	yes	yes	yes
Industry		yes	yes	yes	yes	yes
Time		yes	yes	yes	yes	yes
Region*Time		no	no	no	no	no
Industry*Time		no	no	no	no	no
Mundlak		yes	yes	yes		
Firm FE					yes	yes
Observations	41.756	14.318	23.932	14.318	55.441	15.327
Pseudo R2			0.757	0.765		
R2	0.249	0.272			0.059	0.042

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Table	2:	Extensive	margins	ote	xport.
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Notes: Pooled probit (marginal effects in colums 1-2), RE-probit models with Mundlak correction (marginal effects in columns 3-4) and linear probability models with firm and time fixed effects (columns 5-6). The dependent variable is the extensive margin of export (Export). All measures are defined in Appendix. *, **, *** denote, respectively, significance at 10%, 5%, and 1% level. Robust standard errors in parentheses.

Y:		Proc	luctivity growth		
Estimator:	Withir	n estimator	Matching &	Within estimator	
	(1)	(2)	(3)	(4)	
Innovation	0.041**		0.233***		
	(0.019)		(0.037)		
Product inn.		0.011		0.066	
		(0.016)		(0.049)	
Process inn.		0.018*		0.155***	
		(0.007)		(0.059)	
Organiz. inn.		0.022**		0.133**	
		(0.007)		(0.056)	
Constant	-0.117	-0.117	10.476***	10.491***	
	(0.101)	(0.101)	(0.019)	(0.019)	
Controls					
Region	yes	yes	yes	yes	
Industry	yes	yes	yes	yes	
Time	yes	yes	yes	yes	
Firm FE	yes	yes	yes	yes	
Matching & weights			yes	yes	
Observations	13.827	13.827	5.519	5.519	
R-squared	0.033	0.034	0.021	0.023	

Table 3. Indirect effect of innovation on productivity growth

Notes: Within estimator with firm and time fixed effects. The dependent variable is the growth rate of productivity (value added per worker). In columns 3 and 4 the analysis is performed after matching techniques (Coarsened Exact Matching) identifying a subsample of companies with the same characteristics (size, age, ex ante productivity, region, sector, and all the other set of controls in Table 1) that only differ for the actual introduction of innovations (the treatment variable). Estimates in columns 3 and 4 are performed employing the matching weights. All measures are defined in Appendix. *, **, *** denote, respectively, significance at 10%, 5%, and 1% level. Robust standard errors in parentheses.

Y	: Expo	Export share		Export sales growth	
	(1)	(2)	(3)	(4)	
Productivity	0.450***	0.454***	0.038**	0.038**	
	(0.131)	(0.131)	(0.018)	(0.018)	
Size	1.255***	1.258***	0.035	0.035	
	(0.157)	(0.157)	(0.024)	(0.024)	
Age	-0.095	-0.098	-0.049***	-0.049***	
	(0.102)	(0.102)	(0.014)	(0.014)	
R&D share	0.107***	0.102***	0.007***	0.007***	
	(0.016)	(0.016)	(0.001)	(0.001)	
Innovation	0.584***		0.083***		
	(0.187)		(0.019)		
Product inn.		0.956***		0.061***	
		(0.235)		(0.023)	
Process inn.		0.028		0.012	
		(0.262)		(0.026)	
Organiz. inn.		0.408*		0.040*	
		(0.223)		(0.023)	
Export sales			-0.434***	-0.434***	
			(0.013)	(0.013)	
Constant	4.701***	4.541**	7.213***	7.211***	
	(0.177)	(0.177)	(0.571)	(0.572)	
Controls					
Region	yes	yes	yes	yes	
Industry	yes	yes	yes	yes	
Time	yes	yes	yes	yes	
Region*Time	yes	yes	yes	yes	
Industry*Time	yes	yes	yes	yes	
Firm FE	yes	yes	yes	yes	
Observations	67.108	67.108	16.954	16.954	
R2	0.008	0.009	0.184	0.184	

Table 4. Intensive margins of export

Notes: within estimators with firm and time fixed effects. The dependent variable is the intensive margin of export defined as the share of exported sales on total turnover (Export share in columns, 1 and 2) or as the growth rate of exported value (Export sales growth, in columns 3 and 4). Additional regressors (untabulated) follow the specification in Table 1. All measures are defined in Appendix. *, **, *** denote, respectively, significance at 10%, 5%, and 1% level. Robust standard errors in parentheses.

Y:	Export			Export sales growth				
Estimator:	RE-Probit w	ith Mundlak	RE-Probit with Mundlak		Within estimator		Within e	estimator
Fragility measure:	Si	ize	Produ	ictivity	Si	ze	Productivity	
Threshold fragile:	33rd	25th	33rd	25th	33rd	25th	33rd	25th
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Innovation*Sound	0.0124***	0.011***	0.017***	0.016***	0.078***	0.089***	0.071***	0.080***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.020)	(0.019)	(0.020)	(0.020)
R&D share*Sound	0.002***	0.002***	0.002***	0.002***	0.007***	0.007***	0.007***	0.007***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.002)	(0.002)	(0.002)
Innovation*Fragile	0.0442***	0.0481***	0.053***	0.051***	0.219***	0.141**	0.175***	0.161***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.049)	(0.068)	(0.035)	(0.041)
R&D share*Fragile	0.003***	0.003***	0.004***	0.004***	0.024***	0.030***	0.012***	0.011***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.007)	(0.011)	(0.004)	(0.004)
Constant	-3.115***	-3.110***	-3.164***	-3.174***	7.017***	7.002***	6.992***	6.968***
	(0.212)	(0.212)	(0.240)	(0.240)	(0.588)	(0.588)	(0.588)	(0.588)
Controls								
Region	yes	yes	yes	yes	yes	yes	yes	yes
Industry	yes	yes	yes	yes	yes	yes	yes	yes
Time	yes	yes	yes	yes	yes	yes	yes	yes
Region*Time	yes	yes	yes	yes	yes	yes	yes	yes
Industry*Time	yes	yes	yes	yes	yes	yes	yes	yes
Mundlak	yes	yes	yes	yes				
Firm FE					yes	yes	yes	yes
Observations	45.401	45.401	37.71	37.71	16.424	16.424	16.424	16.424
Pseudo R2	0.759	0.759	0.767	0.767				
R2					0.206	0.205	0.206	0.205

Table 5.	. Disproportionate	effects for small	l or less productive fi	irms
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Notes: RE-probit models with Mundlak correction (marginal effects in columns 1-4) and within estimator with firm and time fixed effects (in columns 5-8). The dependent variable is the extensive margin of export (Export), a dummy variable identifying exporting companies in columns 1-4, or the growth rate of exported value (Export sales growth in columns 5-8). Fragile and Sound are dummy measures identifying firms whose Size (number of employees) or Productivity (log value added per worker) at the beginning of the sample is respectively below or above the 33rd or 25th percentile (threshold in the third row) of the respective cross-sectional distribution. All measures are defined in Appendix. *, **, *** denote, respectively, significance at 10%, 5%, and 1% level. Robust standard errors in parentheses.

Appendix: Variable definition

Variable	Definition
Export	Dummy variable for exporting companies
Export share	Share of sales from exported products
Export sales	Log-value of exported products (lagged)
Export sales growth	$\Delta \ln(\text{export sales})$
Import	Dummy variable for importers
Productivity	ln(value added / # employees)
Size	ln(# employees)
Age	$\ln(1 + age)$
Capitalisation	ln(physical capital / # employees)
Group	Dummy variable for group membership
Innovation	Dummy variable for the introduction of innovations (independently of the type)
Product inn.	Dummy variable for the introduction of product innovations
Process inn.	Dummy variable for the introduction of process innovations
Organiz. inn.	Dummy variable for the introduction of organisational-managerial innovations
R&D share	Expenditure in R&D (as a share of sales)
Sales	Sales / total assets
Sales growth	$\Delta \ln(\text{sales})$
ROA	Net income / total assets
Vertical integration	Value added / total turnover
Cost of labour	ln(Cost of labour / total cost of production)
Leverage	Total assets / equity
Net acc. payable	(Accounts payable - accounts receivable) / total assets
Bank debt	Bank debt / total assets
Human capital	% of graduated employees (tertiary education)
Domestic network	Dummy variable for local domestic relationships with other companies

EXTENDED APPENDIX

1 THE MET SURVEY

The MET survey is the widest survey administrated in a single European country and it is specifically conceived to study Italian firms' characteristics and strategies, with particular attention to their internationalization process, innovative behaviour, and network relationships. Its representativeness is based on a sample design that is stratified along three dimensions: size class, sector, and geographical region.

MET survey's population of interest refers to the enterprises belonging to all the size classes operating within Industry (construction excluded) and Production Services sectors (overall 38 NACE Rev.2 3 digit sectors), accounting for 60% and 40% of the sample, respectively. *9*

The employed calibration estimators allow the survey, under predetermined circumstances, to reproduce known population parameters as well as to recover possible sample biases following from the (non-random) missing responses' distribution. The computation of the calibration estimators takes also advantage of a set of auxiliary information (other than the one employed to identify the strata) drawn from the population of interest. This auxiliary information constitutes a further binding constraint the final sample has to reproduce. All the constraints are drawn from ISTAT Italian Statistical Business Register (ASIA) while the calibration procedure makes use of an ad-hoc iterative algorithm. As for the longitudinal part of the sample, a specific calibration estimator has been computed to account for firms interviewed in two succeeding waves.

	2008	2009	2011	2013	2015
Micro (1-9)	38.4%	60.0%	61.6%	48.1%	46.9%
Small (10-49)	38.4%	26.0%	24.7%	33.6%	34.6%
Medium (50-249)	19.5%	10.5%	10.6%	13.5%	14.7%
Large (>250)	3.00%	3.50%	3.10%	4.80%	3.70%
# observations	24,896	22,340	25,090	25,000	23,071

Composition of the MET database by firms' size class.

On top of that, starting from the wave 2009 the sampling scheme employs Bayesian techniques in order to ensure high precision estimates on a selected range of topics that represent the core part of the survey (R&D, innovation and internationalization strategies among others). These techniques draw on a tree-based classification model able to detect, in the preceding wave, the strata showing higher rates of enterprises undertaking these relevant activities. This procedure has required further constraints leading to an oversampling of the targeted strata. Clearly, such sample bias is accounted for during the calibration estimator's procedure and is perfectly controlled for in the econometric analysis.

2 ECONOMETRIC STRATEGY ADDENDUM

⁹ Production services that are sampled are: distributive trades (6), transportation and storage services (7), information and communication services (9), administrative and support service activities (12).

Dealing with unobserved heterogeneity in a binary-response framework is not trivial. On the one hand, standard randomeffects (RE) models impose unrealistic assumptions on the type of heterogeneity that takes place (*i.e.*, c_i must be uncorrelated with the entire set of regressors). On the other, fixed-effects models, that do not impose any hypothesis on c_i , are computationally difficult and introduce an incidental parameter problem leading to inconsistent estimates. Our strategy is in-between the two approaches and relies on RE-probit models augmented with the time average of each regressor (*i.e.*, Mundlak-type controls).

The standard RE-probit model on the full set of covariates

$$\Pr(Y_{it} = 1 | Z_{it-1}, c_i) = \Phi(\beta' Z_{it-1} + c_i + \varepsilon_{it})$$
(2)

imposes $c_i | Z_i \sim N(0, \sigma_c^2)$, which implies the assumption of strict independence between firm-specific unobserved heterogeneity (c_i) and the full set of regressors. Because this unrealistic hypothesis would generate biased results in our setup, we follow Wooldridge (2010) and relax it by focusing on the effect of each variable in terms of deviations from its time average. This allows us to purge the model from persistent heterogeneity across firms and to derive cleaner policy implications. Our estimator can be viewed as a Mundlak (1978) version of the Chamberlain (1980)'s assumption on the correlation between c_i and Z, which requires the milder hypothesis of: $c_i | Z_i \sim N(\psi + \theta' \overline{Z}_i, \sigma_a^2)$, where σ_a^2 is the variance of a_i in $c_i = \psi + \theta' \overline{Z}_i + a_i$, and \overline{Z}_i is the time-average of Z_{it-1} (see Brancati et al., 2017). Notice that this approach is equivalent to a fixed-effects model in which the heterogeneity is projected on the time-mean of the regressors (\overline{Z}_i), allowing to write the latent variable as $Y_{it}^* = \psi + \beta' Z_{it-1} + \theta' \overline{Z}_i + a_i + e_{it}$, with $e_{it} \sim N(0,1)$. As usual, the estimator hinges on the exogeneity of Z_{it-1} conditional on c_i . We verify this hypothesis by adding the vector Z_{it} to our specification and testing the significance of its estimates (as proposed by Wooldridge, 2010). The test never rejects the null, thus providing at least some justification for the strict exogeneity assumption.

3 SIMULTANEITY OF INNOVATION AND EXPORT

One important issue that, for the sake of brevity, is overlooked in the paper has to do with the simultaneity of the innovation and export decisions. While we always match current export activity with lagged innovative choices, there is still the possibility of significant correlation between the two equations that may invalidate the coefficients of interest. For instance, firms' may choose to invest in innovations to penetrate international markets. If this is the case, the two choices are simultaneously determined and this issue should be properly accounted for. The second point has to deal with the identification of the determinants of firms' innovative strategies, which are especially useful to provide some policy guidance.

To this aim, we account for the simultaneity of the phenomena by employing bivariate probit models (with Mundlak correction). The specification estimates firms' probability of exporting conditionally on its (lagged) innovative status. The model can be summarized by the following system of equations:

$$\begin{cases} Export_{it} = 1 \text{ if } Export_{it}^* = \theta Innovation_{it-1} + \beta_1^T X_{1it-1} + \varepsilon_{1it} > 0 \\ Export_{it} = 0 \text{ if } Export_{it}^* = \theta Innovation_{it-1} + \beta_1^T X_{1it-1} + \varepsilon_{1it} \le 0 \end{cases}$$

 $\begin{cases} Innovation_{it-1} = 1 \text{ if } Innovation_{it-1}^* = \beta_2^T X_{2it-2} + \varepsilon_{2it-1} > 0\\ Innovation_{it-1} = 0 \text{ if } Innovation_{it-1}^* = \beta_2^T X_{2it-2} + \varepsilon_{2it-1} \le 0 \end{cases}$

where $Export_{it}$ and $Innovation_{it-1}$ are the observed (dummy) dependent variables, $Export_{it}^*$ and $Innovation_{it-1}^*$ are latent variables, while ε_{1it} and ε_{2it-1} are the two error terms, assumed to be *i.i.d.* as a bivariate normal with unitary variance and correlation coefficient $\rho = corr(\varepsilon_1, \varepsilon_2)$. The system of equations allows to estimate the impact of innovativeness on export, and to jointly analyze the drivers of innovative strategies. X_{1it-1} is the standard set of regressors in Table 1, while X_{2it-2} is a vector of determinants for innovations, including R&D choices (internal vs outsourcing), structural characteristics (size, age, capitalization, and productivity), proxies for demand conditions (past sales growth), operating environment (group belonging and participation in local networks), as well as measures aimed at capturing firms' financial conditions.

Table A3a presents the main results. First, even after accounting for the simultaneity of the phenomena, and perfectly controlling for third factors that jointly affect export and innovation, firms' innovative strategies are found to have strong and significant effects on their international propensity. In other words, the main results of the paper are found to be robust and not to depend on simultaneity issues.

The analysis on the determinants of firms' innovativeness present interesting results. As expected, structural characteristics are significantly affecting the introduction of innovations, especially in case of larger, younger, and more productive companies. Similarly, past sales growth, which can be thought of as a proxy for demand trends, is positively associated to firms' innovativeness. The existence of R&D projects is clearly correlated to huge increases in the probability of introducing innovations. Importantly, this effect is not limited to the investment in R&D performed within the firm (internal R&D), but extends to firms outsourcing R&D activities, even though with smaller magnitudes (+8% vs. +27% probability). This is a relevant result, as the outsourcing of R&D projects is widely employed by very small firms that are not structured enough to undertake internal research projects.*10* Another important factor in driving firms' innovativeness is related to the operating environment of a firm. Belonging to a corporate group significantly increases the probability of innovating by roughly 5%, as well as the insertion into domestic networks with other companies (4.5%). This result is largely in line with the dominant literature on domestic districts, whereby close proximity with other companies may foster the innovative process through iterated exchanges of knowledge flows. Notice that, once again, the insignificance of Human capital may be driven by its persistence (we always account for Mundlak correction) as well as controls for R&D capturing most of its effect.

Finally, columns 1 and 2 emphasize the critical role played by financial constraints in the development of innovative projects. By their very own nature, innovative firms, especially SMEs, are more likely to suffer from financial problems. Because of their informational opaqueness, their little tangible assets to pledge as collateral, and the riskiness of their strategies, most potentially-innovative firms are credit-rationed and face relevant obstacles in financing their investments. In this regard, the type of innovation to be financed, the characteristics of the firm, and its relationship with the lender bank play a crucial role in the actual capability of introducing innovations.

We analyze this effect in two alternative ways. In column 1, we employ a synthetic measure of firms' creditworthiness (or bankability), defined as the first principal component (Creditworthiness) of several financial rations that are traditionally used by banks to compute internal credit scores (leverage, ability to pledge collateral, age, size, cash flow to total assets ratio, sales to total assets ratio, proxies for rollover risk, ...).*11* As expected, this measure is positively associated to firms' innovativeness, possibly because of its correlation with firm access to external credit.

¹⁰ Notice that the variable Human capital is largely insignificant, possibly because R&D measures are capturing most of its effect. 11 The first principal component accounts for 65% of the total variance and loads on all the coefficients unambiguously indicating increases in creditworthiness.

As an alternative measure, column 2 employs the predicted probability of being financially constrained. In particular, the MET survey contains information on the existence of positive net-present-value investment projects that were not undertaken because of a lack of financial means. This measure can be thought of as a direct proxy for financial constraints (dummy variable) and is employed in Table A3b as a dependent variable.

On the top of some structural characteristics, we employ a set of measures that are traditionally used by the literature as proxies for relationship lending. Relationship lending represents the informational privilege that a bank accumulates over time by establishing close ties with its borrower so to overcome problems of informational asymmetry, especially when dealing with innovative projects. The amount of soft information gathered by banks can be critical in determining credit access, especially for opaque SMEs whose hard information is not enough to correctly evaluate firm creditworthiness. In other words, the existence of close ties with the lender bank significantly helps overcoming credit constraints.

Given the unobservability of the stock of prior information accumulated by the bank, we employ three main measures to capture this phenomenon. The first one, Bank distance, is the physical distance between the belonging province of a company and the headquarter of the lending bank (in log-Km). This measure is correlated with the "informational distance" between the lender and the borrower; the larger the distance, the higher banks' difficulties in transmitting soft information to the headquarters. Similarly, banks' degree of hierarchization (here proxied by Bank size, i.e., the log of banks' total assets) significantly affects the transmission of soft information gathered from delocalized branches to the upper levels. Finally, the higher the number of banks each firm is borrowing from, the weaker the relationship that is established with the lender, and the lower the amount of soft information that is allegedly gathered.

Table A3b presents results that are in line with a priori expectations and emphasize the critical role played by relationship lending in reducing a firm's probability of being financially constrained. Finally, in column 2 of Table A3a we employ the predicted probability from Table A3b to show the detrimental effect of financial constraints on firms' innovativeness, which is always very negative and extremely significant, suggesting that finance may represent a severe obstacle for financing innovative activities of SMEs.

4 ADDITIONAL TABLES AND ROBUSTNESS

Y:		Export		
Estimator:	RE-Probit w	vith Mundlak	Linear proba	ability model
	(1)	(2)	(3)	(4)
Productivity	-0.0002	0.002	0.004	0.006
	(0.0017)	(0.002)	(0.004)	(0.011)
Size	0.0177***	0.0317***	0.020***	0.050***
	(0.0032)	(0.0044)	(0.004)	(0.012)
Age	0.000	-0.001	0.000	-0.005
	(0.002)	(0.002)	(0.003)	(0.006)
Capitalisation	0.0012	0.002	0.000	0.005
	(0.0013)	(0.002)	(0.001)	(0.004)
Group	0.0127*	0.022***	0.028***	0.046***
	(0.0068)	(0.008)	(0.008)	(0.015)
Import	0.084***	0.074***	0.245***	0.177***
	(0.005)	(0.005)	(0.006)	(0.012)
Innovation	0.0133***	0.0163***	0.015***	0.019*
	(0.004)	(0.005)	(0.005)	(0.010)
R&D share	0.0021***	0.002***	0.003***	0.003***
	(0.001)	(0.001)	(0.000)	(0.001)
Investment	0.0125***	0.0153***	0.024***	0.023**
	(0.005)	(0.005)	(0.005)	(0.010)
ROA	0.125	-0.026	-0.004	0.068
	(0.195)	(0.045)	(0.011)	(0.090)
Vertical int.	0.009	0.0119	-0.005	-0.004
	(0.017)	(0.029)	(0.017)	(0.057)
Cost of labor	0.011	0.006	0.002	0.143
	(0.029)	(0.046)	(0.004)	(0.094)
Sales		-0.007		0.003
		(0.007)		(0.012)
Sales growth		-0.005		-0.004
		(0.005)		(0.010)
Leverage		-0.001		0.000
		(0.0047)		(0.009)
Net acc. payable		0.003		0.003
		(0.022)		(0.041)
Bank debt		-0.042*		-0.086*
		(0.024)		(0.050)
Constant	-2.93***	-3.41***	0.21***	0.14
	(0.306)	(0.432)	(0.049)	(0.158)
Controls				
Region	yes	yes	yes	yes
Industry	yes	yes	yes	yes
Time	yes	yes	yes	yes
Region*Time	yes	yes	yes	yes
Industry*Time	ves	ves	ves	ves
Mundlak	ves	ves		J
Firm FF	, 55	, .	Vec	Vec
			51 (99	14.210
Deservations	23.932	14.318	51.088	14.318
rseudo K2	0.768	0.//6		
R2			0.073	0.066

 Table A1. Extensive margins of export: controlling for interacted time effects

Notes: RE-probit models with Mundlak correction (marginal effects in columns 1-2) and linear probability models with firm and time fixed effects (columns 3-4). The dependent variable is the extensive margin of export (Export). All measures are defined in Appendix. *, **, *** denote, respectively, significance at 10%, 5%, and 1% level. Robust standard errors in parentheses.

Table A2: Extensive margins of export: previously non-exporting companies

Y:		Exp	port	
	(1)	(2)	(3)	(4)
Innovation	0.022***	0.022***	0.023***	0.019***
	(0.007)	(0.006)	(0.007)	(0.006)
R&D share	0.002***	0.002***	0.002***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Constant	-1.806***	-0.197***	-1.451***	-0.171***
	(0.323)	(0.052)	(0.422)	(0.053)
Controls				
Region	yes	yes	yes	yes
Industry	yes	yes	yes	yes
Time	yes	yes	yes	yes
Region*Time	no	no	yes	yes
Industry*Time	no	no	yes	yes
Mundlak	yes		yes	
Firm FE		yes		yes
Observations	11.599	32.889	11.599	30.54
Pseudo R2	0.554		0.582	
R2		0.124		0.164

Notes: RE-probit models with Mundlak correction (marginal effects in columns 1-2) and linear probability models with firm and time fixed effects (columns 3-4). The sample is restricted to companies that were not exporting in t - 1. Untabulated controls follow the specification in Table 1. The dependent variable is the extensive margin of export (Export). All measures are defined in Appendix. *, **, *** denote, respectively, significance at 10%, 5%, and 1% level. Robust standard errors in parentheses.

	(1)	(2)
Export equation:		
Innovation	0.493***	0.504***
	(0.020)	(0.019)
R&D	0.003***	0.002***
	(0.000)	(0.000)
Innovation equation:		
External R&D	0.061***	0.082***
	(0.011)	(0.012)
Internal R&D	0.247***	0.273***
	(0.009)	(0.010)
Creditworthiness	0.016***	
	(0.005)	
Prob (financial constraints)		-0.419***
``````````````````````````````````````		(0.167)
Human capital	0.008	0.023
-	(0.017)	(0.017)
Size	0.027***	0.027***
	(0.003)	(0.003)
Productivity	0.013***	0.0115***
	(0.003)	(0.003)
Capitalisation	-0.001	0.001
	(0.001)	(0.001)
Age	-0.008**	-0.0259***
	(0.003)	(0.005)
Sales growth	0.018**	0.021**
	(0.008)	(0.008)
Local network	0.045***	0.040***
	(0.006)	(0.006)
Group	0.050***	0.044***
~ .	(0.008)	(0.009)
Controls		
Region	yes	yes
Industry	yes	yes
Time	yes	yes
Mundlak	yes	yes
Observations	20.684	20.684
Rho	-0.641***	-0.641***

Table A3a: accounting for simultaneity in export and innovation decisions

Notes: bivariate probit models with Mundlak correction (marginal effects). The top panel reports estimates from the export equation (untabulated regressors follow the specification in Table 1). The bottom panel presents the innovation equation. External and Internal R&D are dummy variables identifying companies outsourcing R&D or performing R&D internally. Creditworthiness is a synthetic proxy for firms' creditworthiness computed as the first principal component of several financial characteristics that may affect a bank's decision to lend (leverage, collateral availability, size, rollover risk, age). Prob(financial constraints) is the predicted probability of being financially constrained as computed in the following table (D.8.B). Rho is the estimated correlation of the error terms of the two equations. All measures are defined in Appendix. *, **, *** denote, respectively, significance at 10%, 5%, and 1% level. Robust standard errors in parentheses.

Y:	Financial Constraints
	(1)
Age	-0.032***
	(0.001)
Size	-0.015***
	(0.002)
Bank distance	0.0104***
	(0.000)
Bank size	0.002**
	(0.001)
N banking relationships	0.003***
	(0.001)
Observations	73.865
Pseudo R2	0.122

 Table A3b: estimation of predicted probability of financial constraints

Notes: Probit model (marginal effects, in units of standard deviations in columns 1-2). The dependent variable is a direct measure of financial constraints (self reported) identifying firms having positive net-present-value projects that were not undertaken because of a lack of financial resources. Bank distance is the physical distance (log-Km) between the belonging province of a firm and the headquarter of its lending bank (in case of multiple banking relationships, an average has been applied). Bank size is the log of total assets of the lending bank. N banking relationships is the number of banking relationships in place. All measures are defined in Appendix. *, **, *** denote, respectively, significance at 10%, 5%, and 1% level. Robust standard errors in parentheses.

#### Table A4. Extensive margins of export by geographical maximum extension

Y:	Export(EU)	Export(extraEU)
	(1)	(2)
Innovation	0.010***	0.021***
	(0.002)	(0.002)
R&D share	0.002***	0.001***
	(0.000)	(0.000)
Investment	0.007***	0.005**
	(0.002)	(0.002)
Constant	-3.040***	-2.068***
	(0.212)	(0.213)
Controls		
Region	yes	yes
Industry	yes	yes
Time	yes	yes
Region*Time	yes	yes
Industry*Time	yes	yes
Mundlak	yes	yes
Observations	14.318	14.318
Pseudo R2	0.795	0.749

Notes: RE-probit models with Mundlak correction (marginal effects in columns 1-2). Untabulated controls follow the specification in Table 1. The dependent variable is the extensive margin of export by maximum geographical extention. Export(EU) is a dummy variable identifying companies exporting (at most) in the EU area, while Export(extraEU) is a dummy variable identifying companies exporting in farer countries. The two dependent variables are defined to be mutually exclusive. All measures are defined in Appendix. *, **, *** denote, respectively, significance at 10%, 5%, and 1% level. Robust standard errors in parentheses.

Y:		port		
Sample:		ire	Previously non exporting	
-	(1)	(2)	(3)	(4)
R&D share	0.002***	0.004***	0.002***	0.003***
	(0.000)	(0.000)	(0.000)	(0.001)
Product inn.	0.0121***	0.020***	0.021***	0.040***
	(0.003)	(0.006)	(0.005)	(0.008)
Process inn.	0.007*	0.014*	0.007	0.005
	(0.004)	(0.007)	(0.006)	(0.009)
Organiz. inn.	0.006*	0.013**	0.009*	0.007
	(0.003)	(0.006)	(0.005)	(0.007)
Constant	-3.023***	0.227***	-1.623***	-0.167***
	(0.192)	(0.049)	(0.270)	(0.053)
Controls				
Region	yes	yes	yes	yes
Industry	yes	yes	yes	yes
Time	yes	yes	yes	yes
Region*Time	yes	yes	yes	yes
Industry*Time	yes	yes	yes	yes
Mundlak	yes		yes	
Firm FE		yes		yes
Observations	56.955	57.375	30.301	37.37
Pseudo R2	0.762		0.551	
R-squared		0.033		0.144

 Table A5. Extensive margins of export: heterogeneities by type of innovation

Notes: RE-probit models with Mundlak correction (marginal effects in columns 1 and 3) and linear probability models with firm and time fixed effects (columns 2 and 4). Untabulated controls follow the specification in Table 1. The dependent variable is the extensive margin of export (Export). The left panel reports estimates performed on the entire sample, while the right panel refers to the subsample of previously-non-exporting companies in t-1. All measures are defined in Appendix. *, **, *** denote, respectively, significance at 10%, 5%, and 1% level. Robust standard errors in parentheses.

Y:	: Export			
Estimator:	RE-Probit with Mundlak		Linear probability model	
	(1)	(2)	(3)	(4)
Upgrading	0.046***	0.048***	0.078***	0.075***
	(0.004)	(0.004)	(0.007)	(0.007)
Innovation	0.0396***	0.0441***	0.063***	0.062***
	(0.006)	(0.006)	(0.010)	(0.011)
R&D share	0.002***	0.002***	0.004***	0.004***
	(0.000)	(0.000)	(0.001)	(0.001)
Constant	-3.050***	-3.619***	0.061	0.115
	(0.373)	(0.439)	(0.149)	(0.157)
Controls				
Region	yes	yes	yes	yes
Industry	yes	yes	yes	yes
Time	yes	yes	yes	yes
Region*Time	no	yes	no	yes
Industry*Time	no	yes	no	yes
Mundlak	yes	yes		
Firm FE			yes	yes
Observations	14.318	14.318	14.318	14.318
Pseudo R2	0.771	0.783		
R2			0.055	0.077

 Table A6: Extensive margins of export: upgrading strategies

Notes: RE-probit models with Mundlak correction (marginal effects in columns 1 and 2) and linear probability models with firm and time fixed effects (columns 3 and 4). Upgrading is the change in the number of dynamic strategies (Innovation and R&D) between t-2 and t-1, with the support [-2,+2]. Untabulated controls follow the specification in Table 1. The dependent variable is the extensive margin of export (Export). All measures are defined in Appendix. *, **, *** denote, respectively, significance at 10%, 5%, and 1% level. Robust standard errors in parentheses.

#### Table A7: firms' exit after 2011

Y:	Exit		
	(1)	(2)	
Innovation		-0.085***	
		(0.011)	
R&D share		-0.001	
		(0.001)	
Productivity	-0.014**	-0.012**	
	(0.004)	(0.005)	
Constant	-1.806***	-0.197***	
	(0.323)	(0.052)	
Controls			
Region	yes	yes	
Industry	yes	yes	
Time	yes	yes	
Region*Time	no	no	
Industry*Time	no	no	
Mundlak	yes	yes	
Observations	4.951	4.951	
Prseudo R2	0.540	0.541	

Notes: RE-probit models with Mundlak correction (marginal effects). The dependent variable is a dummy measure identifying firms exiting the international markets after 2011 (Exit). Additional regressors (untabulated) follow the specification in Table 1. All measures are defined in Appendix. *, **, *** denote, respectively, significance at 10%, 5%, and 1% level. Robust standard errors in parentheses.

Y:	Export				Export sales growth
Estimator:	RE-Probit with Mundlak		Linear probability model		Within estimator
	(1)	(1) (2) (3) (4)		(5)	
Innovation with R&D	0.036***	0.041***	0.055***	0.055***	0.117***
	(0.004)	(0.007)	(0.009)	(0.013)	(0.027)
Innovation without R&D	0.010***	0.017***	0.017***	0.025***	0.066***
	(0.003)	(0.004)	(0.006)	(0.006)	(0.021)
R&D share	0.002***	0.002***	0.003***	0.003***	0.006***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.002)
Productivity	0.001	0.002	0.004	0.004	0.038**
	(0.001)	(0.001)	(0.004)	(0.004)	(0.018)
Constant	-3.021***	-1.657***	0.228***	-0.169***	7.214***
	(0.193)	(0.270)	(0.049)	(0.053)	(0.571)
Controls					
Region	yes	yes	yes	yes	yes
Industry	yes	yes	yes	yes	yes
Time	yes	yes	yes	yes	yes
Region*Time	no	yes	no	yes	yes
Industry*Time	no	yes	no	yes	yes
Mundlak	yes	yes			
Firm FE			yes	yes	yes
Observations	56.955	30.301	57.375	37.37	16.954
Pseudo R2	0.764	0.776			
R2			0.033	0.144	0.184

Table A8: Cumulative effects of dynamic strategies: innovation with or without R&D

Notes: RE-probit models with Mundlak correction (marginal effects in columns 1 and 2) and within estimator with firm and time fixed effects (estimates and marginal effects in columns 3, 4, and 5). The dependent variable is the extensive margin of export (Export), a dummy variable identifying exporting companies in columns 1 to 4, or the growth rate of exported value (Export sales growth in column 5). Innovation with or without R&D are dummy variables identifying innovative firms performing or not performing R&D activity. Additional regressors (untabulated) follow the specification in Table 1. All measures are defined in Appendix. *, **, *** denote, respectively, significance at 10%, 5%, and 1% level. Robust standard errors in parentheses.

Y:			Export share		
Quantile:	q10	q25	q50	q75	q90
	(1)	(2)	(3)	(4)	(5)
R&D	0.047***	0.077***	0.118***	0.174**	0.089
	(0.009)	(0.021)	(0.035)	(0.070)	(0.084)
Innovation	0.439***	0.467***	0.838***	0.432	0.070
	(0.127)	(0.151)	(0.292)	(0.508)	(0.880)
Productivity	0.414***	0.536***	1.906***	2.502***	2.544***
	(0.059)	(0.116)	(0.214)	(0.425)	(0.378)
Size	0.869***	1.215***	4.329***	4.651***	3.423***
	(0.066)	(0.190)	(0.107)	(0.296)	(0.301)
Constant	-3.488***	0.210	-4.836***	20.253***	54.684***
	(0.685)	-1477	-1851	-5256	-4880
Controls					
Region	yes	yes	yes	yes	yes
Industry	yes	yes	yes	yes	yes
Time	yes	yes	yes	yes	yes
Region*Time	yes	yes	yes	yes	yes
Industry*Time	yes	yes	yes	yes	yes
Mundlak	yes	yes	yes	yes	yes
Observations	28.016	28.016	28.016	28.016	28.016

Table A9: Marginal vs. Large exporters

Notes: quantile regressions with Mundlak correction. The dependent variable is the intensive margin of export defined as the share of exported sales on total turnover (Export share). The estimation is performed on the subsample of exporters only. Additional regressors (untabulated) follow the specification in Table 1. All measures are defined in Appendix. *, ***, *** denote, respectively, significance at 10%, 5%, and 1% level. Robust standard errors in parentheses.